



Report from scoping of innovation hubs across Africa

*Profiling best practices to inform establishment of an
energy innovation hub at the University of Rwanda*

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SUMMARY

Innovation hubs are being established across the globe as spaces and places where innovative ideas are nurtured and applied to solve emerging societal problems and market needs. There exists, today, more than 600 active hubs across Africa and the interest to establish new ones is widespread. The hubs are understood to have potential for supporting transformative economic growth and development in Africa, through innovation and entrepreneurship.

While hubs have largely been established and promoted by innovators and entrepreneurs independently, we are observing growing interest by public and academic institutions across the globe – also in Africa. These institutions are increasingly acknowledging the value of providing support directly to entrepreneurs and innovators by nurturing and protecting their ideas, also by providing safe spaces to ‘fail’. An additional value is the possibility to build social communities within hubs that bring together academics, students, NGOs, policy makers, government administrators, international support organizations, industry actors, innovators and entrepreneurs, community members, etc. Interactions among these so-called ecosystem actors contribute to knowledge creation and provide new platforms that facilitate the development of knowledge economies.

This study reports on the findings from a scoping study aimed at profiling best practices among innovation hubs in Africa, while highlighting the values of university-embedded hubs. Forty Five (45) hubs and other relevant organizations were identified and studied, of which fifteen (15) were university-embedded. This study finds that university-embedded hubs can contribute significantly to the innovation and entrepreneurship ecosystems by creating a pipeline of students that have gone through ideation stage and are ready to be incubated either on campus or by existing independent hubs. Additionally, academics play an essential role of providing scientific inputs to the development of products, in analyzing market conditions, and in developing frameworks to evaluate the contributions of hubs towards societal transformations.

Section 4 of this study summarizes key considerations to establishing hubs that would support key elements requiring strengthening within the innovation and entrepreneurship ecosystems, leading to positive societal impacts. These include keen consideration on: (i) whether to establish a specialized or a horizontal hub; (ii) how to maintain vibrant activities; (iii) balancing between homogeneity and diversity; (iv) including sustainability components in programs; (v) focusing more on pre-incubation / ideation; (vi) championing for investments by local companies; (vii) adopting virtual support tools; (viii) finding ways to co-create with grassroots actors; and (ix) creating robust hub management. We are of the view that newly established university-embedded hubs have potential to contribute significantly to societal transformations, and what should be expected in the early stages of establishment are continuous adaptations in its concept and approaches – as learning by doing is considered essential in the establishment of innovation hubs in Africa.

Keywords: innovation hub; university-embedded hub; innovation and entrepreneurship ecosystem; incubation; ideation; Africa; Rwanda.

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1. INTRODUCTION

1.1. Defining innovation hubs

In the global context, innovation hubs have been popularized since the 1950s with the prime reference of Silicon Valley startups out of the Stanford Industrial Park. Innovation hubs have since sprung up across the globe as spaces and places where ideas are nurtured and applied to solve emerging societal problems and market needs.

In Africa, the concept of innovation hubs became popular over the past 20 years. They are suggested to provide new possibilities to findings solutions to the sustainable development challenges (Schmitt and Muyoya, 2020; United-Nations, 2019). The earliest use of the concept of innovation hubs, known to the authors, is in 2001 with the establishment of the *Innovation Hub* in South Africa (Baark and Sharif, 2006). Since then, there are more than 600 active hubs across Africa and the interest to establish new ones is widespread (Afrilabs and Briter-Bridges, 2019). Schmitt and Muyoya (2020) have pointed to three factors that have contributed to the rapid growth of innovation hubs in Africa: (i) improved ecosystems and operating environments, (ii) increased volume of venture funding raised by startups, and (iii) pre-existing hubs re-working their business models to better suit their markets and scaling out.

But what exactly are innovation hubs?

There is a lack of consensus to its definition (Toivonen and Friederici, 2015). Innovating in hubs is still a developing concept with diverse context-specific definitions. The word ‘hub’ is often combined with several adjectives in reference of central points of an activity of interest – for example trade hub, research hub, economic hub, transport hub, innovation hubs, etc. As such, an ‘innovation hub’ as a concept envisions a center for innovative activities.

In the context of achieving the Sustainable Development Goals, we adopt the definition of ‘innovation’ as the search for new ways of using software (e.g. knowledge, policy incentives, behavior change strategies), hardware (e.g. technical devices), and/or orgware (e.g. organizational, business models, financial instruments) in such a way that the speed of change towards solving societal challenges is accelerated (Hekkert et al., 2007). In its modern meaning, innovation is not necessarily the introduction of a new-to-the-world way of doing but rather entails the application of better processes to articulate needs, or the use of improved solutions to existing market needs. However, novelty (patent) remains a significant component in the development and utilization of innovations at hubs.

While innovation hubs take diverse forms, this study is interested in highlighting two areas that are a part of the conventional activities in the hubs. These are: (i) community learning, and (ii) support for entrepreneurship.

Community learning

In the African context, establishment of innovation hubs is driven by the need to promote the use of local solutions to the local problems in the cities, countries, and regions. This approach is inspired by shifts in development practice, in the recent decades, from relying only on technology transfer from the west to having locally designed and manufactured products as complementarities (United-Nations, 2019). Local innovating entails the involvement of local innovators, the use of locally available resources and often emphasizing proactive engagements with users/beneficiaries (Hoffecker, 2018), and is perceived to have high chances of success in terms of societal embedding and environmental and economic benefits. Local innovation may involve some non-local inputs such as knowledge, inspiration, materials, or capital. More importantly, however, the processes require people from the specific localities to take initiative to develop the creative and effective ways of making the innovations responsive to challenges they encounter in their daily lives and local environments. Sambuli and Whitt (2017) have suggested that success of innovation hubs entails the inclusion of social innovation through human-centered development, community empowerment, or other concepts beyond purely market-based measures like profitability. In the literature, local innovation has been explored using several concepts including grassroots innovation (Smith et al., 2016), jugaad innovation (Radjou et al., 2012), user-driven innovation (Cherunya, 2019), and frugal innovation (Zeschky et al., 2011).

An important component to innovation in hubs is social communities – that provide shared inspirations, and enable active knowledge transfer between researchers, students, business experts, industry, government, NGOs, local communities, individual innovators, and venture capitalists. Toivonen and Friederici (2015) define innovation hubs as spaces and communities that lower barriers to co-creating solutions, are embedded in local contexts, and encourage collaboration and creative clashes through shared learning. Moraa and Gathege (2013) suggest the development of ‘participatory cultures’ as being a significant function of innovation hubs. Establishment of hubs is based on the premise that no single effort by an innovator in isolation is adequate to transform society. A transformation involves the development and diffusion of a whole range of innovations that create effects across many sectors. As such, the underlying innovation processes must be seen as being ‘systemic’, meaning they depend on the co-development of actor networks, institutions, artifacts, and practices (Bergek et al., 2008). Hubs are perceived to be enablers of the connectivity of different actors to improve innovation processes both internally, within firms, and externally within networks and geographical regions in which they are located (Wu and Eriksson Lantz, 2017). Using empirical insights from Rwanda, Obeysekare (2018) conceptualizes innovation hubs as ‘boundary organizations’ that enable interactions and collaborations between different social worlds. Collaboration is thought to be a good approach for boosting creativity and for accelerating knowledge development targeting the complex and multidimensional sustainable development challenges facing communities and governments.

The innovation hubs in Africa are, therefore, emerging platforms to the localization of skills and knowledge and having potential to foster strategic innovation management and influence the direction of sector transformations.

Support for entrepreneurship

In a report by UNCTAD (2014), it is suggested that technological capacities remain important for social and economic developments in Africa. However, the report argues that micro-level socio-economic knowledge is continually becoming more critical in sustainable development interventions. New context specific business ideas are required to complement technological and scientific breakthroughs. The generation of micro-level socio-economic knowledge that will translate technological breakthroughs to ‘appropriate technologies’ is, therefore, becomes a core form of local innovation. The perceived significance of coupling technological innovations and context-specific entrepreneurial knowledge led to having business ideation, incubators, and accelerators as standard components among innovation hubs.

Business ideation, incubation, and acceleration programs provide (potential) startups with technical skills, entrepreneurial skills, and soft (communication, time management, leadership, personal branding) skills – through training, mentoring, and informal exchanges. These programs also provide material support (ideation spaces, pool of shared support services to reduce overhead costs such as lawyers, tax authorities, market experts, facilities), market information, and networking opportunities (for seed funding, new markets, etc.), to assist the startups in establishing, expanding, and becoming sustainable ventures. The hubs additionally provide direct support in navigating complex regulatory landscapes and result in cost savings when innovators leverage the existing in-house expertise foregoing expensive consultants. The programs offered to innovators and entrepreneurs enable nurturing and protection from market pressures until ideas become well established businesses that have high chances of succeeding in the open market. Ideally, innovation hubs would generate a steady flow of successful new ventures that commercialize and create new opportunities for job creation, therefore revitalizing economies.

In addition to the direct support provided to innovators and entrepreneurs, the hubs also provide indirect support in the form of advocating for accommodative policy and regulatory environments, fund-raising, among others. The direct and indirect support mechanisms are discussed in more detail in Section 3 of this report.

Based on the interest of this study – highlighting hubs’ opportunity for community learning and the direct entrepreneurship support they provide – we define innovation hubs as being *social communities and workspaces that together function as safe spaces for impactful ideas to be identified and nurtured in the early stages to withstand open market pressures. The nurturing and protection are provided to innovators and entrepreneurs through access to subject-matter expertise on technical and market trends and access to practical tools and resources. More significantly, hubs provide the venture owners with a safe space to fail.*

Wu and Eriksson Lantz (2017) argue that innovation hubs can be differentiated from stand-alone accelerators and incubators which typically work directly to assist individual firms to grow. Innovation hubs instead act like a networked platform aiming to create or contribute to an ecosystem where collaborations, knowledge transfer, and spillover effects can occur in order to spur new ideas and business opportunities. Therefore, we suggest that innovation hubs are developing conceptually based on systems thinking approaches (see for example Lundvall (2008)) and seek to contribute to the wider societal system by engaging in multiple roles and broad sets of activities.

1.2. Background of the study and report outline

Rwanda has embarked on a low-carbon development pathway as reflected in its Energy Sector Strategic Plan 2019-2024. Reduction of energy losses through improved generation and end-user efficiency are prioritized. Plans to increase household access to electricity from renewables and to reduce reliance on traditional biomass energy are underway. Sector actors acknowledge that energy is one of the most environmentally impactful sectors and that energy needs are growing as Rwanda's economy grows and consumption increases. The sector strategies and plans suggest that research, innovation, capacity development, and entrepreneurship will contribute greatly to meeting these targets (ITU, 2017).

The African Center of Excellence in Energy for Sustainable Development (ACE-ESD) at the College of Science and Technology at the University of Rwanda (UR) is in the process of establishing an energy-focused innovation hub, the Grid Innovation and Incubation Hub (GIIH). The overall objective of the hub is to become a bridge between the university and energy sector, in order to strengthen the innovation and research capacity within the university in meeting the energy challenges Rwanda is facing. ACE-ESD sought the support of Chalmers University of Technology in developing the initiative.

There are two main components in the initiative. First, the innovation hub has the purpose of translating energy research to positive societal impacts for Rwanda, through interactions (between researchers and sector actors) that lead to formulation of research questions that target urgent societal challenges. Additionally, the creation of a social community in the hub will present a useful outlet for research results dissemination. Second, the hub hosts an incubator. The incubator aims to develop capacity for ideation, and to attract, select, retain, manage, and support brilliant entrepreneurial ideas. The hub aims to enhance students' creative skills and entrepreneurial competences, which are much sought after on the job market. Together, the two hub components (translation and incubation) will address the following gaps or weaknesses:

- There is limited interaction between the researchers, teachers and students of UR with key stakeholders in the energy sector (including industry, business, government, NGOs, donors, community organizations, community members).

- Staff and students of UR have little knowledge of what are the needs, activities and problems faced by energy sector actors, and stakeholders rarely give input on planned and ongoing research and student projects.
- Students are not acquiring all skills necessary for starting business, or practical skills asked by employers.
- Many good ideas developed by students in their research projects every year are never further exploited for societal application.
- There is need for developing further the intellectual property policy for business at campus, such that campus can function as a protected space for nurturing new ideas.
- Before the hub, there was no process in place to identify innovative ideas by students support their development.

The vision of GIIH hub is to foster entrepreneurial thinking among students and staff of the University of Rwanda. The hub wants to become a leading regional hub for energy-related innovation and entrepreneurship solutions and applied research.

This report presents findings from a study that was part of the activities in facilitating the establishment of GIIH. The aim of the study was to engage in a learning process by scoping and documenting best practices in the activities by innovation hubs in Africa. The study was conducted between March and September 2020. The first author was the principal investigator, receiving inputs from other project members both at Chalmers and at ACE-ESD. In this report, we present a summary of the key learning points from the study – particularly highlighting challenges and prospects in establishing new university-embedded hubs.

The report is divided into five sections. The next, Section 2, explains the methodology employed in the scoping activity and provides information on the case studies. Section 3 summarizes the findings – including information on hub activities and insights from university-embedded hubs. Section 4 summarizes the key learning points relating to establishing of new university-embedded hubs. Section 5 highlights areas requiring further research.

2. METHODOLOGY

2.1. Data: Interviews, website information, and literature

This study relied on a desk study, which was complemented with online interviews with managers of innovation hubs and with sector experts. Based on already established connections, a set of innovation hubs in Kenya and Rwanda were selected for an initial investigation. A snowball technique (Biernacki and Waldorf, 1981) was then employed to further identify innovation hubs across Africa to be studied. These word-of-mouth recommendations were useful in filtering and identifying hubs with similar features to those of the GIIH hub, or other aspects of interest like uniqueness of hub concepts and potential for mutual collaborations. In addition to hubs, networks and association of hubs and other supporting organizations were also studied. Forty-six (46) hubs and other relevant organizations were identified and analyzed –

including GIIH (Table 1). Personal communication through interviews followed with twenty-one (21) of the hubs and organizations, to gain deeper insights.

Table 1: List of hubs and organizations studied

	Hub or organization	Source of info: personal communication (PC) & web info
	University-embedded	
1	Grid Innovation and Incubation Hub, University of Rwanda, Rwanda	PC, March – August 2020 (as engaged researchers)
2	Chandaria Business Innovation and Incubation Centre, Kenyatta University, Kenya	PC, 10 th March 2020 PC, 27 th July 2020
3	Ilab Africa, Strathmore University, Kenya	PC, 11 th March 2020
4	Kenya Climate Innovation Centre, Strathmore University, Kenya	PC, 21 st May 2020
5	C4Dlab, University of Nairobi, Kenya	PC, 12 th March 2020
6	Launchlab, Stellenbosch University, South Africa	PC, 24 th April 2020
7	Tshimologong Digital Innovation Precinct, University of the Witwatersrand, South Africa	PC, 16 th July 2020
8	Nairobi Industrial and Technology Park, JKUAT, Kenya	web info
9	RANLab, Makerere University, Uganda	web info
10	Startech, Al Akhawayn University, Morocco	web info
11	ROAR Hub, University of Nigeria, Nigeria	web info
12	Hebron Startup Lab, Covenant University, Nigeria	web info
13	University of Ghana Business School (proposed hub), Ghana	web info
14	FabLab, University of Nairobi, Kenya	web info
15	AKU-GSMC Media Innovation Center, Aga Khan University, Kenya	web info
16	Ashesi Venture Incubator, Ashesi University, Ghana	web info
	Independent (non-university-embedded) hubs	
17	Bioinnovate, Kenya	PC, 13 th March 2020
18	Resolution Innovation Hub, Kenya/Rwanda	PC, 31 st July 2020
19	The Innovation Hub, South Africa	PC, 29 th June 2020
20	250 Startups, Rwanda	PC, 20 th April 2020
21	WesterWelle Startup Haus, Rwanda	PC, 20 th April 2020
22	kLab & FabLab, Rwanda	PC, 12 th May 2020
23	Impact Hub, Rwanda	PC, 21 st April 2020
24	iSpace, Ghana	PC, 20 th July 2020
25	Change Hub, Kenya	web info
26	Nigeria Climate Innovation Centre, Nigeria	web info
27	IHUB, Kenya	web info
28	Pandalabs, Kenya	web info
29	Wennovation, Nigeria	web info
30	CcHub Design Lab, Rwanda	web info
31	Co-creation Hub, Nigeria	web info
32	Swahili Pot, Kenya	web info
33	Impact Amplifier, South Africa	web info
34	Mt Kenya Hub, Kenya	web info
	Networks and communities of innovation hubs	
35	Ghana Hubs Network, Ghana	20 th July 2020
36	Afrilabs, Pan African (HQ, Nigeria)	24 th June 2020

37	Impact Hub, Africa coordination, Zimbabwe	17 th August 2020
38	ASSEK, Kenya	web info
39	Aspen Network of Development Entrepreneurs, international	web info
	International Association of Science Parks and Areas of Innovation, international	web info
40	Other related organizations	
41	African Management Institute, Rwanda	12 th May 2020
42	BoP Innovation Center, Kenya	29 th May 2020
43	StarthubAfrica, Uganda	7 th July 2020
44	BAG Innovation, Rwanda	web info
45	Global Business Labs, Uganda	web info
46	Tanzania Renewable Energy Business Incubator (TAREBI), Tanzania	web info

Secondary data from reports and publications were used to understand better the hub concepts, approaches, and societal implications. Google Scholar was used to identify five recent studies on African innovation hubs. Other relevant publications were traced based on the bibliographies from the five studies. Another useful additional publication is a report from Afrilabs. The organization is the biggest network of African innovation hubs, currently holding membership of 202 hubs. Table 2 below presents the list of publications, which can be helpful in getting an overview of hub-related activities in Africa. These publications contain case studies and thus are comprehensible for practitioners and provide practical insights on challenges and opportunities when establishing and managing innovation hubs.

Table 2: List of main publications informing this study

1.	Schmitt, D., & Muyoya, C. (2020). Influence in Technological Innovation Spaces: A Network Science Approach to Understand Innovation for Sustainability in the Global South. <i>Sustainability</i> , 12(5), 1858.
2.	Afrilabs and Briter-Bridges. (2019) Building a conducive setting for innovators to thrive: a qualitative and quantitative study of a hundred hubs across Africa. Afrilabs.
3.	Obeyskare, ER. (2018) The Role of Boundary Institutions in Rwandan Innovation Hub Operations. College of Information Sciences and Technology. Pennsylvania: Pennsylvania State University.
4.	Friederici N. (2018) Grounding the dream of African innovation hubs: Two cases in Kigali. <i>Journal of Developmental Entrepreneurship</i> 23: 1850012.
5.	Sambuli N and Whitt JP. (2017) Technology innovation hubs and policy engagement: Making All Voices Count Research Report. Brighton: IDS.
6.	Friederici, N. (2016) Innovation hubs in Africa: Assemblers of technology entrepreneurs. <i>Oxford Internet Institute</i> . Oxford: University of Oxford.

We acknowledge that this is not an exhaustive collection of the research/literature on the topic of hubs in Africa as they were selected based on a limited literature search criterion. A systematic literature review is proposed to synthesize the growing number of research studies on innovation hubs in Africa.

3. FINDINGS

This section presents the findings from the research study, which is grouped into the following sub-sections: sector focus, activities at hubs, gender dimensions, social impacts of hubs, the Rwandan ecosystem, and lastly insights on university-embedded hubs.

3.1. Sector focus

The GIIH hub at the University of Rwanda wants to become a leading regional hub for energy-related innovation and entrepreneurial solutions. As such, this study was interested in exploring hub initiatives beyond the conventional tech focus. Here, we explain the leading role of tech hubs and the developments beyond tech.

Early establishment of innovation hubs was motivated by a need to leverage the high-speed internet infrastructures that were set up in Africa in the early 2000s (Zayed-Sustainability-Prize, Webinar, 2 June 2020). The hubs provided a platform where discussions among interested actors from government, the private sector, NGOs, academia, among others were fostered – on opportunities for accelerated social and economic developments from the novel digital infrastructures. Capacity development in digital innovations and entrepreneurship became a core activity at the hubs, starting with the ICT field. Nonetheless, digital technologies are growing at inexorable pace creating disruptive changes in every sector of the economy and aspects of daily life. The digital technologies still have huge potential and will continue providing opportunities for more efficiency, precision, transparency, connectivity, inclusivity, and new economic opportunities in Africa (Ndemo and Weiss, 2017), in their utilization in energy, healthcare, finance, water, solid waste, agriculture, food, government services, legal services, media, transport, education, sanitation, etc. Within the hubs, innovators and entrepreneurs leverage on the possibilities in digital technologies, where the issues they tackle relate to all the above-mentioned sectors and more. In fact, it was pointed out by an interview respondent that most of the innovation hubs call themselves ‘tech hubs’ but what they actually do is “wrap technology around” various forms of sectoral initiatives (Ghana-Hubs-Network, Personal communication, 20 July 2020).

Innovation hubs have additionally scaled out to support development of hardware components through makerspaces. For example, Chandaria Business Incubation and Innovation Centre, in Kenya, and Fablabs in Rwanda and Kenya have light-weight manufacturing facilities providing access to various work areas including machine, metal and woodworking shops, textile and electrical processing facilities, 3D printers, and laser and water jet cutters, etc.

Hubs across Africa are also broadening their reach to supporting individuals and groups in the creative and cultural sectors (arts, music, media) by providing space and support for networking, business development and community engagement. An example is Swahilipot Hub in Kenya which incorporates support to poets & poetry into their programs.

We can then argue that digital transformations in Africa have progressed and innovation hubs are now moving beyond the early-stage focus on supporting the adoption of digital technologies. The focus is shifting towards engaging in all forms of innovation that will solve immediate societal challenges and market needs in all sectors, i.e. by empowering innovation and entrepreneurship in the forms of hardware, software, and orgware.

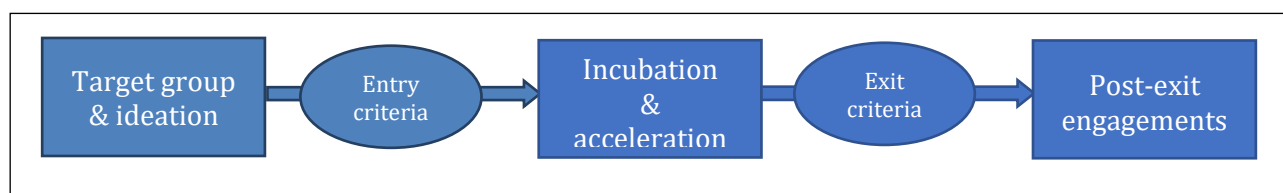
3.2. Activities at innovation hubs

We are of the view that innovation hubs in Africa are evolving and are searching for diverse combinations of approaches and business models, which fit the needs of innovators and entrepreneurs and the societal problems they wish to tackle in their local contexts. Most of the African hubs have initially adopted the structures of the western hubs that provided the initial support and resources in the early stages of establishment. However, local adaptations have been inevitable. IBM managers suggest that their hub expansion in Africa came with a unique set of challenges that couldn't be viewed in the same way as the expansions in other parts of the world – say China or India (IBM-Communications, 2013). They argue that each country in Africa has its own political, economic and cultural dynamics and its own plan for development, and therefore the African context cannot be seen as a single market. Based on diverging local contextual conditions, activities of hubs are broad and diverse making it difficult to create a categorization that is representative of most hubs. Below, we present a summary of activities that could be identified based on this (limited) research study. They include the following: (i) support for innovators and entrepreneurs, (ii) fundraising, (iii) convening, (iv) research and information management, (v) consulting, (vi) Corporate Social Responsibility, (vii) curriculum development, (viii) promotion of environmentally sustainable ventures.

3.2.1 Support for innovators and entrepreneurs

The primary goal of innovation hubs is to provide support to innovators and entrepreneurs, and the hubs do this both directly and indirectly. The perceived value of innovations and entrepreneurship to the economy and the creation of new opportunities for (youth) employment are the core motivations to the support hubs provide. Below, we present the conventional programs for providing direct support to innovators and entrepreneurs.

Figure 1: Program by hubs for nurturing innovations through ideation, incubation or acceleration



Incubation and acceleration

Individuals or start-ups that get nurtured at innovation hubs often enter the program with different levels of maturity. The support provided is often categorized as either incubation or acceleration based on these levels.

“An incubator is a program that helps transform ideas to ventures by offering advisory services, resources, workshops and hands-on training that guide innovators and entrepreneurs in defining and refining their business models and value propositions with the goal of becoming sustainable businesses. They sometimes provide financing to support the new venture” (Afrilabs and Briter-Bridges, 2019).

“An accelerator is a program that offers support to growth stage ventures to achieve scalability and self-sufficiency, through offering advisory services, mentorship, workshops, networks and usually investments in cash or in kind” (Afrilabs and Briter-Bridges, 2019).

Incubation and acceleration programs are often cohort-based and fixed term ranging from 3 to 9 months. Some hubs have models where the direct support goes beyond 1 year. The duration and degree of support often depends on the resources budgeted for the program. In most cases, the programs are externally funded by grants whose amounts vary. It was suggested in an interview that most innovation hubs essentially support incubation and not acceleration (despite the use of the term acceleration). This is because acceleration often requires a lot of background knowledge of a business venture and providing specialized support over extended periods of time (Ghana-Hubs-Network, Personal communication, 20 July 2020). Financial support for the incubated or accelerated ventures, usually in the form of loans or donations, are often complementary to the technical capacity building provided.

Target groups, ideation, and entry criteria

Innovation hubs have diverse preparatory steps and entry criteria. An example of a structured preparatory step is pre-incubation which essentially supports ideation. This is when target groups are provided with the task to come up with an idea that can be quickly applied to tackle a pending problem. Pre-incubation programs could take a few days (e.g. 2 days) to a few weeks (e.g. 2 - 3 weeks) – and complementary terminologies to them include hackathons and bootcamps. During the programs, interested innovators and entrepreneurs will receive deeper description of the issue they are required to find a solution for and receive guidance from experts in the ideation. Access is also provided to makerspaces where equipment such as electrical processing facilities, 3D printers, laser and water jet cutters, and high-speed internet are utilized to develop prototypes. Pre-incubation activities also entail having access to training courses on innovation and entrepreneurship.

Some hubs have pre-incubation as part of the entry criteria while other hubs focus wholly on pre-incubation in their programs. As an entry criterion, the programs are shorter where the selected promising ideas advance to an incubation program by the same hub. For CBIIC, they focus majorly on pre-incubation. This is driven by the fact that being university-affiliated forces the hub to prescribe to the university’s major mandate for capacity development – rather than focusing on profit making which pushes many hubs to opt for incubation (CBIIC, Personal communication, 27 July 2020). CBIIC’s mission is to foster entrepreneurial thinking and creating a community of citizens (emanating from within the university) who are solution-makers. Pre-

incubation could, for example, be provided by making entrepreneurial courses mandatory to all students of non-business faculties like architecture, natural sciences, and engineering. Pre-incubation as a stand-alone program often offers longer-term direct engagements for the supported individuals.

Another pre-incubation model is the unstructured one where all registered members of a hub are given voluntary access to makerspaces, courses, and advisory services. They get the opportunity to continuously develop ideas while they hold membership. The members have opportunities to showcase their ideas during open pitching events which are organized weekly, monthly or bi-monthly at the hubs, where they receive feedback or are able to be matched with venture capitalists interested in partnership to develop further the idea.

It was found during the interviewing that many innovation hubs focus on incubation and acceleration programs and provide little support to ideation. It was argued that hubs focusing majorly on ideation could contribute significantly to the innovation and entrepreneurship ecosystem by creating a pipeline for individuals and their ideas which are ready to be incubated (Westerwelle-Startup-Haus, Personal communication, 20 April 2020). University-embedded hubs could be able to integrate pre-incubation support through (mandatory) curriculum trainings (African-Management-Institute, Personal communication, 12 May 2020). They could also participate in hackathons and bootcamps targeted at emerging societal challenges – as was seen in the case of the Covid-19 pandemic (CBIIC, Personal communication, 27 July 2020).

Looking at target groups, many hubs are open to supporting innovators regardless of gender, age, occupation, etc. The general trend, however, is that young adults are attracted the most to the offerings provided at hubs (The-Innovation-Hub, Personal communication, 29 June 2020; iSpace, Personal communication, 20 July 2020). For university-embedded hubs, the primary target group is the university community (lecturers, researchers, students). However, some university-embedded hubs like KCIC and Launchlab recruit significant numbers of innovators and entrepreneurs from the general public. For CBIIC, they reach out beyond the campus community as a form of corporate social responsibility considering they are a public research institution. However, the outreach targets mainly the large numbers of unemployed graduates as they wait to find new work opportunities. What is remarkable is that there unemployed youths often commit more fully to developing their entrepreneurial ideas as a result of joblessness, compared to active university students who often are overwhelmed by studies (CBIIC, Personal communication, 27 July 2020), and still strive to be employed. At campuses, it is often a huge challenge to keep student groups that are being incubated motivated and committed. For university-embedded hubs, specification of target beneficiaries of a hub is continuously a topic of debate taking into consideration the role and responsibility of a public university. Should university-based hubs aim at training a small exclusive number of only the best ideas or students, or attempt broad skills training for as many students as possible?

In the literature, Bergek and Norrman (2008) have specified approaches by which entry criteria for programs can be categorized. They suggest that the task of identifying ventures that are ‘weak-but-promising’, while avoiding those that cannot be helped through incubation or those that do not need incubation, is a challenge which requires a sophisticated understanding of the market and the process of new venture formation (pp11). The selection criteria are diverse and often include some of these components: level of idea/venture development (idea + market research + minimum value product + business plan + formal registration, etc.), technical expertise of the team, the properties of the market the venture is aiming at, the properties of the product or service, and the profit potential, and societal impact potential. Bergek and Norrman (2008) summarized the various components as consisting of either selection focused primarily on the idea, or selection focused primarily on the entrepreneur/the team. However, selection criterion needs to be flexible in other instances. Based on the scoping study, it was found that special considerations are sometimes required to promote and support the nurturing of entrepreneurial thinking and activities among females because they are largely under-represented. The under-representation is often due to structural societal limitations (Westerwelle-Startup-Haus, Personal communication, 20 April 2020).

Exit criteria and post-exit engagements

The active and structured engagements with innovators and entrepreneurs are terminated when the program period ends. The expected outcomes from incubation and acceleration programs differ from one hub to another. However, the general expectation is that the innovators and entrepreneurs have utilized the protected spaces and the provided resources to its full potential. The hubs aim at giving innovators and entrepreneurs the peace of mind to focus on building their products, without any concerns regarding how they will cover the rent charges, internet costs, capacity training costs etc. The expectation is that this opportunity is used well. (ASSEK, Webinar, 14 July 2020).

Hubs engage with the supported innovators and entrepreneurs in the following post-exit interactions: (i) Hubs make follow up calls to check on progress and provide additional support or necessary information for further development when necessary, and (ii) hubs invite former incubates to share their experiences and to become mentors.

3.2.2 Fundraising

Innovation hubs fundraise to acquire (i) seed money to be given to entrepreneurs, (ii) finances to cover hub expenditures, and (iii) finances to cover ideation, incubation, acceleration, and/or ecosystem strengthening programs. The funds received by hubs are grants, loans or investments. In addition, hubs support individual entrepreneurs in fundraising by connecting them directly with investment partners. Some hubs are giving support to entrepreneurs through loans while others consider grants to be more effective. Loans are suggested to encourage the innovators and entrepreneurs to commit and put effort into ensuring the success of their venture (KCIC, Personal communication, 21 May 2020). Additionally, loans can be more easily mobilized by hubs in comparison to grants. On the other side, grants are seen to be impactful as they provide

innovators and entrepreneurs a safe space to be innovative and no losses in case of failure (CBIIC, Personal communication, 27 July 2020).

Hubs in Africa largely rely on external funding from western organizations. Because most of the investments through hubs are from foreign organizations, there is need for quality deliberations that would enable the funders to understand better the needs and priorities of the hubs and to support the hubs accordingly. The funding organizations should also be ready to listen to the local experts and be flexible to align their terms and conditions to local circumstances, rather than imposing pre-determined ideas that have worked in the western world. Funders need to realize that countries must find their own way to sustainable development and that innovation ecosystems aren't just a necessary element of economic progress, but are a way to discover the path forward for a society (IBM-Communications, 2013).

There is still a lack of interest in venture capital investments by local businesspeople and organizations in Africa. Minimal resources are provided by banks to early stage startups. This trend, however, is changing rapidly due to increasing trust and legitimization of hubs and increased understanding among local organizations of the value of venture capital investment. There is increasingly a change in mindset among local companies, banks, and among government agencies who have started to avail funds to innovators and small-scale entrepreneurs. There has been major progress with local funding in Nigeria and South Africa – also including the interest by government agencies to direct national budgets towards startups and SME support. In South Africa, the *Innovation Hub* was established by the provincial government of Gauteng and receives consistent funds from national budgets. Countries have started putting in place national policies and legislations that will further facilitate local funding opportunities for innovation hubs, innovators and entrepreneurs.

There remains a big challenge and broad discussions related to the extent to which external funds influence – and often restrict – the activities and programs by innovation hubs. Many funders may provide finances that come with certain expectations that do not align with the values of a hub. For example, funders may want an incubation program to run for a shorter timeframe in comparison to what hubs see as a reasonable duration for sustainable impacts to be created. It was also observed that the reliance on international funds is becoming a challenge for startups founded by Africans, as very little of the internationally sourced funds are made available for startups by African founders (Musse, 5 February 2020; Onukwue, 29 July 2020). Racial bias in access to venture funding was discussed with an interview respondent who sought anonymity, indicating that the topic is sensitive and may have negative effects on their own hub activities. The interview respondent suggested that one way to support hubs founded by Africans is to mobilize local resources. This is in addition to other interventions, including creating hybrid hubs that can raise internal funds through consultancy and the sale of market data. A related challenge concerns the question of value appropriation and how to make funding schemes socially sustainable. Unless there is access to local funding, talent and good ideas may be exploited as young local entrepreneurs develop innovative solutions through hard effort and at

high personal risk. In the conventional funding system, the best ideas and big profits are appropriated by external venture capitalists with, often, little benefits for local entrepreneurs, communities and African societies (Personal Communication with hub representative who requested anonymity).

3.2.3 Convening

The organizational purpose of innovation hubs has been to create a sense of community with entrepreneurial individuals at the center (Toivonen and Friederici, 2015). Working together at hubs brings about heterogeneous cognitive resources that make the emergence of novel combinations of ideas and practices more likely, resulting in unique and viable innovations. As such, co-working spaces have become standard features in hubs. The co-working spaces are often accessed based on membership. However, accessing the hub is facilitated for non-members under special events and activities. For example, an investor may stay at the hub for a certain period meeting innovators and co-developing products and creating collaborations. The convening enables two types of interactions: between innovators and entrepreneurs themselves and across diverse ecosystem actors.

Toivonen and Friederici (2015) argue that, hubs view individuality, leadership, collaboration, and community participation as complementary rather than opposing characteristics. However, finding a balance between these characteristics can be challenging. They argue that new entrants to hubs assume, somewhat romantically, that spontaneous sharing of ideas and egalitarian relations will flourish in hubs. In reality however, power and influence emanating from charisma, recognized expertise, being a founder, and strong network positions create hierarchies which can limit the individual agency of new entrants. Additionally, hubs welcome diversity in a broad sense (gender, class, and ethnicity), as well as the knowledge and ideas from the different community members. Whether implicitly or explicitly, hubs subscribe to a theory of innovation that prioritize creative clashes between people from different networks and domains. Friederici (2016), however, argues that it is difficult to balance between ‘convening’ which is geared towards bringing people together who would not otherwise come together, and ‘activating’ which implies enabling meaningful deliberations and requiring like-mindedness, mutual commitment, and social cohesion.

The physical space is considered a key feature influencing the convening activities in hubs (Toivonen and Friederici, 2015). Hubs are typically set up in metropolitan areas and the architectural and interior design dimensions help foster a collaborative, urban and “buzzy” atmosphere that supports face-to-face interactions. Digital spaces extend the scope of the hub; for example, websites function as an important digital representation, revealing a hub’s existence to a broader audience and strengthening its identity (Toivonen and Friederici, 2015). Virtual convening spaces for ecosystem actors are getting vibrant in Africa, including webinar series, discussions on LinkedIn, Twitter feeds, and blogs. Annual general meetings are organized by the associations of innovation hubs (Ghana-Hubs-Network, Personal communication, 20 July 2020), and the annual conference organized by Afrilabs (Afrilabs, Personal communication, 24 June 2020) are considered important points of convention by African innovators and entrepreneurs.

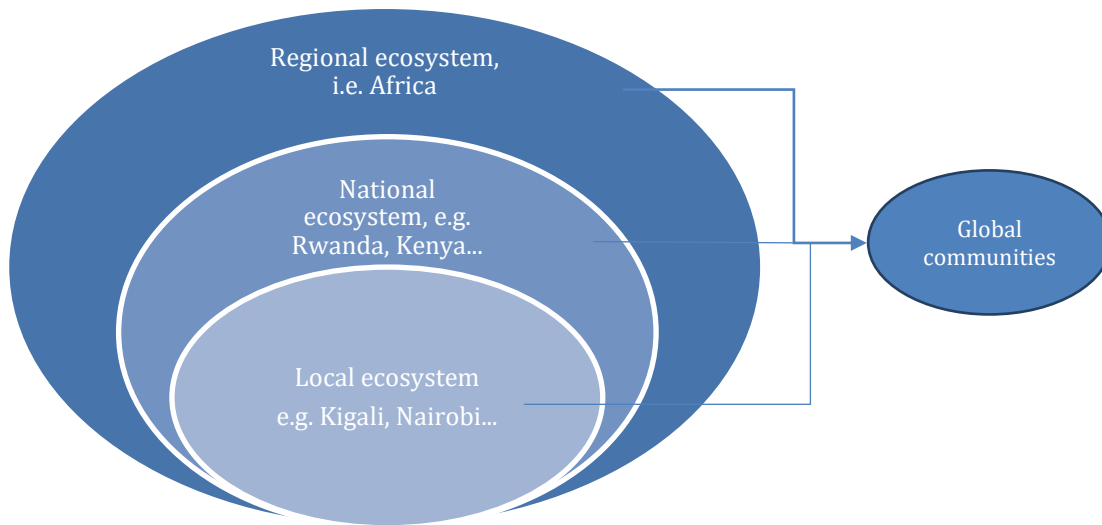
Hubs also view themselves as members of a global community and their core values being shaped by what some refer to as the global social entrepreneurship movement or the startup revolution (Toivonen and Friederici, 2015). The functional implications of perceiving themselves as a global community are reflected in the relatively homogeneous entrepreneurial culture that hubs have developed. Shared concepts and instruments can facilitate collaboration among members who are meeting one another for the first time, whether at the same hub or across considerable geographic distances. The attempts at maintaining globally shared values and approaches are also observed in the striking stylistic similarities. A typical hub space might feature wooden furniture, large desks, brick walls, whiteboards, a foosball table, at least some artwork, shared kitchen spaces, a coffee bar, meeting rooms, and bean bags (Toivonen and Friederici, 2015). Nonetheless, many hubs across the globe continue to localize their hubs to fit to the local social, political, economic, or geographical contexts, but still attempt to keep shared concepts with the global community.

Innovation hubs are not only a community of innovators and entrepreneurs but provide spaces for interactions among the so-called ecosystem actors – consisting of policy makers, funders/venture capitalists, academics, government officials, NGOs, private sector and industry actors, students, network organizations, hub employees, among others. Innovation ecosystems can be defined at different levels: locally (e.g. at cities), at national levels (e.g. countries), and the regional levels (e.g. Africa). The local level is where regular physical meetings happen, and the actors come together often to tackle local issues. This is the level with hub-to-hub interactions, especially characterized with engagements and movement of mentors, leaders, and innovators from one hub to another. There are also individuals that have taken up leadership roles in the local ecosystems where they influence deliberations and often act as spokespersons of the local ecosystem. An interview respondent described the local ecosystems as ‘bubbles’ working together to solve problems within the immediate jurisdictions, i.e. the Nairobi bubble, the Rwanda bubble, the Johannesburg bubble etc. (Tshimologong, Personal communication, 16 July 2020).

There have been fewer active interactions across different bubbles until more recently when efforts to establish network organizations at national and regional levels have been made. Established in 2011, Afrilabs is the biggest network organization of African innovation hubs, currently holding membership of more than 200 hubs across Africa. In addition to supporting hubs to raise successful entrepreneurs that will create jobs and develop innovative solutions to African problems, Afrilabs works to continuously update a database of innovation hubs and consolidate knowledge. At national levels, the Association of Startups and SMEs Enablers of Kenya (ASSEK), established in 2019, and Ghana Hubs Network, established in 2017, are examples of coordination organizations at national levels. The active local hubs are often those in capital/major cities like Kigali, Nairobi, Johannesburg, Accra, etc. Fewer hubs are established in the smaller towns. In Kenya, The Countrywide Innovation Hub has been established as an association looking into the needs of hubs located outside Nairobi, the capital city. Its main objective is to promote activities and programs of the member hubs and the hubs’ vision of testing and building impactful sustainable businesses in rural and “second level” towns of Kenya.

Hubs may also want to stay informed on developments at the global level thus engaging in international communities such as the International Association of Science Parks and Areas of Innovation.

Figure 2: Levels at which innovation and entrepreneurship ecosystems can be specified



In the literature, a range of innovation system conceptualizations have emerged beyond the spatial dimension, i.e. local innovation system (LIS), national innovation system (NIS), regional innovation system (RIS), and global innovation system (GIS). Technological dimensions, i.e. technological innovation systems (TIS), and sectoral dimensions, i.e. sectoral innovation systems (SIS) have also been conceptualized. The engagements among innovation and entrepreneurship ecosystem actors in Africa tend to take place around spatial clustering as specified in Figure 2. Fewer clustering around technological and sectoral competences and interests exist. However, since digital technologies play a key role in hub activities, as mentioned in Section 3.1 of this report, the ecosystem could be analyzed taking a technological innovation systems lens. Additionally, innovators and entrepreneurs often define societal problems (to be tackled by digital innovations) on the basis of sectors. We are of the view, therefore, that competence sub-clusters focusing on sectoral challenges and needs, e.g. establishing a renewable energy ecosystem, could provide complementary platforms for knowledge generation, accumulation, and diffusion, which is required to accelerate societal transformations. The Grid Innovation and Incubation Hub (GIH) wants to establish itself as a leading regional hub for energy-related innovation and entrepreneurship solutions and applied research. The success of the hub may inspire new knowledge sub-clusters (or ecosystems) to be established, that are specific to different sectors, for example in healthcare, finance, water, solid waste, agriculture, food, government services, legal services, media, transport, education, and sanitation. Overlapping functions would be expected especially between these sectoral systems and the already existing technology innovation (eco)system.

The ecosystem actors take diverse enabling roles within the ecosystem and altogether create more conducive social, economic, and governing environments for innovators and entrepreneurs. A community of entrepreneurs, government support, good universities, availability of capital and culture are the ingredients

for building a healthy innovation ecosystem and for creating a conducive environment for innovation and entrepreneurship (IBM-Communications, 2013). The actors have different roles, or can be seen as ‘champions’ or ‘enablers’ of diverse causes leading to efficient working environments for innovators, startups, and hubs. The following ecosystem actors were identified in this study:

Policy makers create linkages and become advocates of the needs of innovators and entrepreneurs in the policy making arenas.

Funders and venture capitalists get the opportunity at hubs to interact with innovators where they can identify mutual values and areas of collaboration, where they provide capital funding.

Academics provide scientific inputs to the development of products and on analyzing market conditions. They also have the potential to develop tools and frameworks for monitoring and evaluating the socio-economic transformations emanating from hubs. They can also contribute in developing tools for evaluating and valuing the contributions of innovation hubs to society.

Government officials can provide insights into the governance challenges, at different administrative levels, that can be tackled by hubs. They may facilitate collaborations between hubs/innovations with city/national governments in solving these challenges. OpenIX challenge (South Africa) and Huduma Whitebox (Kenya) are online marketplaces for service providers (innovators) and service seekers (government departments). The platforms were established based on collaborative work between innovation hubs and government agencies. For Open IX, challenges are posted on the platform by the government and private sector partners. The *Innovation Hub* then selects appropriate solutions from its ecosystem. The offers are vetted, and a winning proposal is given the opportunity to further develop the solution together with the organization that placed the bid. For Huduma Whitebox, it is open to innovators to suggest ideas and products tackling the four pillars of Kenya’s Big 4 Agenda: manufacturing, food security, universal health coverage, and housing. NGOs share insights on aligning hub activities to the sustainable development goals, and provide funding, e.g. through the United Nations.

Private sector and industry actors provide expert knowledge and skills on market and industry gaps, challenges, and opportunities.

Universities, students, and recent graduates provide a pipeline of talent to be supported by hubs. High levels of youth unemployment in Africa make students and graduates an appropriate target segment to be supported.

Hub network organizations foster collaborations horizontally and vertically in the ecosystems. They accumulate knowledge, information, and experiences from different hubs. They consolidate the information, identify shared challenges and advocate for the hubs at policy and governance levels.

Hub employees working as project managers and assistants contribute significantly to the innovation and entrepreneurship ecosystems. In the view of an interview respondent, many of the hub employees are also innovators and entrepreneurs themselves. So apart from supporting the hub activities, they also contribute to knowledge development.

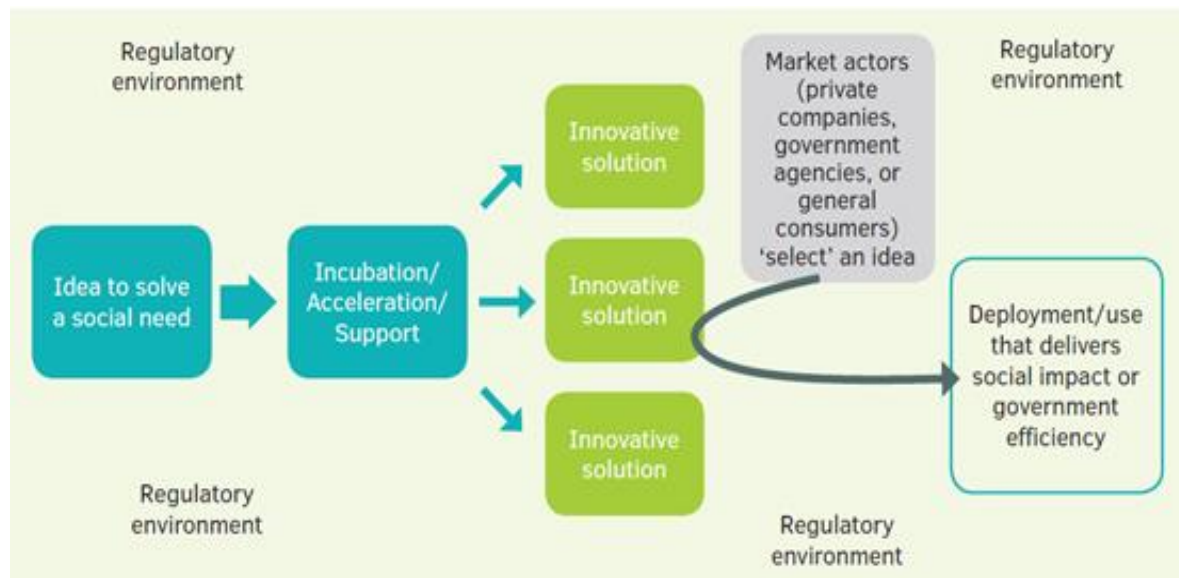
Innovation hubs are innovation engines, action facilitators, market builders, ecosystem conveners.

Convening for policy advocacy

National legislations that create clear frameworks and operational support for innovators and entrepreneurs are suggested to be one of the best ways to help Africa's startups survive and thrive and improve their environment over the long term (Ashebir, 19 May 2020). Efforts by hubs and their networks are influencing the emerging developments in policy and regulations at national levels that support environments for innovators and entrepreneurs. However, there is still much more that can be done. In 2019, Senegal became the second African nation to enact a national Startup Act, following Tunisia's landmark bill that passed in April 2018. Other countries may follow soon: startup legislations are being discussed in Ghana and Mali. The Acts are valuable in clarifying rules surrounding angel, seed and venture capital funding and would bestow benefits on companies designated as startups, for example by alleviating their tax and social security contribution burdens, providing access to foreign bank accounts and offering subsidized salaries for founders (Ashebir, 19 May 2020).

In their recent publication Sambuli and Whitt (2017) have analyzed the significance of policy engagement by hubs and specified the different engagement approaches. They argue that there is potential for innovation hubs in the Global South to play a more active role in promoting social change within local democratic spaces and policy co-creation platforms. The Figure 3 represents how activities of hubs are inherent in policy environments and why engaging in policy processes cannot be overlooked.

Figure 3: The linkages between hub activities and regulations (Sambuli and Whitt, 2017)



Sambuli and Whitt (2017) have specified the following ways through which hubs (can) engage with policy makers and government officials:

Indirect or non-engagement: this is by far one of the most common approaches where innovation hubs prioritize their ‘core’ activities without explicitly targeting government officials as key stakeholders to engage. The officials are invited on occasions to participate in activities at the hub.

Superficial engagement: this is when relationships are opportunistic, short term and rarely lead to impactful outcomes. These opportunistic engagements may be initiated by the hub or by the government officials. It is commonplace that government officials request for a tour of the hubs to learn about what they do but with no follow-up interactions.

Premature engagement: This is when innovation hubs attempt to engage on an issue or opportunity before the moment is ‘ripe’. It entails making a policy request without the evidence, timing or coalitions necessary to overcome policy-maker reticence or a lack of understanding of why to prioritize the hub’s request. These interactions present opportunities for identifying policy gaps and hurdles and they set the pace for more productive engagements in the future.

Client-based engagement: This is when government agencies directly procure services from innovation hubs. Such client-principal relationships are essential in identifying shared values and developing legitimacy of the hubs. This may lend itself to more meaningful engagements particularly in co-creation of more conducive policy and regulatory environments for innovators and entrepreneurs.

Strategic engagement: This entails longer-term relationships where hubs advise policymakers or convene regular moments of advocacy between citizens and policymakers. More and more key leaders within innovation and entrepreneurship ecosystems are being invited to join government taskforces where they provide expert opinions influencing governments projects and programs (ASSEK, Webinar, 14 July 2020).

3.2.4 Research and information management

Innovation hubs have become an important tool for generation of knowledge and data regarding local market needs and innovation capacity limitations. Some innovation hubs have created units that are dedicated to research, data and knowledge management. Innovation hubs, therefore, are developing to become critical players in social and economic developments by contributing with reliable information and data. For university-embedded hubs, a symbiotic relationship is easily created where university faculties use data and information from hubs to conduct applied research and the hubs gain by accessing expertise from the academicians to help the innovators develop their ideas using science-based inputs (KCIC, Personal communication, 21 May 2020).

3.2.5 Consulting

Hubs are encouraged by Afrilabs to explore new hybrid business models that would lead to financial sustainability – this being one of the biggest challenges for African hubs, innovators, and entrepreneurs. Hubs need to tap into two key resources: skills and market data (ASSEK, Webinar, 14 July 2020). These two resources are currently given free-of-charge to market actors who wish to extend their activities within Africa. It was suggested that hubs need to work together and build systems for securing their data and providing consulting services to interested market actors at a fee – and the new flow of revenues can be

reinvested into the not-for-profit ideation, incubation and acceleration programs. Consulting can provide consistent flow of revenues and reduce the current over-dependence on foreign funders whose funds are erratic and thus failing to provide continuity for programs. Additionally, it is the view of Afrilabs that African hubs could establish themselves to become a first port-of-entry for international investors interested in African markets where they can get market information and quality collaboration opportunities. The hubs can provide the required information on consumer markets and help in linking the interested organizations with the right innovators to collaborate with (ASSEK, Webinar, 14 July 2020).

3.2.6 Corporate Social Responsibility

Many hubs organize outreach programs targeting underrepresented people in society, unemployed graduates, and young boys and girls. With digital technologies becoming an integral part of our society and lives, the programs are done to ensure no one is left behind by providing the needed digital skills – particularly to people from low-income communities. The approach taken by the *Innovation Hub* in South Africa is to establish hubs within low-income areas in South Africa. The proximity makes local community members the main target group and encourages them to participate. iSpace in Ghana identifies mainly with providing support to women, with often over 80% of the supported innovations and entrepreneurs being women (iSpace, Personal communication, 20 July 2020). For CBIIC, they extended their target group beyond the Kenyatta University community targeting the talented unemployed graduates and encouraging and supporting them in self-employment ventures. Many hubs also organize programs targeting girls and boys (especially those from low-income communities), to instill in them curiosity and interest on innovation and entrepreneurship starting from a young age. The programs focus on coding, developing critical thinking skills, learning how to work in teams to build projects, etc. Women-led tech hubs also reach out to young girls in schools to encourage them to choose Science, Technology, Mathematics and Engineering (STEM) courses.

3.2.7 Curriculum development

Hubs have developed various training modules for their members. It is becoming commonplace that institutions of higher learning are adopting the unique training programs by hubs, or the institutions consult hubs to support in developing their own curricula.

3.2.8 Promotion of environmentally sustainable ventures

Businesses are one of the drivers of environmental degradation. Rapid digitalization and disruptive innovations are not necessarily reducing pressure on the environment, but can instead contribute to economic growth that increase demand for materials and energy. With the effects of climate change increasingly being felt by African populations, the need for environmentally benign innovations is dire. Under these conditions, innovation hubs provide opportunities for designing environmentally sustainable business models thus promoting environmental protection. It is suggested that Africa has the potential to leapfrog the unsustainable development paths of western countries by seizing the opportunity to adopt a low-carbon socio-economic pathway (Africa-Progress-Panel, 2015), for example through the adoption of renewable

energy options which would create opportunities to increase agricultural productivity, improve resilience to climate change, and contribute to long-term reductions in dangerous carbon emissions.

This study found that only few hubs actively give considerations for environmental sustainability in their programs. Executing sustainable business models could provide hubs with a competitive advantage in the long run considering the developing preference among consumers, funders, governments etc., for environmentally sustainable products and services. Among the hubs we studied, Impact Hub, Kigali, had achieved most progress in the integration of environmental sustainability in their programs. They incorporate environmental sustainability components by hosting/supporting sustainability-oriented events by partners, e.g. smart cities. In their programmes, they strive to include climate change adaptation components. They deliberately choose to collaborate in projects that align their activities with environmental sustainability components. They also engage mentors with strong environmental sustainability backgrounds in their design thinking trainings and to mentor the innovators. They have had regular “green drinks” events with a good community building effect (Impact-Hub-Rwanda, Personal communication, 12 May 2020).

Despite the low-levels of active considerations to environmental issues in programs, we observed based on bootcamp submissions to a GIIH incubation program, that awareness is high among the (student) applicants. Most of the proposals included environmental considerations despite this not being highlighted in the call as a criterion.

3.3. Gender dimensions

Women are largely underrepresented among the innovators, entrepreneurs, and startup founders in the African innovation and entrepreneurship space (iSpace, Personal communication, 20 July 2020). Gender is perceived a key point of consideration for activities of many hubs. There are diverse structural and social issues limiting talented women from engaging in innovation hubs – ranging from being overwhelmed by other economic and family commitments to having fewer women with qualifications in tech-related field of studies (Westerwelle-Startup-Haus, Personal communication, 20 April 2020). The three areas where gender issues have been considered among the hubs studied include: selection criteria in incubator and accelerator programs, special programs for women, and outreach initiatives.

Most of the hubs suggested that they ensure a percentage of innovators and entrepreneurs they support are women, and more significantly supporting initiatives that are founded and led by women. iSpace in Ghana has established special incubation programs focusing on women. Many hubs also organize programs targeting girls to develop curiosity and interest in innovating, technology, and entrepreneurship starting from a young age.

These observations are complementary to recent research studies on gender equality in the Small and Growing Business (SGB) sector. A study by Global Accelerator Learning Initiative, based on data from 14,985 early-stage ventures (75% from emerging markets), found that only 13% of the ventures were all-

women teams and 52% was all-men teams (GALI, 2020) . A World Bank study has used household and firm level data to present evidence about the barriers to growth and profitability faced by women entrepreneurs. The study goes beyond looking at contextual, endowment and household restrictions in isolation, and, through deep-dive analysis uncovers new evidence on how social norms, networks and household-level decision making contribute to business performance. It analyzes how the factors are linked to each other and to women's strategic business decisions (World-Bank, 2019). The study argues that training programs should consider the complex challenges faced by women and design programs to target the multiple obstacles. Guzman and Kacperczyk (2019) have found that the gender disparities exist also in Global North contexts. A report by Aspen Network of Development Entrepreneurs (2019) provides the following insights for gender considerations:

- Designing product and services to benefit women must go well beyond a “make it pink” approach and instead deeply consider the needs and experiences of women as consumers. This also requires designing ‘with’ women and not ‘for’ women.
- There is a significant gap in financing women entrepreneurs. Gender lens investing is required. This is a form of investing in which investors seek to generate both positive financial return on their investment, and a beneficial impact on the lives of women. These can be achieved through supporting women-owned or -run businesses; supporting businesses that hire women or incorporate women into supply chains in a beneficial way; and supporting businesses providing a socially beneficial product or service targeting women or girls.
- Adopting a gender lens throughout the programming cycle, from outreach and targeting to selection and program design. Intentional and inclusive outreach may help overcome the fact that male-led groups are more likely to submit applications to participate in training programs than female-led groups.
- Leadership and mindset training programs to address deeper psychological and social constraints facing women are required to complement business skills training.
- Provide growth-supportive social networks and mentorship to women. This will help them shift social norms that often hinder them from entering more competitive but productive sectors.
- Outreach targeting young girls to encourage entrepreneurial mindsets and confidence to build skills expertise in the technical fields.

Gender-inclusive practices are critical to developing an equitable society. If half of the world's population is left behind, significant progress on the Sustainable Development Goals is impossible. For innovation hubs, this means that gender awareness must exist at all levels, not the least in the leadership of the hub as such, and continuously be reflected upon and evaluated.

3.4. Societal impacts of innovation hubs

Based on insights from attending three webinars, it became clear that hub proponents have the impression that their efforts and impacts are not well-understood and recognized in society. It was argued that hubs have

not been able to communicate their value to society – and as such, they are inaccurately perceived to acquire large sums of both private and public funding with very little to show for it. It was suggested that it is difficult for a concept where failure is perceived as a normal part of the process to communicate its successes. The essence of hubs is to support ideas most of which are completely new to markets. Hubs are about experimentation. The success of an experiment comes after dozens of failed tests and the failures are an integral part of the success (Zayed-Sustainability-Prize, Webinar, 2 June 2020; ASSEK, Webinar, 14 July 2020).

It was suggested, therefore, that hub proponents need to communicate better about their processes and outputs. The successes need to be discussed beyond the focus on amount of funding raised, number of incubates/startups supported, and number of successful ventures. There are varied spillover impacts at ecosystem levels that contribute positively to national economies. Hubs need to communicate better their ‘learning from failures’ and how the backstopping processes they use help to improve future activities.

3.5. The Rwandan innovation ecosystem

The innovation and entrepreneurship ecosystem in Rwanda is growing rapidly. The key attribute to the developments is the ambitious plans for socio-economic developments in the country and enactment of corresponding policies, regulations, and strategic plans. This is observed, for example, in the ICT field where the government is pursuing an ambitious digital strategy to transform the country into a knowledge-based economy (ITU, 2017). Rwanda’s ICT centric innovation ecosystem is currently at an early stage of development, but rapid progress is happening with the interest to support networks, capital, and talent. The ITU report argues that entrepreneurs have opportunities to develop solutions to domestic needs, strengthening ICT awareness and usage and bringing higher value to many sectors of the economy – including in public procurement. Rwanda is becoming a popular East African destination for international investors. The policies, regulations, and political situation altogether create more conducive environments for investments by expats in comparison to the neighboring countries (Obeysekare, 2018).

In comparison to other countries, for example Kenya, hubs in Rwanda have gained more legitimacy among policy makers and government officials, thereby receiving support from public institutions. For example, establishment of Kigali Digital Fabrication Laboratory (Fablab) was facilitated by the country’s president Paul Kagame. Innovation hubs also receive support and participate in strategic deliberations in the Rwanda Development Board (RDB) – a government institution whose mandate is to accelerate Rwanda’s economic development by enabling private sector growth. To address financial gaps in tech-enabled companies, the Ministry of Finance mobilized 60 million USD in 2018 from government, the African Development Bank, and private investors. The funds provide equity financing to Small and Medium-size Enterprises (SMEs), train tech-oriented entrepreneurs in business planning and management, and increase awareness and sensitization with respect to intellectual property rights. The funds are also directed towards capacity

building for a range of incubators and accelerators, facilitating angel networks, and training of approximately thirty thousand entrepreneurs (African-Development-Bank, 2018).

This kind of support from public institutions is an indication that the relatively young Rwandan innovation and entrepreneurship ecosystem is vibrant and upcoming university-embedded hubs have opportunities to align their activities with the ongoing activities among both private and public sector actors. For example, energy-related innovations targeted by GIIH hub could complement the government-led Rwanda Smart City initiative which has several projects including Kigali smart bus project, the microgrids project, the smart electricity meters project, the Kigali innovation city project, the Huza energy resource planning system, the water and electricity online payments systems, among others (UN-Habitat, 2013).

3.6. University-embedded innovation hubs

Innovation hubs in Africa have largely been launched independently by innovators and entrepreneurs themselves (Were, 14th July 2020). In fact, the independent hubs are suggested to have become popular because tertiary education often fails to produce entrepreneurial students. More recently, however, there have been developments where universities are taking inspirations from the independent hubs and are establishing on-campus hubs. University-embedded hubs take students and researchers as the core target group. The hubs are able to utilize the many ideas emanating from student projects by incubating them and facilitating their commercialization (CBIIC, Personal communication, 27 July 2020; KCIC, Personal communication, 21 May 2020). Additionally, university-embedded hubs present a great opportunity in the development of the knowledge-based economy. Potentially, the hubs become useful platforms for research translation where researchers can interact with community members, market experts, and government officials, to be able to better understand the emerging societal problems requiring scientific studies. The platform can be used to communicate research findings back to practitioners.

Conceptually, university-embedded hubs can be positioned under the literature on the ‘triple helix approach’. The concept has been applied to analyze the different forms of interactions between the university, industry and government and the eventual outcomes related to knowledge-based economies (Leydesdorff and Etzkowitz, 1998). Most low-income countries are still far from establishing a knowledge-based economy which is characterized by the World Bank (see Chen and Dahlman (2005)) under the following four pillars:

- Presence of institutional structures that provide incentives for entrepreneurship and the use of knowledge.
- Availability of skilled labor and a good education system.
- Access to information and communication technology (ICT) infrastructures.
- A vibrant innovation landscape that includes academia, the private sector, and civil society.

There is potential for hubs to contribute to the above-mentioned pillars of a knowledge-based economy through the activities covering entrepreneurship, capacity development, leveraging on ICT and strengthening

innovation and entrepreneurship landscapes. Fraser (2012) underscores that the triple helix relations are not well defined in low-income countries where the regions have not in a recent historical perspective generated their own innovations and technologies. Fraser argued (although this may be contested) that in the advanced economy, private industry has been the primary driver of the triple helix relations, while governments remain the most significant player in low-income countries. Notwithstanding, how one sees the contribution of respective sectors, the hub concept, which has largely been fostered by independent innovators and entrepreneurs, is generating active participation of private industry in the triple helix in Africa. The hubs are also bringing complementary bottom-up insights to the government-led top-down approaches to innovation management in Africa. University-embedded hubs have the additional value of incorporating scientific knowledge and skills into the triple helix.

Being an emerging area of engagement by universities, the balance between education, research, and entrepreneurial activities is still under development. Research and education are still perceived to be the primary mandate of the universities, and as such hubs are often not prioritized when it comes to budget allocations – especially within resource-constrained public universities (CBIIC, Personal communication, 27 July 2020). The hubs still need to put a lot of effort into communicating their value and convincing university management to prioritize their budgetary and other needs. Another observed challenge faced by university-embedded hubs is bureaucracy and a slow pace in decision making which affects the activities of hubs (Tshimologong, Personal communication, 16 July 2020). The innovation and entrepreneurial ecosystems are fast-paced environments hence requiring equally fast-paced decision making among hubs in order to benefit from available opportunities. To tackle this problem, some hubs establish as autonomous organizations within university settings, for example LaunchLab and Ilab Africa. While Tshimologong, CBIIC, and ROAR hubs are still 100% integrated into universities, they are making efforts to create structures and more conducive working relations with the academic and administrative sections of the universities they belong to.

More generally, however, there are advantages to university affiliation, including: access to a pipeline of innovative ideas emanating from students' project work, having a regular source of income when hubs are included in university budgets, possibility to design products that have undergone scientific scrutiny, and legitimacy and a positive reputation among external actors. These aspects could allow university-embedded hubs to make longer-term plans and for their innovations to be more trusted by market actors (Tshimologong, Personal communication, 16 July 2020; KCIC, Personal communication, 21 May 2020; CBIIC, Personal communication, 27 July 2020).

4. CONSIDERATIONS FOR SUCCESSFUL HUBS

Based on the findings presented in the previous sections of this study, we summarize some aspects that may be important to consider for establishing an impactful and transformative hub. The points summarized below relate to existing competence gaps that need to be filled at ecosystem levels and the general challenges expected when establishing new hubs.

4.1. Establishing a specialized vs. a horizontal hub

Several interview respondents found the idea appealing, that GIIH want to specialize in innovations and ventures in the energy sector. With the specialization, the hub has potential to identify as a leader in energy-related innovation and entrepreneurship solutions and applied research.

On the contrary, establishing a horizontal hub – one that welcomes innovators and entrepreneurs that position themselves in different sectors – has its benefits including: enabling trans-disciplinary solutions to be developed when incubates cooperate, and creating broader opportunities for funding. However, if the sector-specific hubs are able to legitimize their position within the innovation and entrepreneurship ecosystems, they are equally able to attract funding. This is possible especially for rapidly growing sectors like the renewable energy. Nonetheless, hubs will need to consider the advantages and disadvantages of both approaches and develop a model that will best serve the challenges faced within their local environments.

For university-embedded hubs, the question may arise to whether it should be department-specific or should be accessible to all departments, or where it should be fully integrated in the existing university structure or be established as semi- or fully autonomous unit. Different structures were observed in this study to have its own advantages and disadvantages. For example, autonomous hubs are able to make quick decisions relating to budgets, funding, and new activities by avoiding bureaucracies existing within the system of its host university. On the other hand, fully integrated hubs may benefit from university budgets and are forced to prioritize student and staff in their programs. It was observed that autonomous hubs may run the risk of focusing more on entrepreneurs and innovators from beyond the university.

4.2. Maintaining vibrant activities

The location of hubs in accessible and socially vibrant areas are suggested to be a core success factor. This is because the essence of hubs is to build an active community of diverse ecosystem actors. University-embedded hubs therefore will need to consider the limitations of being located on-campus. They will need innovative ways to ensure individuals from the outside are able to comfortably access the hubs and engage without obstacles. Effort must also be placed on keeping students and other people in the university motivated in participating in hub activities – considering they are often extra-curriculum and requiring the investment of individual's free time. Pro-activity will rely on the types of programs offered and degree of access.

One way that CBIIC keeps the hub active is by providing access to the university's innovation and entrepreneurship students club to hold their regular meetings within its premises. Additionally, student interns are placed at the hubs on full-time basis to ensure that event attendants are met with familiar faces every time they visit the hub. This would provide a sense of familiarity and continuity.

4.3. Balancing between homogeneity and diversity

Friederici (2016) has suggested in his study that developing a criterion to select who will be included and who excluded from hub activities can be challenging. Hubs must balance between 'convening' which is geared towards bringing people together who would not otherwise come together, and 'activating' which implies enabling meaningful deliberations and requiring like-mindedness, mutual commitment, and social cohesion. These two factors are conflicting but essential for hubs to be impactful. The hub managers therefore need to carefully reflect on how they can maintain diversity, inclusiveness, and multi-stakeholder processes they aspire for and with the practical realities of managing access and fostering impactful deliberations. The space itself can enable or obstruct a good balance in this regard. We reflect that hubs seem to share an urban cosmopolitan culture and design which sets them apart from the wider culture. While such design can attract young people, it may alienate other groups who do not feel at home in the space. A balanced design that includes elements of public culture, mixing traditional and contemporary art and design can possibly make the space attractive to even more people.

4.4. Including sustainability components in programs

A pro-active consideration of the environmental sustainability of hub activities can be valuable. While some hubs like Impact Hub-Kigali and the Kenya Climate Innovation Centre already take sustainability considerations, many of the interviewed hubs do not. Integrating sustainability can be achieved, for example, by infusing theories on the Sustainable Development Goals in the trainings and using sustainability as a criterion for selecting innovative ideas to be supported. Collaboration with local and international NGOs that focus on SDG issues could provide other opportunities for designing sustainable business models. While hubs are growing to be key players in Africa's innovation and entrepreneurship ecosystems, they have great potential to be advocates for sustainability-oriented policy frameworks at local, national and regional levels.

4.5. Focusing on pre-incubation / ideation

Most innovation hubs support the incubation stage, targeting startups that already have a proof of concept and minimum value products. These advanced ventures have higher chances of receiving support and funding. Ideation and pre-incubation are supported to a much lesser degree. The development of entrepreneurial mindsets among young people is required within African innovation and entrepreneurial ecosystems and university-embedded hubs are positioned well to provide this kind of support – as they can reach many students at once. Pre-incubation programs will give students the confidence to try and set up businesses and will provide knowledge and information about availability of opportunities to receive support. The sensitized students will then create the required pipeline of talent and skills to be incubated

upon completion of pre-incubation programs at campus. Students who go through entrepreneurial training acquire skills that are very attractive for employers as well, meaning that those who end up employed rather than self-employed act in entrepreneurial ways and as change makers within their organizations.

4.6. Championing for investments by local companies

Fund-raising was suggested to be one of the biggest challenges for African hubs. Additionally, it was suggested that African-founded hubs could benefit from locally mobilized financial resources as the international funds tend to sometimes overlook brilliant African-founded ideas (and rather support expat-founded ventures in Africa). Local businesspeople need to be sensitized and provided with skills about how to invest in startups, and be encouraged to take risks in the role of angel investors. Hubs can engage with potential local investors as a form of outreach. For university-embedded hubs, they could work towards building trust and legitimacy with public institutions, this way opening up new revenue streams beyond the current reliance on international donor agencies.

4.7. Growing relevance of virtual tools

Hubs are increasingly interested in reaching out to mentors from beyond the local ecosystem and are exploring online platforms to facilitate this. The shift seems to also be triggered by the ongoing Covid-19 pandemic which is expected to limit movements and gatherings significantly over the next months or years. As such, virtual programs may be necessary for tapping into competences outside the campus and to navigate travel limitations. To acquire inspirations, skills, and resources from other parts of the world, digital conventions, co-working spaces, and online training courses are becoming popular, for example, the Global Village Concept that is used at CBIIC to co-innovate with like-minded individuals in the west. For this to work effectively, good ICT infrastructures are required at the innovation hubs.

4.8. Considering ways to co-create with grassroots actors

Significant amounts of the innovations and business models designed at hubs target low-income and marginalized communities. Despite being key beneficiaries, they often lack time and resources to be proactive in the ecosystem engagements where they could contribute their knowledge and viewpoints. To foster the much-needed co-innovation with this segment of beneficiaries, hubs need to find innovative ways to reach out to them and to provide conducive environments for their proactive engagements. In most cases, the physical environments in these hubs tend to have a “sophisticated” feeling that may not be inviting to this segment of beneficiaries. The hubs may, for example, have to go where the marginalized communities are and work with them from their areas of living and businesses, e.g. in rural villages. As such, a re-thinking of the hub concept is required, that broadens activities beyond the physical locations, and also encourages proactive participation by marginalized and low-income communities.

Possible areas to find inspiration is studying incubation programs that target organized community groups as partners. An example is the Netherlands funded program *2Scale*. It is an incubator for inclusive agribusiness

that aims to improve rural livelihoods and food and nutrition security across nine sub-Saharan countries. 2Scale offers a range of support services to private partners – companies and farmer groups – enabling them to produce, transform, and supply quality food products to local, national, and regional end-user markets, including base-of the pyramid (low-income) consumers (2Scale, 2020).

4.9. Significant role of hub management

Hub developments generally require flexibility and constantly being open to change. A newly established hub will have to go through a lot of adaptations in its model over several years before a model that is fitting to local circumstances is eventually defined. Monitoring, evaluation, and learning processes will require dedicated personnel who are ready to commit to nurturing the hub. Dedicated leadership was suggested to be a key ingredient to establishing an impactful innovation hub. A dedicated hub management is critical for the following:

- To steer the development in the hub by improving the systems over the years.
- To keep hub activities in sync with the current and emerging themes and needs by students and researchers and within fast-paced innovation and entrepreneurship ecosystem.
- To coordinate the development of thematic focus areas for the hub and to shape its objectives, missions, and vision.
- To coordinate capacity development programs and ensure the hub is active – meaning: planning the program, managing schedules, being in communication with trainers, mentors, incubates and other partners, executing events and budgets.
- To develop systems to manage the different programs, and to conduct monitoring, reporting, evaluation, and learning.
- To promote the hub and its activities: call for innovative ideas, engaging in strategic deliberations with supporters, and representation at conferences and ecosystem meetings.
- For university-embedded hubs, to create and steer ongoing interactions with the different institutions within the university to identify areas of mutual benefits and how best to work together.
- To identify opportunities for the hub and make fund-raising campaigns.
- To keep inventory of items in the hub and to monitor emerging needs for the physical spaces (e.g. requirements in the physical spaces).

The tasks are diverse, and the strategic components call for dedicated personnel. Coordination and timely execution of these tasks will keep a hub effective and vibrant.

5. AREAS FOR FUTURE STUDIES

To conclude, we highlight some research gaps that were identified in this study. There are more than 600 innovation hubs in Africa and widespread interest to develop new ones (Afrilabs and Briter-Bridges, 2019). Hubs are increasingly becoming influential within innovation and entrepreneurial ecosystems in countries across Africa. We are observing hub proponents taking leading roles in national agendas and fostering the establishment of Startup Acts. The significant potential of hubs for social, governance, political, and economic transformations in Africa warrants increased scientific studies – findings that will help hub managers, policy makers, and other ecosystem actors to design more impactful concepts and approaches. The following three areas of study may provide beneficial insights:

First, a systematic review of literature on innovation hubs in Africa would provide an overview of the past and current developments, which could inform future developments in the sector. There is currently no systematic review – known to the author – focusing on hubs in Africa. Such a review would help guide researchers that are new to the area of study. A systematic study would also identify if and how African hub concepts have evolved over time and the factors influencing the transformations.

Second, studies related to funding flows and biases therein, and on how to foster equitable funding mechanisms, could be beneficial for the innovation and entrepreneurial ecosystem in Africa. This topic is currently discussed widely among ecosystem actors with the concern that the bias in favor of expat startups could be draining the continent of value. Few scientific studies exist that explore this question.

Third, a study on the value of university-embedded innovation hubs would be useful – considering their more recent entry into the role of hosting and managing hubs. We hypothesize that hubs have resources and capabilities that could contribute in significant ways to the broader innovation system in Africa, particularly in fostering a knowledge-based economy. University-embedded hubs are positioned differently from the independent hubs and investigating the differences would provide useful insights on how they can contribute most effectively to the innovation and entrepreneurial ecosystems. The value of different ecosystem actors (including the university-embedded hubs) could for example be analyzed using actor-networks frameworks from the innovation systems literature.

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