

Tech Start-up Ecosystem in Dar es Salaam

FINDINGS AND RECOMMENDATIONS



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Terms Used

Start-up	A newly establish business venture that is in its first stages of operation. This report focuses on tech start-ups, which are start-ups that have a technological component. These start-ups are typically designed to scale up quickly.
Start-up Ecosystem	The combination of people, start-ups at various stages and other stakeholders and organizations supporting or connecting to these start-ups, interacting in multiple dimensions to create and scale new start-up ventures.
Scale-up (Firm)	OECD defines a scale-up as a firm that has an average annualized return of at least 20 percent in the past three years with at least 10 employees at the beginning of the period (OECD 2007).
Venture Capital (VC)	An institutional investor that provides financing to start-ups and small early stage firms. Usually VCs look for high growth potential firms to exit the investment in the short term.
Angel Investor	An investor who invest in ventures (primarily at an early stage) in their personal capacity (that is, investing their personal money) and may or may not have an active advisory or guidance role for the founders in the venture.
Mentor	An experienced person who can provide advice, knowledge, or connections to a start-up founder. Mentors usually have strong business acumen and practical experience through former entrepreneurship experience or industry knowledge.
Business Acumen	Theoretical or practical knowledge of how to develop and manage a business, including proclivity and speed in understanding and dealing with risks and opportunities in the business environment.
Exit (start-up exit)	Refers to the point at which a founder or early stage investors sell their stakes in the venture, generally either in a private acquisition or public offering. This report refers more widely to “start-up exit” as the point at which a start-up is sustainable or it has received sufficient funding to grow in the medium-term (that is, over the next five years).

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Executive Summary

Technology is one of the main drivers of productivity and economic growth (Isaksson, Ng, and Robyn 2005). Developing countries have traditionally had difficulties in both developing technology and absorbing foreign technology. Seventy to eighty percent of the productivity gap between developed and developing countries is estimated to result from the lag in the adoption of technologies in these countries (Comin and Marti 2013; and Comin and Hobijn 2010).

Tech start-ups are an effective a mechanism to both create local technology and absorb foreign technology. In recent years, there has been a surge in tech start-ups across the world. Fueled by global technology-led cost reductions and increased access to resources, tech entrepreneurs have emerged in both develop and developing countries. However, there is little understanding of how these tech entrepreneurs form ecosystems, their internal dynamics, how they work, what makes them grow and achieve sustainability, how they connect with the local economy to drive productivity and employment, and why some ecosystems are more effective than others.

This report is part of a broader research initiative (See Box 1.1) aiming to provide answers to these questions. It provides new data and analysis of the tech start-up ecosystem in Dar es Salaam, Tanzania. The analysis comprises: (i) an attempt to provide an accurate description and measurement of the city's tech start-up ecosystem; and (ii) a comparison and gap

analysis of four key components of the tech start-up ecosystem (skills, finance, entrepreneurial supporting infrastructure, and community).

The objective of this report is to provide a better understanding of the status of Dar Es Salaam's start-up ecosystem and provide policy recommendations for policy makers and other stakeholders who are interested in supporting the growth and sustainability of the ecosystem.

Analysis Limitations

Measuring the tech start-up ecosystem is difficult. Relevant databases of start-ups are not readily available, and the fast-paced and multidimensional dynamics of start-up ecosystems, with new ventures constantly being created, failing, being closed, being bought or transformed (changing names and/or purpose), makes accurate measurement over time inherently difficult.

For this analysis, 221 entrepreneurs were surveyed in Tanzania from July to September 2016 and data was collected for 159 relevant start -ups and 239 start-up founders. The survey was based on the standard questionnaire from the Global Entrepreneurship Research Network (GERN) Ecosystem Connection project (see Box 1.1). The findings and conclusions of this analysis are based on this survey and so there are some limitations to this analysis. The dataset is not exhaustive and only represents a subset of the ecosystem's start-ups. Moreover, it is subject to survivorship bias and does not include start-ups that

were no longer in business when data was collected. Historical data about start-ups was collected through existing founders who were available at the time of the survey.

Despite these limitations, the subset of start-ups surveyed provides unique insights into the ecosystem. Data was collected by snowballing from public data contained in existing databases, networks from key stakeholders (for example, accelerators, events, and so on), as well as recommendations from founders. Although there are start-ups that were not captured in this survey, nevertheless it provides one of the richest samples of data collected to date on the most influential founders.

Findings

The tech start-up ecosystem in Dar es Salaam is a nascent ecosystem in its initial growth phase (see table below). The ecosystem is rapidly growing, with a 33 percent compound growth rate in start-up creation since 2009. However, it consists of fairly young start-ups, with most founders being in their first venture, with a limited number of serial entrepreneurs and few successful cases of scale-up.

A key characteristic of the ecosystem is the presence of educated founders (with 80 percent having a university degree and 15 percent an additional graduate degree, masters, or professional qualification). However, the education backgrounds of founders (for example, in engineering) suggest a highly technically driven ecosystem with low

business acumen, which may affect the survival rate of start-ups since business knowledge is essential for sustainability beyond the founding phase. Indeed, founders that have successfully obtained funding in Dar es Salaam have a higher rate of business education.

The supporting infrastructure (for example, accelerators, mentors) and the community are still nascent. When compared with more mature ecosystems (such as in Cairo or Medellin), the community in Dar es Salaam only features a small cluster with low-density connectivity. The accelerators are the key connectors of the ecosystem, holding it together and providing the higher connectivity within their networks. However, they are not producing a high number of start-ups that can sustainably and independently obtain further funding. The reasons for this may lay in low-quality services, capacity building, or network connections provided by the accelerator. Research also highlighted the need for increased availability of mentorship.

Investment options are limited for start-up founders in Dar es Salaam. This may be because of a lack of maturity in the investment infrastructure to support and follow up the growth of start-ups, either because scale-up has not occurred very often or because the investors available for start-ups (with the risk appetite for early ventures) are limited. In addition, larger constraints highlighted by entrepreneurs relate to incorporation (when outside of Dar es Salaam), and processes related to obtain close loans and funding.

DEVELOPMENT STAGE OF DAR ES SALAAM'S START-UP ECOSYSTEM

Ecosystem Area	Stage		
	Nascent	Advancing	Mature
 Community			○
 Skills			○
 Supporting Infrastructure			○
 Investment			○
 Constraints			○
OVERALL			○

Policy Recommendations

Based on this analysis, a set of policy recommendations were developed (see table below), which are further expanded in the report.

Ecosystem Area	Policy Recommendation	Objective
 Community	Coordination mechanism and ecosystem support program with stakeholders	Create community of ecosystem stakeholders and coordinate private and public support actions
 Skills	Catalyze community spaces (for example, coworking spaces) and events (for example, meetups, competitions, and so on)	Expand community of entrepreneurs and increase both density and volume of connectivity
 Support Infrastructure	Increase business skills among entrepreneurs, expand practical education in universities and through rapid skills training programs	Address gap in business skills and business acumen and provide pipeline of talent for start-up growth
 Investment	Capacity building of mentors in accelerators and attraction of international talent (as mentors, entrepreneurs, or capacity builders) to the ecosystem	Address lack of quality mentors and support services
 Constraints	Catalyze privately managed seed-funding options	Address limited availability of funding for start-ups
	Address processes constraints (for example, business registration and access to loans)	Reduce constraints for start-ups incorporation and operationalization

Measuring and Analyzing the Tech Start-up Ecosystem in Dar es Salaam

This report provides an analysis of the tech start-up ecosystem in Dar es Salaam. The analysis comprises: (i) an attempt to provide an accurate description and measurement of the city's tech start-up ecosystem and (ii) a comparison and gap analysis of four key components of the tech start-up ecosystem (skills, finance, entrepreneurial supporting infrastructure, and community).

For the purposes of this report, tech start-ups are defined as for-profit business ventures that a) have a financial model targeting high growth and b) employ an innovative and technology-enabled approach to the product or service that they provide to ensure scalability. These ventures may not be profitable at their current stage.

In order to capture the whole tech start-up ecosystem, this report expands the concept of start-ups to include newly emerging start-ups as well as small and medium enterprises (SMEs) that were once start-ups and have reached the scaling phase. This definition allows us to collect data to describe the evolution of the tech start-up ecosystem over time as these start-ups grow and succeed.

Measuring the Tech Start-up Ecosystem

Measuring the tech start-up ecosystem is a difficult task. Relevant databases of start-ups are not readily available, and the fast-paced and multidimensional dynamics of start-up ecosystems, with new ventures constantly being created, failing and being closed, and being bought or transformed (changing names and/or purpose), makes accurate measurement over time inherently difficult.

Some databases have tried to collect information on start-ups. These databases are global, local (mostly at the level of metropolitan areas' ecosystems) and, in some cases, domestic

(countrywide). Databases are both open and proprietary. Access to proprietary databases is limited and in some cases restricted (not being open to wider research). The most relevant open databases of start-ups are provided by CrunchBase and Angellist. Neither of these databases, however, necessarily provides accurate or complete information. CrunchBase is a self-reported database that is not curated by an official entity, and as such it can have inaccurate information such as closed or transformed ventures still being posted with the original data, founders omitted, and so on. Angellist generally contains more accurate information since start-ups listed there have received or are actively soliciting investment from angel investors or venture capital (VC) firms. Other global start-ups repositories, such as Startup Genome,¹ build on these databases with additional self-reporting data from start-ups, and therefore are subject to similar limitations. Finally, while LinkedIn can provide more accurate data of start-ups through funders and employers, data access and use restrictions make its use for independent research purposes difficult.

These global databases, however, are of little use in building an overall picture of the tech start-up ecosystem in many developing countries, as they contain little information on these regions. At the time of conducting this analysis, CrunchBase contained only 43 start-ups from Tanzania, and Angellist only 76.

Regional and local start-up databases can be richer in data and more accurate, since they are often the result of an active effort to track the activity and lifecycle of start-ups. Examples of these databases are Digital NYC² in New York or Tech Map³ in London. However, these databases are not present in many ecosystems, particularly in developing country ecosystems, and given their localized methodologies, their data is difficult to utilize for comparative analytics. Other datasets, such as that of the Global Accelerator Learning Initiative,⁴ only have enough power to report data at the regional level.

While official government or NGO-managed databases in developing countries can provide richer and more accurate data from SMEs and larger companies, they also lack both data breadth and depth when it comes to start-ups. In the case of Tanzania, the census (last conducted in 2012) only contains information on employment by sector and age, but does not include a category for start-ups or SMEs.⁵

To combat this poor data availability, a survey was designed and deployed by extending the standard questionnaire from the Global Entrepreneurship Research Network (GERN) Ecosystem Connection project (see Box 1.1). For a broader description and technical details of this survey, please see the “Survey Questions” section in the Methodology portion of the Annex. We surveyed 221 entrepreneurs in Tanzania from July to September 2016 using an online interactive survey distributed through local partners by email, phone, and in person.⁶ Out of these interviews, we collected data for 159 relevant start-ups and 239 start-up founders. This sample gives us unique insights into the characteristics of founders, start-ups, investors, and supporting infrastructure in Tanzania, as well as the relationships between them.⁷

BOX 1.1 GER N ECOSYSTEMS CONNECTION PROJECT

The Ecosystem Connections Mapping Project goal is to map start-up ecosystems across the world by collecting data on start-up founders (for example, education, work experience, serial entrepreneurship, and so on) and the connections between themselves and other key stakeholders in their ecosystem (for example, mentors, investors, accelerators, universities, and so on) to better understanding and support entrepreneurs in local start-up ecosystems. This data aims to identify gaps in ecosystems and provide a base for policy action to address these gaps and support growth and sustainability of start-up ecosystems.

The project has mapped over ten start-up ecosystems in cities across the world (including, Bogota, Cairo, London, New York and Singapore). The survey conducted for this report is also part of this project, adding Dar es Salaam to the ecosystems mapped.

The leading partners of this project are Endeavor Insight and the World Bank.

Source: <http://gern.co/gern/ecosystem-connections-mapping>.

The resulting dataset is not exhaustive and only represents a subset of the Dar es Salaam ecosystem’s start-ups. Moreover, it is subject to survivorship bias and does not contain start-ups that were no longer in business when data was collected. Historical data about start-ups is collected from existing founders available at the time of surveying. These limitations are discussed in detail in the Methodology section of Appendix A. Despite these limitations, the subset of start-ups surveyed is likely to be a representative sample since the start-up data was collected by snowballing from public data contained in existing databases, networks from key stakeholders (for example, accelerators, events, and so on), and recommendations from founders. Although there are start-ups that were not captured in his survey, nevertheless it provides one of the richest samples of data collected to date on the most influential founders, start-ups, intermediaries, and other ecosystem stakeholders in Dar es Salaam.

This report assumes that, owing to the fast-moving nature of start-up ecosystems, any attempt to accurately measure the tech start-up ecosystem is inherently flawed – any measurement will be obsolete immediately after collection. The findings and recommendations provided in this analysis should be taken with this limitation in mind. Less emphasis should be placed on exact numbers, which are subject to change with the addition of more start-ups and sensitive to minor tweaks in methodology. Rather, the data collected provides insights into general trends and the dynamics of the ecosystem that can inform specific policies. This analysis should not be considered in isolation, however, and policy makers are encouraged to confirm these findings through other available resources (for example, perspectives from practitioners and anecdotal evidence).

Analyzing the Tech Start-up Ecosystem

The following analysis of the tech start-up ecosystem in Dar es Salaam is based on the data collected through the survey described above. This report analyzes four key elements: i) skills, ii) finance, iii) supporting infrastructure for entrepreneurship, and iv) community. The analysis first describes the status of each of these elements based on the data collected, and then compares the results with those reported by both average and successful start-up founders.

For the purposes of this analysis, successful start-ups are defined as those that have been funded and those that employ people. “Short-term success” is defined as obtaining funding once; “long-term success” is defined as continuously hiring employees (as a proxy for growth).

Comparing average founders and start-ups with successful ones highlights which characteristics (in terms of education, experience, connections, and so on) are more predominant in successful start-ups in Dar es Salaam and whether they are

consistent with those in other ecosystems or with global trends (where data is available). Where comparable data is available on other ecosystems surveyed under the GERN Ecosystems Connections Project, local results are benchmarked with other ecosystems to understand if there are gaps that could be addressed.

The four elements this report analyzes represent the key ingredients needed for tech start-up ecosystems to grow and be sustainable. *Skills* aims at understanding the educational and work experience that founders have and those that are more common for successful founders. *Finance* looks at the funding obtained by start-ups during their lifecycle and the general availability of such funds. *Supporting infrastructure* for entrepreneurship seeks to understand the quantity and quality of support programs and resources for start-ups to succeed. Supporting infrastructure encompasses accelerators and incubators, mentors, events, and other ecosystem and/or skills building resources. Finally, *community* looks at the maturity

of the ecosystem as a network of stakeholders that support each other (directly or indirectly) for the successful outcome of start-ups.

This analysis is conducted under the premise that start-up ecosystems are communities of stakeholders and that the success of such ecosystems is linked to the maturity, health, and sustainability of the community. Previous World Bank research (Mulas, Mingos, and Applebaum 2015) shows that tech start-up ecosystems act as communities and that centrality (that is, the number of ecosystem stakeholders to which a founder is connected to directly or indirectly) is critical for start-up success. This finding is also consistent with research from Endeavor Insight showing that access to mentors increases the probability of start-up success.⁸ In this environment, the supporting infrastructure acts both as a skills and network provider and is critical for ecosystem sustainability. The ecosystem's supportive infrastructure is mainly comprised of networking assets (see Table 1.1).

TABLE 1.1 NETWORKING ASSETS (ECOSYSTEM'S SUPPORT INFRASTRUCTURE)

 Community-Building Events	 Skills Training Events	 Collaboration Spaces	 Collaboration Spaces/Networks of Mentors	 Network of Mentors
Meetups	Bootcamps and technology training linked to community building	Collaboration and community-building spaces (e.g., coworking spaces, maker spaces, fab labs)	Accelerators (network value)	Angel investors (network value)
Tech community events/conferences	Rapid technical and entrepreneurial skills programs		Incubators (network value)	Venture capital (network value)
				Networks of mentors and start-up "alumni" networks (if different from accelerators, incubators, angel investors, and venture capital)

Source: Mulas, Mingos, and Applebaum 2015.

Based on these four elements, the analysis categorizes ecosystems into three broad categories: a) nascent ecosystems, b) advancing ecosystems, and c) mature ecosystems (see Table 1.2):

a) Nascent Ecosystem. There are a limited number of start-ups, most of which are in the very early or early stages. The community of entrepreneurs is forming, and has low density of connections with few clusters, if any. In these ecosystems, founders lack business experience, mentors are scarce and inexperienced and there are few generations of entrepreneurs (most entrepreneurs are in their first or second venture), there are few or no start-up exits or, if there are any, they are outliers. There are few or no international connections. The finance pipeline has multiple gaps and private early stage finance is rare (if it exists).

b) Advancing Ecosystem. These ecosystems have an increased number of start-ups, with most in the early stages but with increasing numbers of scale-ups. The community of entrepreneurs has several clusters and a high density, and there are a handful of successful start-up exits. There is still a lack of business acumen among entrepreneurs but there are a growing number of serial entrepreneurs and the ecosystem has more than three generations of start-ups.

There are an increasing number of international connections and mentors with local start-up experience. The finance pipeline is starting to form with increasing private sector investment in early stage start-ups, but there are still gaps in the path to scale up and exit.

c) Mature Ecosystem. These ecosystems have a large number of start-ups in all stages (for example, growing, scaling up, exits) and the ecosystem is highly interconnected. The majority of entrepreneurs have business acumen and previous relevant business experience, there are several generations of start-ups with multiple serial entrepreneurs and successful exits. Mentors are abundant, they have solid practical experience, and there is a solid base of angel investors. The ecosystem is an international hub itself and attracts international talent. The finance pipeline has no gaps and early stage funding is provided by sustainable private funds.

These categories are broad and serve to provide a sense of where ecosystems are in their life cycle. As this research continues and we can access data from a larger sample of ecosystems from the GERN Ecosystems Connection project, we will be able to provide more concrete metrics on these stages.

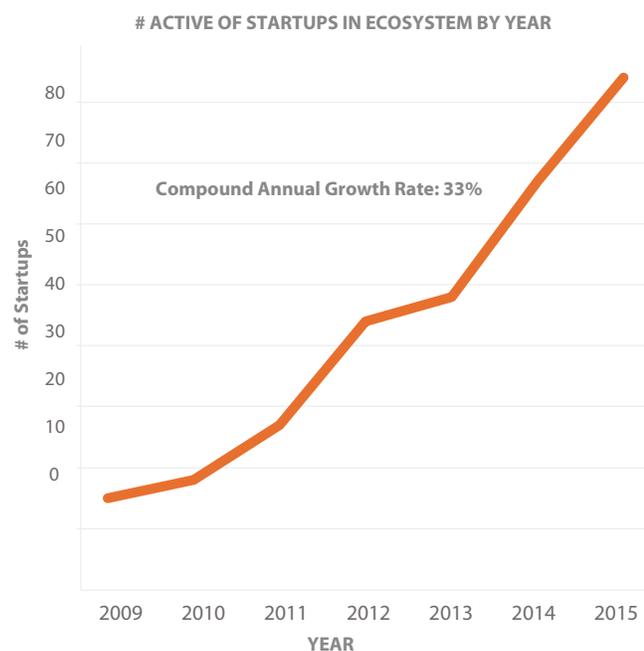
TABLE 1.2 CATEGORIES OF ECOSYSTEMS

Ecosystem Area	Stage		
	Nascent	Advancing	Mature
 Community	<ul style="list-style-type: none"> Limited number of start-ups, most in early stage Low density of connections Low number of clusters 	<ul style="list-style-type: none"> Increased number of start-ups, most in early stage with increasing number of scale-ups Several clusters High density in clusters 	<ul style="list-style-type: none"> Large number of start-ups in all stages Highly dense, hyperconnected clusters
 Skills	<ul style="list-style-type: none"> Lack of business acumen and experience Very few serial entrepreneurs and limited generations of entrepreneurs No substantial exits 	<ul style="list-style-type: none"> Limited business acumen Increasing number of serial entrepreneurs and more than 3 generations Exits start to appear 	<ul style="list-style-type: none"> Business acumen and practical experience Several generations of start-ups Successful exits
 Supporting Infrastructure	<ul style="list-style-type: none"> Mentors are scarce and inexperienced No international connections 	<ul style="list-style-type: none"> Mentors are available and they have local practical experience Increasing number of international connections 	<ul style="list-style-type: none"> Plenty of mentors with sound practical experience International hub attracting international talent
 Investment	<ul style="list-style-type: none"> Gaps in finance pipeline Very few private sector funding opportunities 	<ul style="list-style-type: none"> Finance pipeline with some gaps Private early stage investment exists 	<ul style="list-style-type: none"> No gaps in finance pipeline Private early stage finance sustainable

The Tech Start-up Ecosystem in Dar es Salaam

The tech start-up ecosystem in Dar es Salaam is a nascent ecosystem in its initial growth phase. On average, each year, 11.5 more start-ups are created than in the previous year, resulting in a 33 percent compound growth rate in start-up creation since 2009 (see Figure 2.1).⁹

FIGURE 2.1 START-UP GROWTH IN DAR ES SALAAM



Note: Data shows tech start-up ventures as reported by founders of active start-ups during date of survey. Data of start-ups founded in year 2016 was not included in this figure because the survey was carried out in mid-2016, which was not comparable with all previous data from complete years.

About one-third of the start-ups surveyed reported hiring at least one employee, with a median of four jobs per start-up and

a total of 196 jobs created. The median start-up that provided employment data was one year old and hired three people per year. This suggests that Dar es Salaam is a nascent ecosystem, with fairly young start-ups and few successful cases of scale-up.

Start-ups in Dar es Salaam face some bureaucratic hurdles in their life cycle (see Figure 2.2). Ventures can rapidly open a bank account but incorporation, renting an office, and hiring qualified personnel typically takes about a month. The time for incorporation increases substantially if the start-up is located outside Dar es Salaam, as the only accessible registrar for incorporation is in the capital city.¹⁰ Obtaining funding is a much lengthier process taking about three months to procure bank credit (for example, a loan) and four months to close funding (for example, individual or institutional investor).

Respondents also expressed sentiments such as, "Taxation and laws governing filing of taxes are not readily available and friendly for the start-up scene. Hiring services for filing taxes is expensive and difficult to find one that can help a start-up," and, "The business registration process is frustrating especially because I am a foreigner. I cannot register a business without a permit and I cannot get a permit without a business registration." One entrepreneur expressed disappointment with "bureaucracy in the government policies, as it took us more than two years, to just get the Impact Assessment certificates," and another found that "patenting procedures in Tanzania is not very clear." Another relayed that, "Only until recently office space has been readily available and affordable for start-ups to rent for less than three month advance payments." There is a general sentiment that, "Government processes and regulations are a challenge, they are very slow, and most of the time, there is no clear process to follow."

Compared to other early and middle stage ecosystems (such as Lebanon and Palestine), processes in Tanzania are lengthier for receiving credit and funding, indicating greater difficulty (linked to procedures or access to finance requirements) in obtaining funding for start-ups.

On average, start-ups have 1.5 founders and each founder has launched 1.1 start-ups. This is consistent with nascent stage ecosystems, when serial entrepreneurs are yet to feature.

Founders are predominantly male, and they are as likely to have business and technical functions, with about a quarter taking on business functions, a quarter taking on technical functions, and half doing both simultaneously (see Figure 2.3).

FIGURE 2.2 TIME TO COMPLETE PROCEDURAL TASKS IN LIFE CYCLE OF A START-UP ACROSS REGIONS

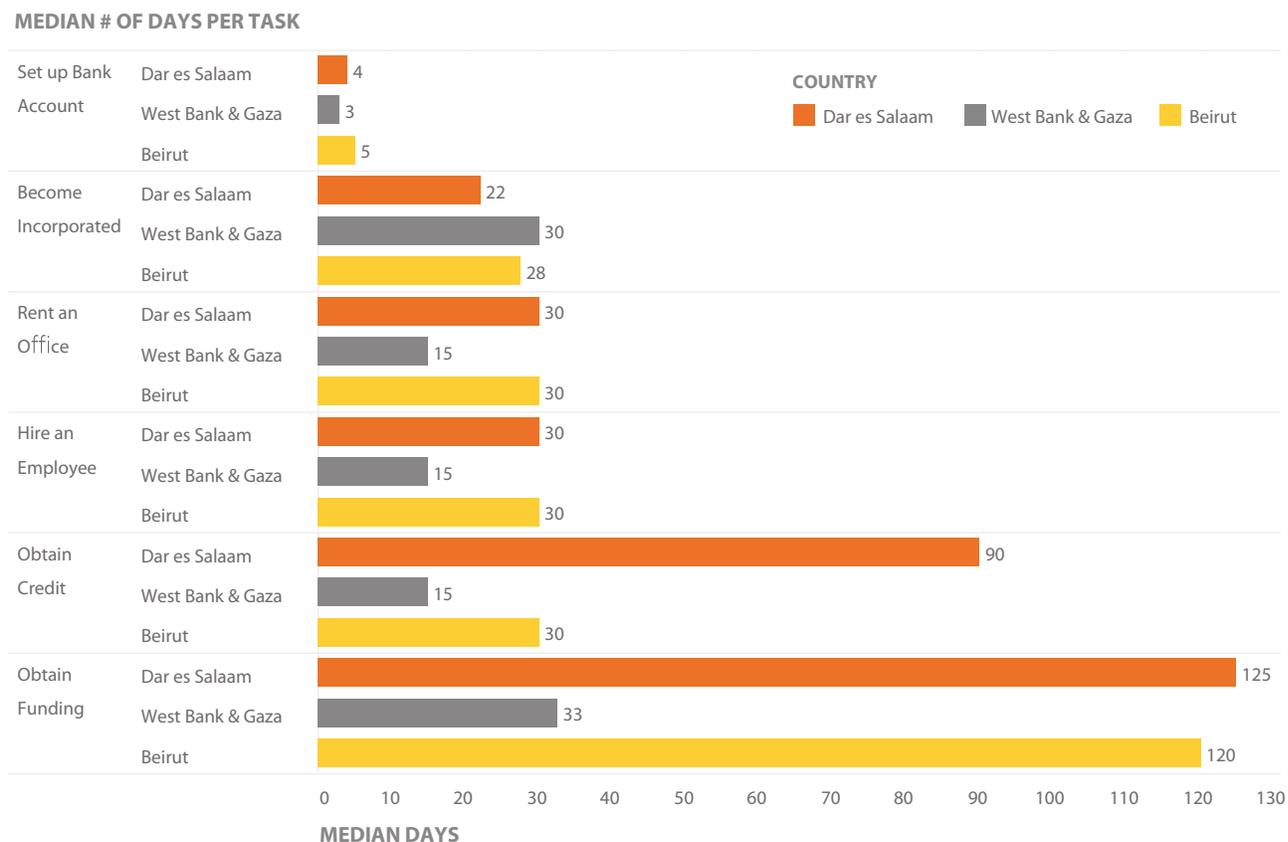
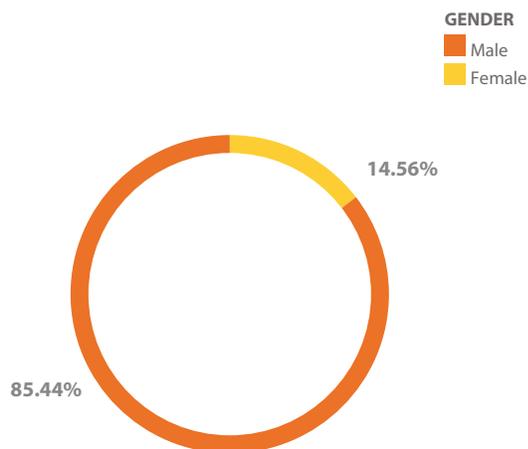
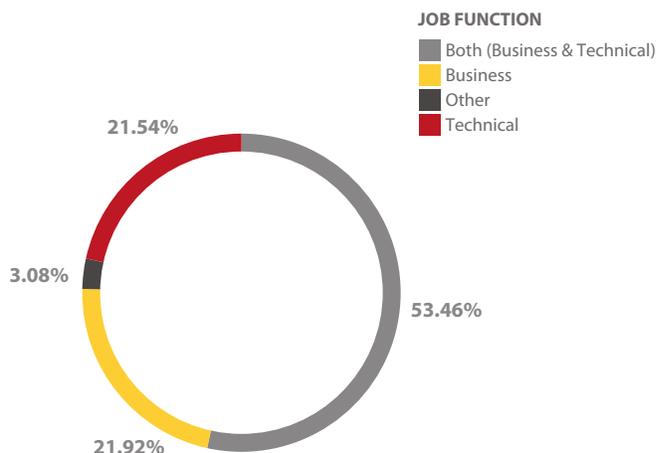


FIGURE 2.3 GENDER DISTRIBUTION AND JOB FUNCTIONS OF FOUNDERS

Gender Distribution of Founders



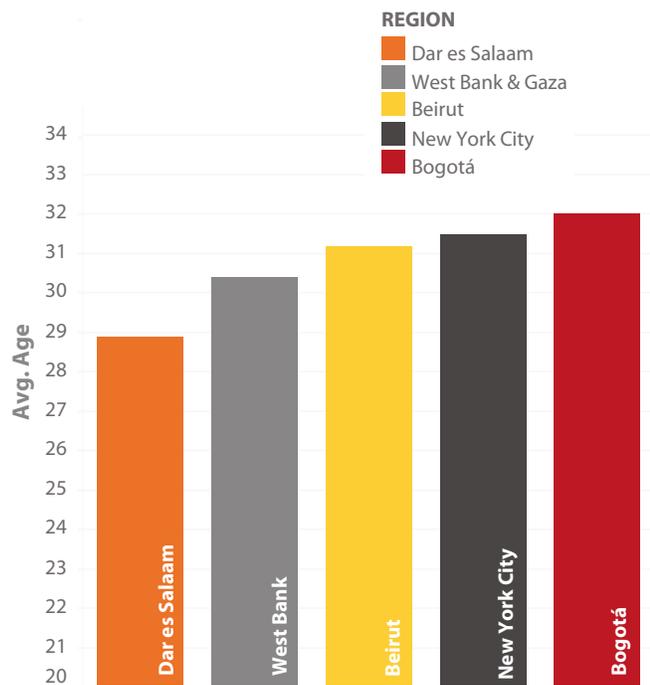
Job Functions of Founders



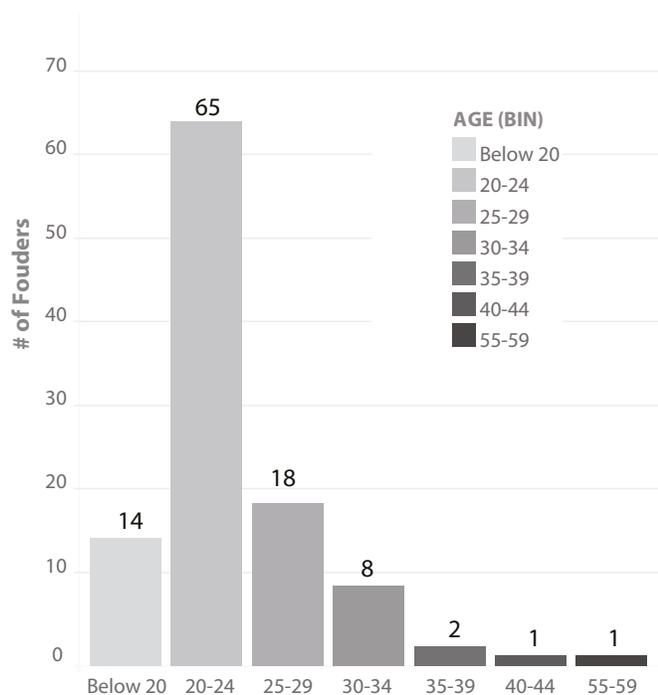
Founders are quite young, with an average age of 23-24 at the time of founding (see Figure 2.4).¹¹ As a comparison, mid-stage ecosystems, such as Bogota, and mature ecosystems, such as New York, have an average age of founders in the late 20s and early 30s.¹²

FIGURE 2.4 AVERAGE AGE OF FOUNDERS

Average Age of Founders Across Various Regions



Age Distribution of Founders in Tanzania

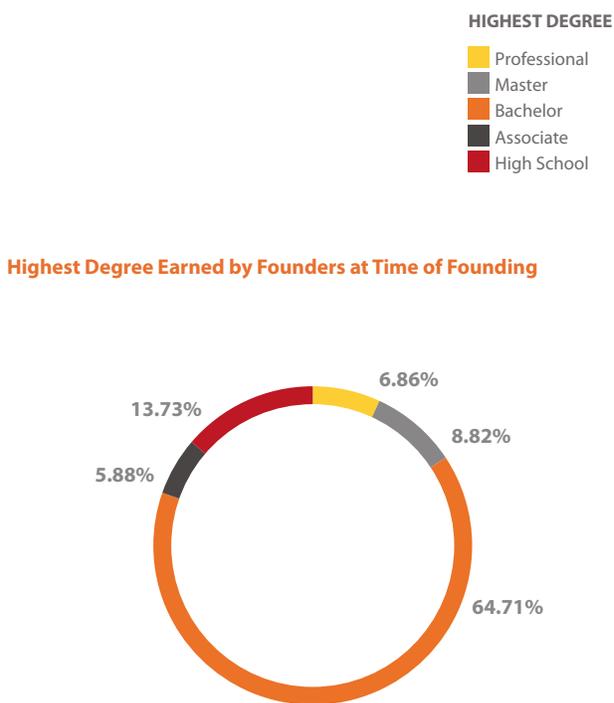


Skills

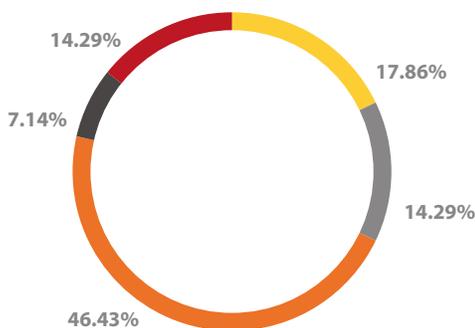
Dar es Salaam founders are highly educated for Tanzania, but they lack critical business acumen and are fairly inexperienced.

Education is high among founders in the context of Tanzania¹³ with 80 percent having a university degree (65 percent bachelor's and 15 percent an additional graduate degree, masters or professional qualification).¹⁴ Funded start-ups were more likely to have higher education, with a third of them having founders graduate education in the form of a masters or professional degree (see Figure 2.5)

FIGURE 2.5 EDUCATIONAL LEVEL OF FOUNDERS IN DAR ES SALAAM



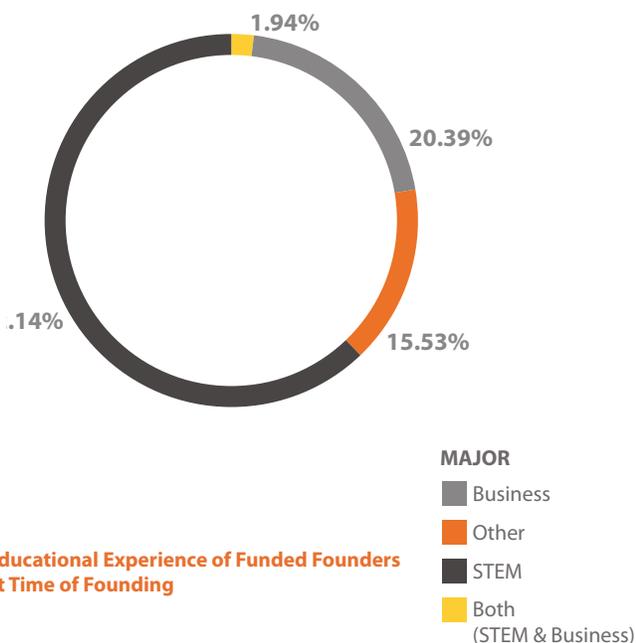
Highest Degree Earned by Funded Founders at Time of Founding



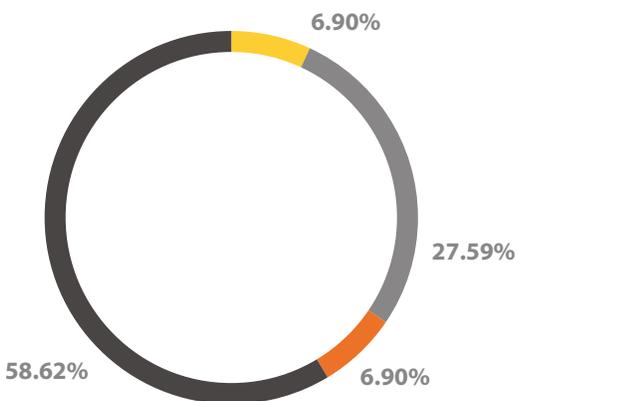
The majority of founders (62 percent) have a degree in science, technology, engineering or mathematics (STEM), 20 percent have a degree in business, and 2 percent had both STEM and business degrees.¹⁵ Twenty percent of STEM degrees were master's or higher. This suggests a highly technically driven ecosystem with low business acumen, which may affect the survival rate of start-ups since business knowledge is essential for sustainability beyond the founding phase. By comparison, in a more mature ecosystem, such as New York, almost half of the founders hold a graduate business degree.¹⁶ Indeed, founders that have successfully obtained funding in Dar es Salaam have higher rate of business education with about a third of them having degrees in business (see Figure 2.6).

FIGURE 2.6 EDUCATIONAL EXPERIENCE OF FOUNDERS IN DAR ES SALAAM

Educational Experience of Founders at Time of Founding



Educational Experience of Funded Founders at Time of Founding

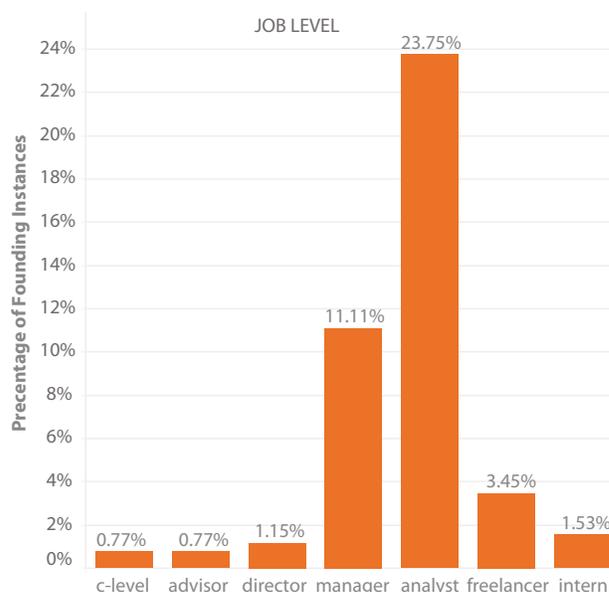


The average founder in Dar es Salaam has 5.4 years of work experience with no more than two companies (1.6 companies on average). This work experience is similar to other emerging ecosystems. For instance, in Bogota, the average founder and has worked in an average of 1.7 companies. In a much more mature ecosystem, such as New York City, the experience of founders is much higher, with 9.9 years in 3.3 companies.

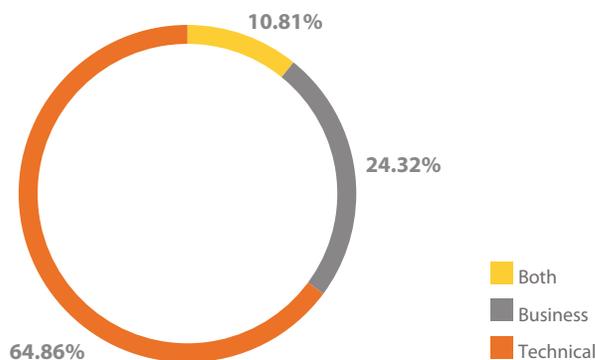
The largest category of previous experience is analyst, with 24 percent of founders with such experience. Only about one in ten founders have experience in a managerial role, confirming the lack of business acumen in the ecosystem (see Figure 2.7). Indeed, most founders have technical experience, with only 35 percent having business work experience. There are few serial entrepreneurs, with most founders being in their first venture. This job experience of Dar es Salaam founders is consistent with the preeminence of younger founders and the nascent stage of the ecosystem.¹⁷

FIGURE 2.7 PREVIOUS FUNCTION AND ROLE TYPE OF FOUNDERS IN DAR ES SALAAM

Previous Role Type of Founders



Previous Functions of Founders at Time of Founding



Supporting Infrastructure for Entrepreneurship

Consistent with the ecosystem maturity, the supporting infrastructure for start-ups in Dar es Salaam's ecosystem is nascent but growing. The two main elements of the supporting infrastructure analyzed are accelerators and incubators, terms that are used interchangeably in this report (see Box 2.1), and mentors.

Accelerators

Accelerators support start-up growth by providing skills and networks of connections. Previous research from the World Bank shows that accelerators have a key role in supporting the community of start-ups that generate the ecosystem, providing the necessary social connectivity among entrepreneurs and other ecosystem stakeholders (Mulas, Minges, and Applebaum 2015). Research from the Aspen Institute also suggests that accelerators have a positive impact in supporting early stage ventures by providing access to a network of mentors and capacity building, particularly regarding business skills and acumen (I-DEV International 2014; Baird, Bowles, and Lall 2013; and Roberts, Lall, and Baird. 2016).

There are five relevant accelerator and mentorship programs supporting a total of 34 of 159 start-ups in the ecosystem (see Figure 2.8). Three of these programs stand above the rest: 1) Buni Hub,¹⁸ 2) Small Industries Development Organization (SIDO),¹⁹ and 3) DarTeknohama Business Incubator (DTBI).²⁰ Two of these (SIDO and DTBI) are government-funded programs provided by the Ministry of Trade and Economy and the Tanzanian Commission for Science and Technology (COSTECH), respectively. Buni Hub is funded by COSTECH and is based in their government offices. A subset of start-ups accelerated by these programs was included in the survey.

BOX 2.1 ACCELERATORS AND INCUBATORS

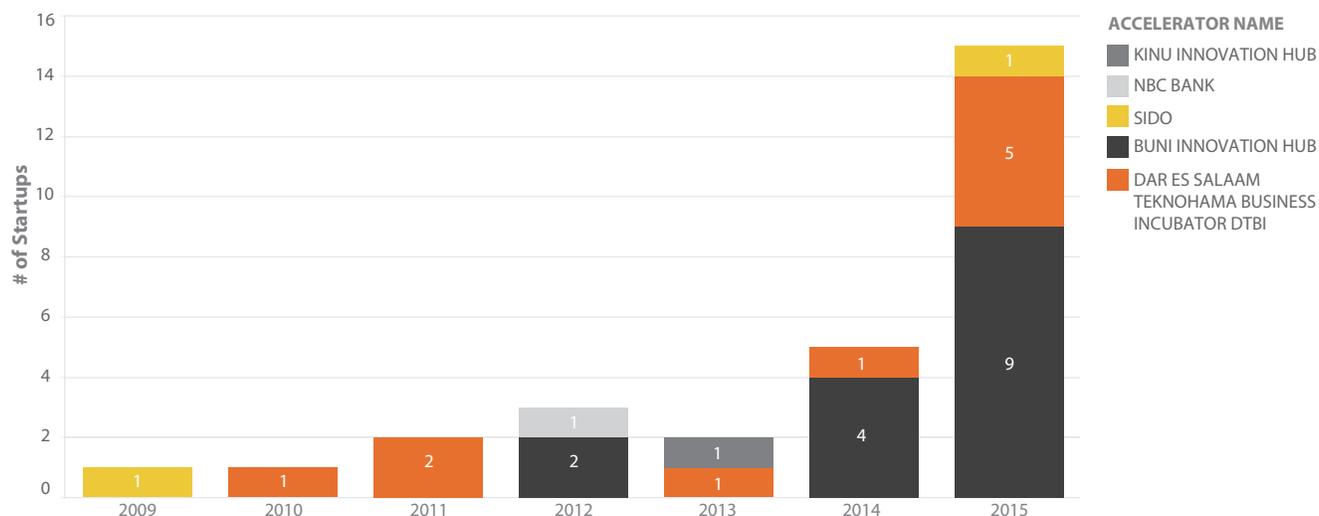
Although the dataset and analysis does not differentiate between incubators and accelerators, there is a difference in their definition:

Accelerators support entrepreneurs and start-ups in the early stages of development and they are often comprised of the following features: (i) a highly competitive and open application process for entrepreneurs, (ii) provision of small amounts of seed investment, (iii) a focus on small teams rather than individual founders, (iv) intensive support for a limited period of time (usually 3-6 months), with active mentorship and networking, and (v) collaborative work among start-ups through cohort or classes of start-ups.

Incubators are spaces that support start-ups by providing an office space and administrative support services. The most typical services are legal, recruiting, IT, accounting, public relations and pooled buying programs. In addition, incubators may also provide coaching, mentorship, and help with access to funding on an ad hoc basis. Start-ups pay rent (which is usually below the market rate) for the office space and normally a time limit is not set for start-ups staying in the incubator (the average length of stay ranges widely from 18 months to five years). Some incubator providers may ask for a share of future profit or require minority stake in the start-up as a prerequisite for access to the incubator.

Source: Mulas, Minges, and Applebaum 2015.

FIGURE 2.8 START-UPS IN ACCELERATOR PROGRAMS IN DAR ES SALAAM



Buni Innovation Hub has the largest portfolio of start-ups, and it also hosted 10 percent of the events entrepreneurs reported attending, suggesting a broader impact of this accelerator in the ecosystem buildup (see Community section below for further details) beyond supporting the start-ups in its program (see Table 2.1). About 20 percent of start-ups in our sample in Dar es Salaam participated in an acceleration program and those who received funding from acceleration obtained a median of \$1,000 in initial investment.

TABLE 2.1 TOP EVENT HOSTS IN DAR ES SALAAM

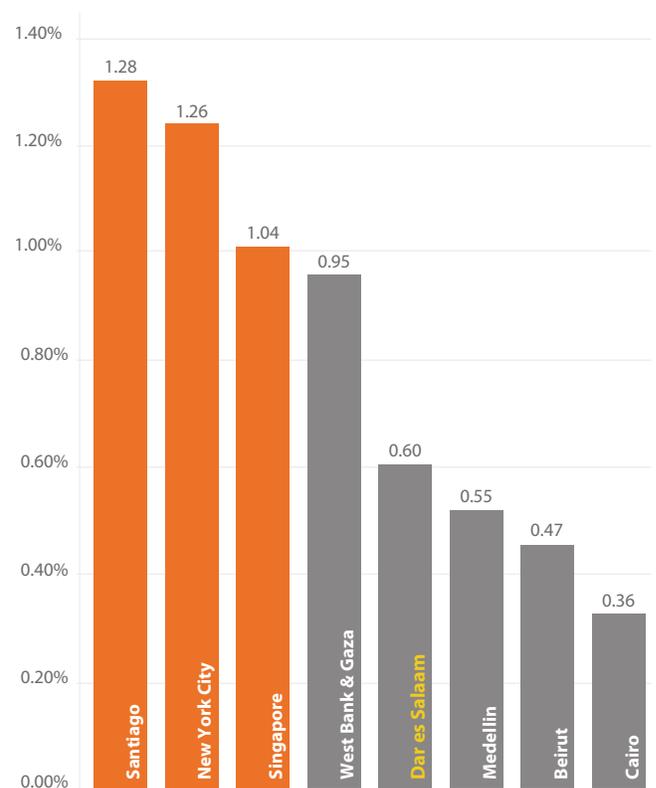
Event Host	Number of Events Attended by Entrepreneurs
Buni	7
Costech	5
Government of Tanzania	4
Others (World Bank, Sahara Parks, Tantrade, University of Dar es Salaam, 2 Seeds Network)	3 or fewer

35.3 percent of accelerated start-ups were funded, while 20.8 percent of unaccelerated start-ups were funded. This means that the acceleration multiplier for funding probability is 1.70.²¹ This is a normal effect for nascent ecosystems, where accelerators are crucial in increasing the quantity of funded start-ups in the ecosystem’s pipeline. Preliminary analysis of similar measurements in more mature ecosystems, such as New York City or Santiago, shows that this ratio reduces to become closer to 1 as the funding ecosystem matures and accelerators are no longer the gatekeepers to investment networks.

Of start-ups that were funded, accelerated start-ups received an average of 1.16 investments, while unaccelerated start-ups received an average of 1.15 investments.²² an acceleration multiplier of investment 1.01.²³ If we interpret the number of investments a start-up receives as a signal of its quality, this suggests that accelerators in Dar es Salaam are not having a meaningful impact in improving the quality of start-ups. In fact, of the 38 start-ups that were funded, more (26) were unaccelerated than accelerated (12).

Using these numbers, the effectiveness of accelerators in Dar es Salaam’s ecosystem may be estimated by calculating a ratio of quality, as represented by the acceleration multiplier of investment (1.01), to quantity, as represented by the acceleration multiplier for funding probability (1.70), which results in a ratio of 0.6. This is consistent with the quality to quantity ratio from other less mature ecosystems such as Cairo, which also has a ratio less than 1, while more mature ecosystems such as New York City will have a ratio of more than 1.

FIGURE 2.9 ACCELERATOR’S QUALITY/QUANTITY RATIO OF 0.6. (SELECTED CITIES)



These results support the conclusion that simply producing a number of start-ups does not necessarily mean that they will be sustainable or will receive additional funding. In fact, only five percent of these accelerated start-ups received additional investment in the years after graduating, indicating that the

vast majority of funding obtained by accelerated start-ups occurred in the same year as acceleration. This suggests that, while accelerators are directly connecting start-ups with investors, they are not producing a high number of start-ups that can sustainably and independently obtain further funding. The reasons for this may lay in low-quality services, capacity building, or network connections provided by the accelerator, the lack of available funding in later stages of start-ups (see Investment analysis below) or both. This is a common characteristic of accelerators in nascent ecosystems, that lack the talent and expertise to produce high-quality, internationally competitive services with a recognizable brand that holds its value after the end of the program.

Mentors

Mentorship is a knowledge transfer mechanism for entrepreneurs to acquire business acumen, understand the unspoken rules of start-up challenges, and access networks of talent, knowledge, and resources. Mentors need to be knowledgeable and experienced. A study for the U.K. government found that the most important characteristic of a mentor is proven business success in the area of work and network of contacts (BMG Research and Galli 2013). Mentorship relationships were found to often develop informally through a preexisting relationship. For example, acceleration and incubation programs typically assign start-ups formal mentors to assist them for a designated period of time. Research from Endeavor Insight shows that top performing start-ups have much higher support from mentors.²⁴

Thirty-five percent of founders in Dar es Salaam received mentorship. On average, mentorship was provided for a duration of one year. The top three mentors are related to Buni Hub or DTBI. Individuals affiliated with these institutions mentor around 30 percent of founders. This is consistent with the wider impact of accelerators supporting the ecosystem (see Community section below) and highlights the need to have experienced people in these accelerators (see Box 2.2).²⁵

Investment

The value of investors extends beyond the money they provide. Early stage investors are often valued both for their networks and for their experience and subject area expertise, hence the phrase “smart money.” This report considered all organizations that invest in high-growth start-ups, venture capital firms, angel investors, and other individuals.

Investment options are limited for start-up founders in Dar es Salaam,²⁶ the study identifying only 11 investors. A third of these were venture capital firms, and two-thirds were angel investors. They made a total of 11 investments in nine start-ups, of which two (18 percent) were identified as debt financing, and four (36 percent) were identified as equity financing.²⁷

Almost all of the investments occurred in the first year of operation of the start-up concerned with a long-tail distribution, consistent with the nascent and young ecosystem observed in Tanzania (see Figure 2.10). One company raised capital four times, one three times, and one twice. The remaining companies raised capital once. While the majority of fundraising captured in the dataset is in the very small seed range, 84 percent of investments received (37 out of 44) are below \$25,000, although there are a few large outliers (one start-up raised \$4.5 million in one round).

This may suggest that there is a lack of maturity in the investment infrastructure to support and follow up the growth of start-ups, either because it has not occurred very often (for example, because there are not many start-ups and few have advanced to the scale-up stage) or because the investors available for start-ups (that is, with the risk appetite for early ventures) is limited. Further analysis is needed to understand the availability of funding through the early stage pipeline.

A respondent also suggested that “funding agencies, should stop giving people money, as grants, and rather find a better way to fund start-ups, potentially loans, because it floods the market with cheap cash.”

FIGURE 2.10 MEDIAN INVESTMENT AMOUNT BY YEAR OF EXISTENCE



Note: Only three start-ups received investment more than once.

Community

Start-up ecosystems operate as communities, where knowledge spillovers and access to resources flow through a network of embedded connections (see Figure 2.11). The tighter and more connected an ecosystem, the more efficient is the flow of knowledge and access to resources. The less connected it is, the less effective is the ecosystem in spotting talent and nurturing potential ventures into successful start-ups.

Connectivity matters because success of start-ups is impacted by their connectivity and access to other ecosystem stakeholders and their networks (Mulas, Mingos, and Applebaum 2015). Networking assets (see Supporting Infrastructure for Entrepreneurship section above), and accelerators in particular, act as key connectors of ecosystem stakeholders, creating events and networks among stakeholders and creating clusters that strengthen the ecosystem.

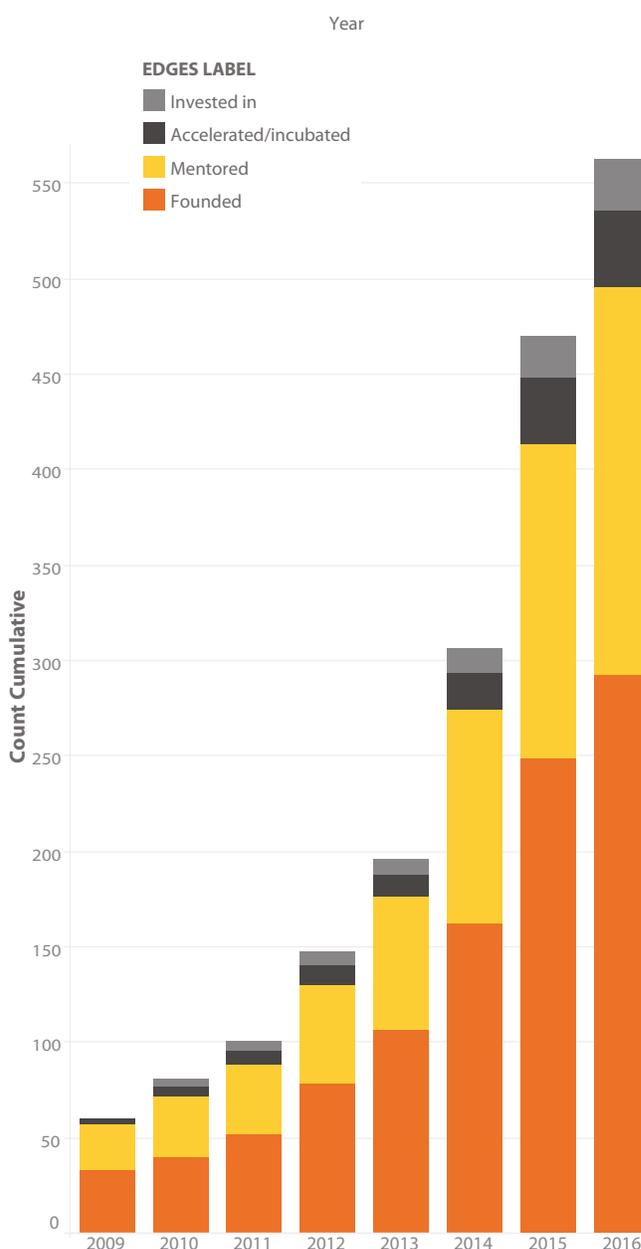
In Dar es Salaam, accelerators are the key connectors of the ecosystem, holding the ecosystem together and providing the higher connectivity within their networks. They have the highest centrality measures in the ecosystem by all social network measures (see Analysis section of Appendix A).

The largest two networks of connectivity in Dar es Salaam's ecosystem are Buni Innovation Hub and the University of Dar es Salaam (see Figure 2.12). For start-ups to raise funding successfully, they need to be part of the core clusters of connections. In Dar es Salaam, the ecosystem is less densely connected, meaning that founders already need to have a connection with the clusters of accelerators, investors, or funded start-ups or reach out to those clusters as outsiders. Indeed, there appears to be an inner circle in the investment ecosystem, outside of which raising capital is difficult. This hypothesis is further supported by a comment from a survey respondent who stated, "On many occasions, start-ups in Tanzania, unless housed at the few existing hubs, have little to no access to programs inside and outside of Tanzania that can help them get funding or participate in competitions."

The community of Dar es Salaam's ecosystem is consistent with its nascent stage, with very low density and limited number of clusters.²⁸ Higher density and more clusters allow entrepreneurs to connect to knowledge and resources through other actors in the ecosystem. The less dense the ecosystem, the more difficult it is for a founder to find their way to mentors, investors, or other relevant knowledge or resources required for their venture. Clusters serve as multipliers of density, helping founders leapfrog orders of connection (for example, connections that in other case are a 5th or 7th order connections, that is, the founder is connected through five or seven connections to the target person, become a 2nd or 3rd order connection, where the founder is connected through two or three people to the target connection).

When comparing the density and clusters of the community with those of more advanced ecosystems (see Figure 2.13), Dar es Salaam only features a small cluster with low-density connectivity. Cairo or Medellin have already evolved into highly connected clusters driving connectivity in the ecosystem.

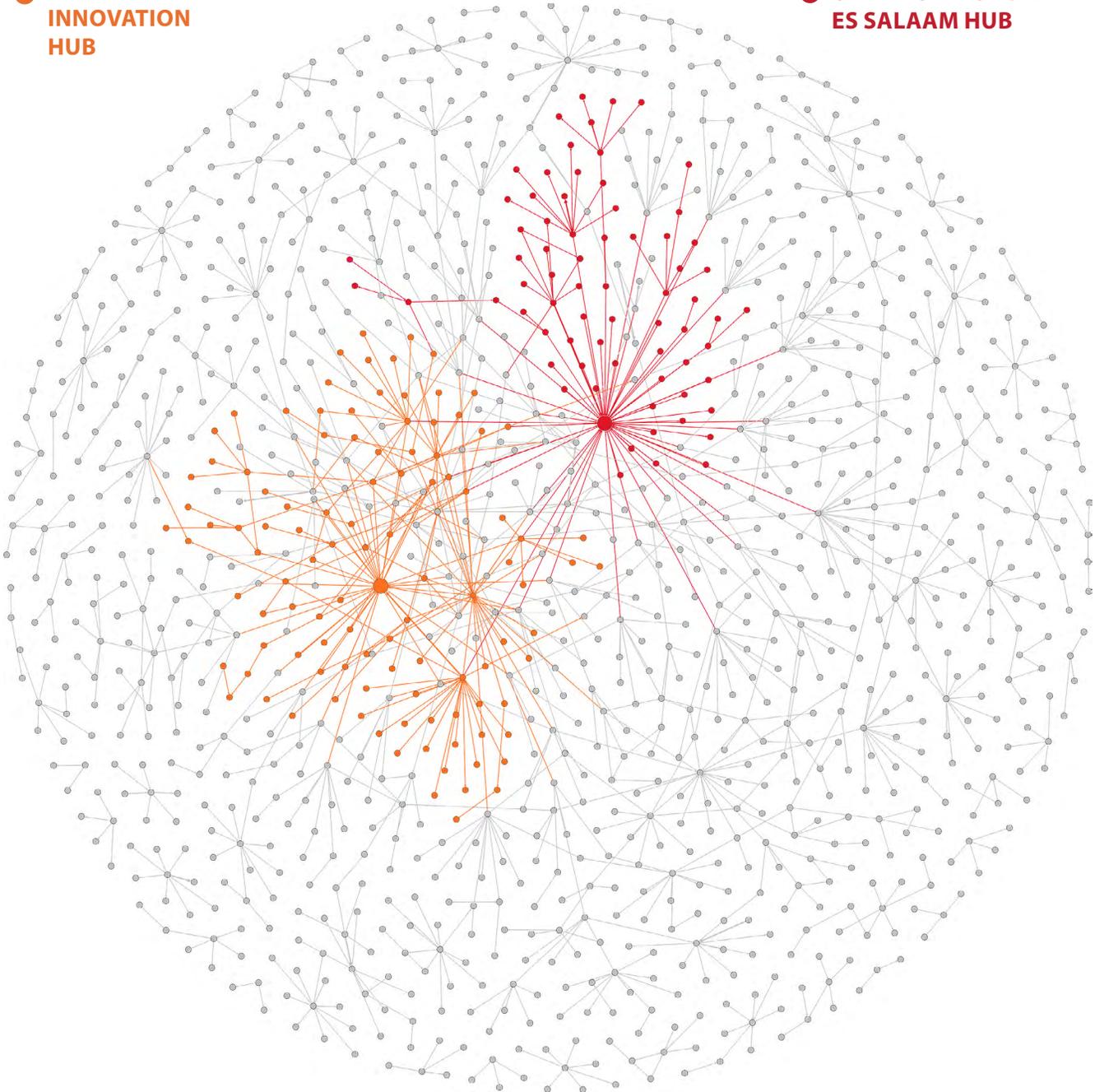
FIGURE 2.11 GROWTH OF FOUNDERS AND CONNECTIONS IN DAR ES SALAAM



**FIGURE 2.12 CONNECTIONS IN
DAR ES SALAAM'S ECOSYSTEM**

● **BUNI
INNOVATION
HUB**

● **UNIVERSITY OF DAR
ES SALAAM HUB**

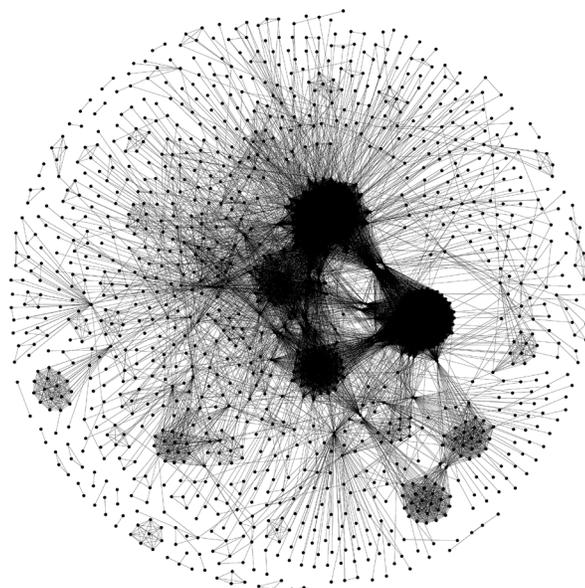


Note: This graph highlights University of Dar es Salaam (red) and Buni Innovation Hub (orange), two of the most influential actors in Dar es Salaam's innovation ecosystem.

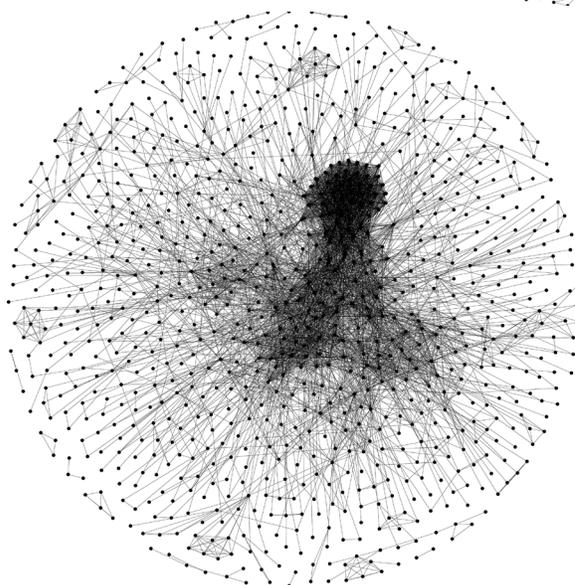
FIGURE 2.13 EVOLUTION OF START-UP CLUSTERS AND CONECTIVITY IN ECOSYSTEMS

Advancing

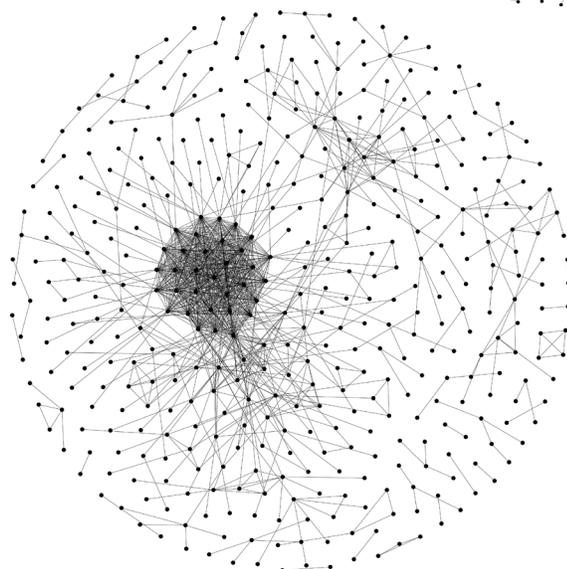
MEDELLIN



CAIRO



DAR ES SALAAM



Note: Network graphs were created by taking all the people in the ecosystem and creating edges to all other people they were directly or indirectly connected to in order to exaggerate the effects of clusters for illustration purposes. Because this treatment visualizes the influence of edges seen in Figure 2.12 by counting them more than once, the density of the clusters and the overall graph will appear different from Figure 2.12, where each edge is represented only once, even though the underlying data is the same.

Nascent

Start-up Success Factors

Start-up success is difficult to determine as tech ventures operate in a fast-paced environment under continuous change. To analyze factors that have determined start-up success, this analysis identifies two moments in the growth of start-ups. We consider “short-term success” as when a venture obtains funding from an outside investor and “long-term success” as when a venture hires employees consistently (this assumes continuous growth as the talent-knowledge assets of the start-up grow).

Factors of Short-term Success

The most significant factor for raising funding in Dar Es Salaam is to be part of an influential investment cluster and be well connected within the cluster. Given the early stage of the ecosystem’s community (see Community section), there are few clusters available for start-ups and few start-ups inside these clusters. Those start-ups who are inside these clusters have access to investors and can leverage those connections to obtain their first funding. Once start-ups have become part of one of these clusters and obtained funding, they increase substantially their network of investors, reinforcing their positioning in relation to future investments.

These results suggest that there appears to be an inner circle in the investment ecosystem, outside of which raising capital is difficult. This hypothesis is supported by a comment from a survey respondent who stated, “On many occasions, start-ups in Tanzania, unless housed at the few existing hubs, have little to no access to programs inside and outside of Tanzania that can help them get funding or participate in competitions.” This results in a divide between “privileged’ (that is, part of the inner group) start-ups and “non-privileged” start-ups, which

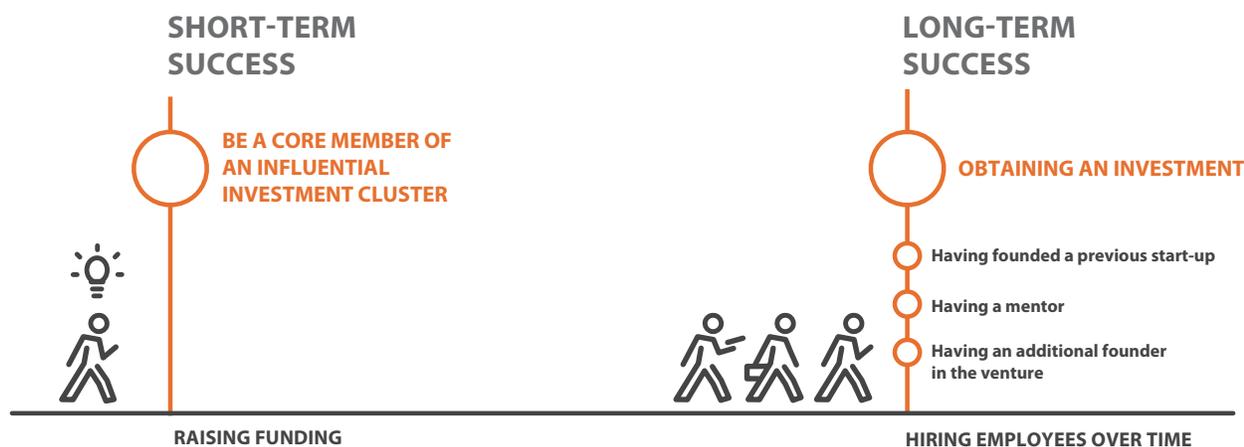
are unable to benefit in terms of access to opportunities and resources of the ecosystem. Another entrepreneur laments, “There are gaps in the ecosystem, no platform for people to meet, everyone is doing their own thing” and another agrees that, “The start-up ecosystem is very young and fragmented. Current initiatives being made are very scattered.” There is an additional sense that the ecosystem is not working together, and a respondent suggests that “players in the ecosystem, for example, incubators, hubs, accelerators, and so on, should work together to build a stronger ecosystem rather than competing and dividing opportunities,” perhaps through, as another respondent suggests, “joint forums where people can collaborate and share ideas.”

Factors of Long-Term Success

The most significant factors for long-term success (that is, hiring employees over time and continuing to do so) are: a) obtaining an investment, b) having founded a previous start-up, c) having a mentor, and d) having an additional founder in the venture. The most significant is having an investment. This is consistent with previous findings, confirming that once start-ups enter the inner circle, they obtain the full benefits of the ecosystem, being able to access both resources and knowledge.

Apart from investment, all other factors are related to increased knowledge and experience, either direct or indirect (for example, mentors) practical founding experience, or additional knowledge and experience from another founding member.²⁹ Overall, these factors suggest that the low success rates of start-ups are directly related to the general lack of practical experience and knowledge, particularly business acumen, in the ecosystem.

FIGURE 2.14 START-UP SUCCESS FACTORS IN DAR ES SALAAM



Gap Analysis and Policy Recommendations

Summary of Gap Analysis and Stage of Ecosystem

The evidence from our analysis points to the conclusion that the start-up ecosystem in Dar es Salaam is at a nascent stage that is just beginning to develop (see Table 3.1).

TABLE 3.1 DEVELOPMENT STAGE OF ECOSYSTEM (PER AREA AND OVERALL)

Ecosystem Area	Stage		
	Nascent	Advancing	Mature
 Community	○		
 Skills	○		
 Supporting Infrastructure	○		
 Investment	○		
 Constraints	○		
OVERALL	○		

There are multiple gaps that can be addressed through policy action and support. The ecosystem is not functioning as a solid community yet and start-ups cannot take advantage of social connectivity to reach out to talent, skill capacity, mentors, and investment. Events and community building relies on mainly isolated actors, although connectivity is growing with increasing activity by some actors, for example, such as Buni) and donor and government action still drives a large number of activities in the ecosystem. There is an incipient number of support programs for entrepreneurs (for example, accelerators)

but they do yet not seem to be providing services of sufficient quality to support sustainable ventures. Investment options are limited and scarce beyond seed funding. There is a lack of experienced talent and relevant business acumen in founders, which together with the limited availability of quality mentorship, reduces the availability of young talent to complete the cycle of a successful venture. Other constraints (for example, processes for establishing a business, hiring, obtaining space and funding) reduce the ability of start-ups to grow.

Policy Recommendations

Table 3.2 summarizes the policy recommendations for the Dares Salaam ecosystem based on the key gaps and constraints identified.

TABLE 3.2 POLICY RECOMMENDATIONS

Ecosystem Area	Policy Recommendation	Objective
 <p>Community</p>	<p>Coordination mechanism and ecosystem support program with stakeholders</p> <p>Catalyze community spaces (e.g., coworking spaces) and events (e.g., meetups, competitions, etc.)</p>	<p>Create community of ecosystem stakeholders and coordinate private and public support actions</p> <p>Expand community of entrepreneurs and increase both density and volume of connectivity</p>
 <p>Skills</p>	<p>Increase business skills among entrepreneurs, expand practical education in universities and through rapid skills training programs</p>	<p>Address gap in business skills and business acumen and provide pipeline of talent for start-up growth</p>
 <p>Support Infrastructure</p>	<p>Capacity building of mentors in accelerators and attraction of international talent (as mentors, entrepreneurs, or capacity builders) to the ecosystem</p>	<p>Address lack of quality mentors and support services</p>
 <p>Investment</p>	<p>Catalyze privately managed seed-funding options</p>	<p>Address limited availability of funding for start-ups</p>
 <p>Constraints</p>	<p>Address processes constraints (e.g., business registration and access to loans)</p>	<p>Reduce constraints for start-ups incorporation and operationalization</p>

These policy recommendations only address short-term actions to support the Dar es Salaam ecosystem. Policy makers should constantly monitor the ecosystem (which can be done through the coordination mechanism once in place) and iterate the policy approaches as needed and address new upcoming gaps or growth hurdles as they arise. As the ecosystem grows and evolves into more maturity, new needs will emerge and other specific policies would be more applicable.

1. Community

Establish a coordination mechanism and codevelop support program with ecosystem stakeholders. At the early stage of an ecosystem, stakeholders are uncoordinated, and information about actions and activities does not flow transparently through the community. Successful ecosystems, such as in Buenos Aires, Tel Aviv, or New York, create different types of coordination mechanisms among stakeholders led by public policy actors (for example, municipal or government innovation agencies). This varies from stakeholder roundtables to continuous consultation processes to online platforms to share events and intermediaries' activities (ITIF 2017).

A practical way to catalyze this coordination is through cocreation of the support program, where ecosystem gaps are validated with the stakeholders and support activities are allocated and coordinated among public support policies and stakeholder actions, avoiding duplication and catalyzing sustainability. A follow-up mechanism to coordinate implementation of the program would serve to institutionalize coordination. An example of such an approach was implemented in Chile to catalyze start-up ecosystems in secondary cities (Mulas and Barroca 2015).

Expand community spaces and events. Public policies can support the number and expansion of community spaces (for example, coworking spaces, accelerators, and so on) and events. In many early stage ecosystems, government (for example, municipalities, or regional or national government) have sponsored or implemented periodic competitions to address challenges and foster start-up creation. Chile, Barcelona, and Amsterdam are examples of such an approach.

In addition, ecosystems in cities such as Buenos Aires, Tel Aviv, and New York, catalyzed community spaces by providing space and operational funding for a limited period (one to three years) to coworking spaces, accelerators, and incubators to set up in the city. These public-private partnerships (PPP) resulted in a growing number of community spaces that create their own clusters, increasing the density and breadth of connectivity.

BOX 3.1 WHAT ARE CODING BOOTCAMPS?

Coding bootcamps are intensive short-term programs, typically lasting three to six months, designed to train participants in programming skills to make them immediately employable in entry-level tech positions.³⁰ In essence, they combine characteristics of traditional vocational training programs with the intensity of military bootcamps for new recruits, intermingling soft and tech skills learning in an intense manner, in what could be referred to as "skills accelerators." Coding bootcamps follow a structured process with three main characteristic features: 1) intense rapid skills training, 2) an experiential learning approach, and 3) curricula based on, and continuously adapting to, industry's demand.

Although the bootcamp methodology has primarily focused on coding skills, it has also been adapted for business and entrepreneurial skills as well as other technical skills. Usually, bootcamps programs embed "life skills" in their curriculum, enabling their graduates to be competitive irrespective of the industry in which they choose to work, for example, the ability to master new knowledge quickly and efficiently, effectively work in a team, meet tight deadlines, and so on. Evidently, these "life skills" belong to the subset of future-proof soft skills (World Bank, 2017).

In New York, these community spaces were required to create and provide a network of mentors, provide capacity training, and develop a local community with entrepreneurs and neighborhood actors (Mulas and Gastelu-Iturri 2016).

2. Skills

Increase business skills and practical education. Public policies can catalyze and support practical educational programs to address the skills gaps in tech start-up ecosystems. Coding bootcamp methodologies (a rapid skills training methodology) have proven successful in quickly assessing market gaps and demands in tech start-up ecosystems. For instance, New York City's initiative to support rapid skills training programs resulted in General Assembly, one of the largest providers of bootcamps worldwide, which serves to address skills gaps ranging from entrepreneurship and business skills to specific coding and technical skills through rapid skills training programs (see Box 3.1) (Mulas and Gastelu-Iturri 2016). Public policy programs can also help community spaces, and accelerators can also be supported to enhance their capacity to provide higher quality mentorship and training to start-up ventures with potential through their programs (in the case of accelerators) of related activities.

Additionally, public policies can catalyze the introduction of practical education programs for university students and address part of the gap in business acumen. Initiatives, such as Demola in Tampere,³¹ Finland and Jacobs Technion-Cornell Institute³² in New York were created to address this specific gap in their ecosystems. In both cases, a practical project-based education is added for students to learn-by-doing with businesses.

3. Support Infrastructure

Increase capability of mentors and attraction of international talent. Support can also be provided to increase the capability of mentors (for example, through training and capacity-building programs). However, local capacity programs have limited impact in nascent stages of ecosystems. This is because there is a general lack of practical experience and knowledge among mentors and trainers since there have not been many cases of successful ventures that have been proven internationally.

A way to address this lack of experience and knowledge is to attract international talent with such practical acumen. There are several support programs that can achieve this goal, ranging from events that gather international talent and connect it to the ecosystem, to more structural programs. For instance, in Lebanon, the Central Bank took an informal approach, organizing an annual conference and inviting top

international talent.³³ This has led to a broader connection of the ecosystem's intermediaries (for example, community spaces, accelerators, and so on) with international talent and partners, increasing the ecosystem's connectivity and capacity building overall.

Santiago, Chile, followed a more structured approach, creating a program (Startup Chile)³⁴ to attract international talent to the ecosystem. The program is in essence an acceleration-funded program for high-skilled international talent to conduct their ventures' initial stage in Chile. The program introduced specific activities to ensure knowledge spillovers between international talent and domestic entrepreneurs. For instance, international entrepreneurs were collocated in a coworking space with domestic entrepreneurs with a requirement that they provide capacity building and workshops on entrepreneurship and technical skills for domestic entrepreneurs. This mechanism has been emulated by other ecosystems, including the K-Startup Grand Challenge in the Republic of Korea.³⁵

4. Investment

Catalyze privately managed seed-funding options.

Access to finance for early stage ventures and their scale-up is key for sustainability of the ecosystem. This, along with the lack of mentorship and skills, are the main constraints for new ecosystems in their nascent stage. Successful ecosystems, such as in New York or Tel Aviv, applied policies to catalyze the attraction and development of local seed investment options for their ecosystems. In both instances, policy support was focused on catalyzing private-sector led early stage financing, using public funds to derisk the entrance of players, without interfering in investment decisions (Mulas and Gastelu-Iturri 2016).

5. Constraints

Address processes constraints. The larger constraints highlighted by entrepreneurs relate to incorporation (when outside of Dar es Salaam), and processes related to obtain close loans and funding. Policy reforms can streamline these processes, by establishing specific conditions for start-up processes (for example, by reducing requirements) or, to facilitate access to finance (for example, by providing guarantees for loans).

Sector in Focus: Climate Tech

One particular challenge in ecosystem-building is identifying competitive advantages inherent to each region and building upon existing strengths in order to create unique local hubs. As a respondent summarizes, “there should be more locally relevant innovation and not western copied innovation.”

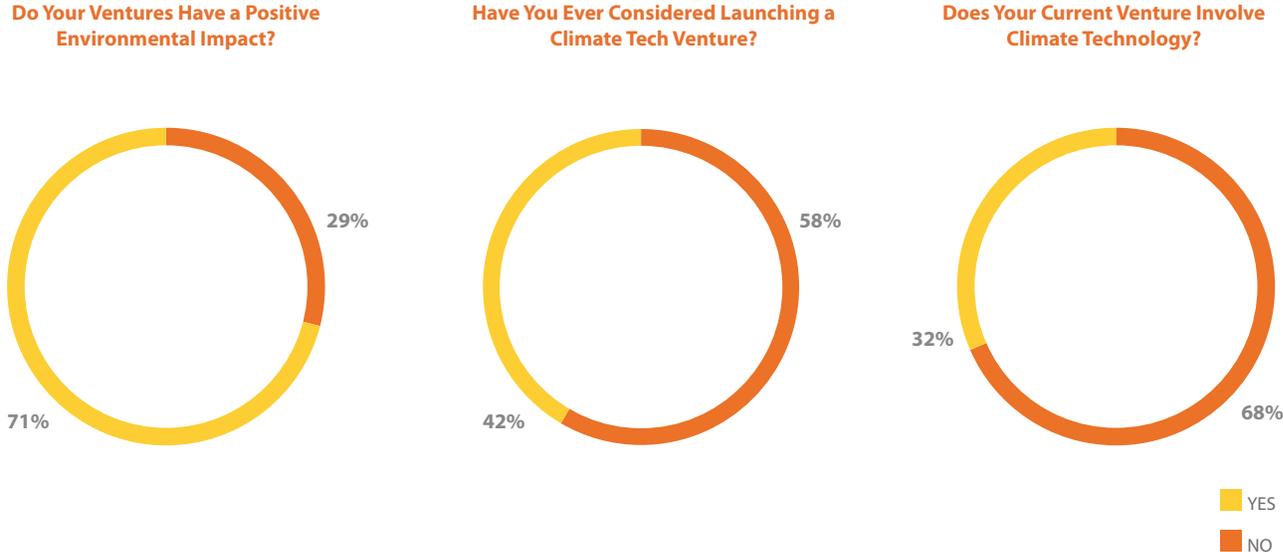
As a sector in focus, the climate tech sector potential was analyzed within the start-up ecosystem in Dar es Salaam. Climate tech was defined to include those ventures that incorporate climate adaptation (for example, agricultural resilience) and/or mitigation (for example, renewable energy) activities in addition to their use of technology.

To understand the size of this sector and the opportunity and challenges for its expansion, specific questions were

asked regarding the nature of respondents’ businesses, as well as the attractiveness of the sector and what might improve that attractiveness. The results of this sector in focus survey are as follows:

The start-up ecosystem in Dar es Salaam has a significant proportion of ventures employing climate technologies. About one-third of start-ups (32 percent) incorporate climate technology in their projects. Moreover, the ecosystem has a much broader portion of ventures conscious of climate-related effects, presenting a larger opportunity for expanding the climate tech sector among start-ups. Over 70 percent of entrepreneurs surveyed indicated that their ventures had a positive environmental impact.

FIGURE B.1 START-UP INTEREST IN CLIMATE TECH IN DAR ES SALAAM



For those that answered “no” to whether they had ever considered launching a climate venture, the three most common reasons given were that 1) they had never thought about it, 2) they lack interest, or 3) they lack skills/ideas. Fewer indicated that there was not enough funding or that opportunities in the sector were not apparent. Those that answered “yes” commonly listed both environmental and economic motivations for entering the climate tech market.

Regarding opportunities in the climate tech sector, the most common types of opportunities cited were in renewable energy (18 mentioned), agriculture (18 mentioned), recycling (10 mentioned) and various IT (6 mentioned). Fifteen respondents referred to opportunities to generate employment in the sector.

When asked what support would make the climate tech sector attractive, respondents listed the following most commonly: finance - 80 respondents, incubation - 47 respondents, mentorship - 32 respondents, education/skills training - 19 respondents, marketing/sensitization - 13 respondents. Note that the former three were all listed as options in the questionnaire, whereas the latter two were proposed by respondents.

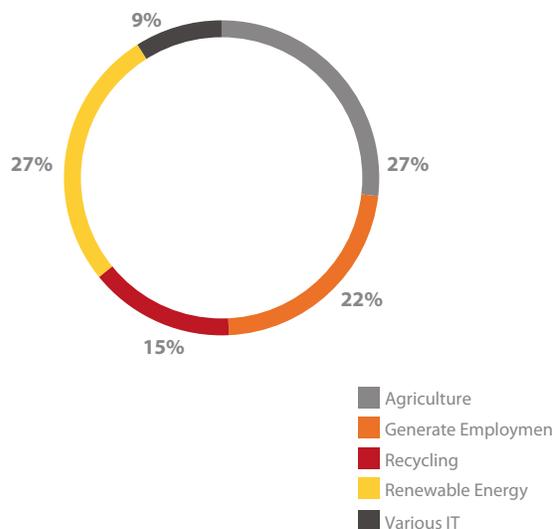
This mirrors the general challenges that the ecosystem identified in the broader analysis, with the great need for access to finance, shrewd and relevant business/sector mentorship, and support programs (for example, incubators, accelerators), and options to improve skills.

To address the expansion of this specific sector, policies could support: (i) the establishment of specific tracks in accelerator programs, (ii) attraction of technical and astute business mentors, (iii) provision of specific training (rapid and experiential) for both technical and business climate tech subjects, as well as (iv) catalyzing specific seed financing facilities for climate tech ventures.

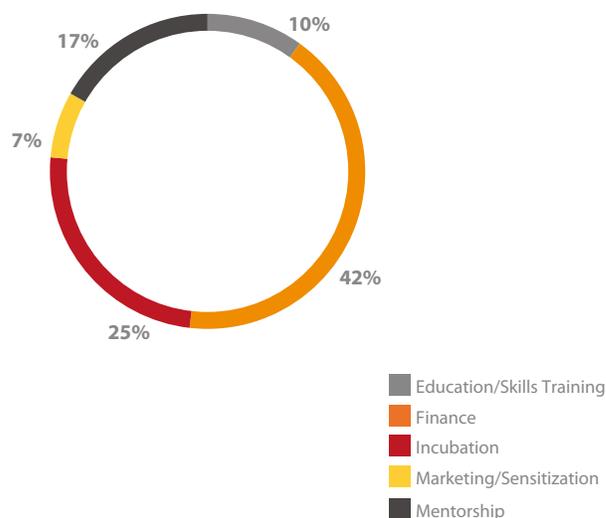
However, the definition of climate tech was quite broad and open to interpretation from the entrepreneurs, whose comments indicated involvement ranging from using “devices that are environmental friendly” to helping to “prevent the use of paper through our ventures” to businesses that “use recyclable materials” to “soil and weather analysis” to general climate advocacy using technology. Most respondents indicating a climate tech venture could in reality be more accurately categorized as “tech for climate” versus “climate tech” in that they express a clear interest in working with climate and environmental issues but lack the technological sophistication to be true “climate tech.” As such, further analysis would require more in-depth research on the operations and products of each business to gauge whether or not the business falls into a stricter definition of climate technology.

FIGURE B.2 OPPORTUNITIES AND SUPPORT NEEDED FOR CLIMATE TECH IN DAR ES SALAAM

Opportunities in the Climate Tech Sector



Support Needed to Make the Climate Tech Sector Attractive



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Appendix A. Survey Methodology and Analysis

Methodology

Survey Questions

The survey of start-up founders used the standard questionnaire developed under the Global Entrepreneurship Research Network (GERN) with some additional questions to understand specific constraints faced by start-ups. The GERN-developed standard questionnaire includes the following sections:

1. Educational history (including vocational, bootcamps, and certificate programs)
2. Employment history
3. Founding history (serial entrepreneurship)
4. Support programs (for example, acceleration, incubation, and so on) history
5. Connections with mentors and mentees
6. Connections with investors (angel and institutional)

In addition to this questionnaire, the survey captured the geographic location of start-ups and intermediaries (for the geographic analysis) and included the following standard questions:

1. Incorporation: On average, how many days did it, or would it, take you to incorporate a new start-up?
2. Funding: On average, how many days did it, or would it, take you to set up a bank account for your start-up?
3. Credit: On average, how many days did it, or would it, take you to get a line of credit for your start-up?
4. Funding: On average, how many days did it, or would it, take you to raise a round of equity funding?
5. Hiring: On average, how many days did it, or would it, take you to hire an employee, from job posting to employee start?
6. Office space: On average, how many days did it, or would it, take you to obtain office space for your start-up?
7. Exit: On average, how many days did it, or would it, take you to exit your start-up?

Additional free response questions were also included:

1. What are the three biggest challenges you are currently facing?
2. How important are the following criteria when evaluating whether to pursue a venture?:
 - Size of market/opportunity
 - Profitability
 - Social impact
 - Ease of validation (product/market fit)
 - Existing relationships/Access to potential customers
 - Personal passion/skillset
 - Access to financing
 - Regulatory/legal environment

Specific questions on climate technology were also included in the survey:

1. Do your ventures have a positive environmental impact?
2. Have you ever considered launching a climate tech venture?
3. Why or why not?
4. Does your current venture involve climate technology?
5. Please explain further.
6. What opportunities do you see within the climate tech sector?
7. What support mechanisms would make it an attractive sector? (for example, business incubation, financial, incubation, mentorship).

Outreach Strategy

Entrepreneurs filled in an online survey available at <http://survey.techecosystems.org/>. Studio 19 Limited was responsible for preparing a team that directed start-ups to the online survey. Telephone calls and face-to-face meetings were the primary methods for collecting data.

The following strategy was implemented:

1. First, the team collected e-mail addresses and telephone numbers for start-ups. Then they e-mailed start-ups with the above link and explained the importance of the survey. Two rounds of emails were to be sent.
2. Second, the team followed up the e-mail with a telephone call to encourage start-up founders to complete the survey.
3. Third, where needed, physical visits and interviews with start-ups and SMEs were scheduled and performed.
4. As a way of increasing the response rate, group meetups were planned to supplement the individual efforts to collect data.

Incentives given to start-ups to participate in the survey, apart from contributing to an important research study by the World

Bank, included the potential for their company to feature in an official World Bank case study, and the chance to win T Sh 500,000 (about \$225; one prize per 33 respondents).

Sampling and Engagement

The survey included key players in the innovation ecosystem in Tanzania, including innovation hubs, incubators, accelerators, funds, government entities, and competitions. Partners in the survey were identified by the study team and extended through Studio 19's experience in the ecosystem and the working relationships they had built over time.

Partners played a crucial role, not only identifying start-ups, but also in connecting and introducing the study team and the survey to relevant start-ups. Table A.1 lists the partner organizations that collaborated with Studio19 in reaching start-ups

TABLE A.1 SURVEY PARTNERS

Organization	Type	Location
Anza 360	Accelerator	Moshi
Tigo Reach for Change	Competition	Dar es Salaam
Teknohama (DBTi)	Incubator	Dar es Salaam
SIDO Business and Technology Incubator Programme	Incubator	Dar es salaam
Twende - AISE	Accelerator	Arusha
Zanzibar Living Lab (TAYI)	Coworking space	Zanzibar
Rlabs Iringa	Innovation space	Iringa
Zanzibar Technology and Business Incubator	Incubator	Zanzibar
University of Dar es salaam Incubator (UDCTII)	Incubator	Dar es salaam
University of Iringa Tanzakatemia	University	Iringa
Sokoine University Agribusiness Incubator (SUGECO)	Incubator	Morogoro
Niwezeshe Lab	Innovation space	Dar es salaam
Mbeya University of Science and Technology (MUST)	University, Innovation space	Mbeya
State University of Zanzibar	University	Zanzibar
Sengerema Living Lab	Innovation space	Mwanza
Iringa Living Lab	Incubator	Iringa
Buni Hub	Innovation space, Coworking space	Dar es salaam
STIC Lab	Innovation space	Dar es salaam
Iringa Innovation Space	Innovation space	Iringa

Mbeya Living Lab	Innovation space	Mbeya
Zanzibar Innovation Space	Innovation space	Zanzibar
Seedstars World	Competition	Dar es Salaam, Switzerland
Apps & Girls	Innovation program	Dar es salaam
TANZICT	Government, Fund	Dar es salaam
Commission for Science and Technology (COSTECH)	Government	Dar es salaam
Human Development Innovation Fund (HDIF)	Fund	Dar es salaam

Dar es salaam had by far the largest number of partners, and they greatly helped with sharing their networks and introducing Studio 19 to start-ups. Other regions such as Arusha, Iringa, and Moshi, also had helpful partners. Partners were engaged at different levels, depending on their willingness and access to start-ups as shown in the table below:

TABLE A.2 ENGAGEMENT BY PARTNER

Engagement Strategy	Partners
E-mail only	Mbeya University of Science and Technology (MUST), SUGECO, Seedstars World, TANZICT
E-mails and telephone calls	Sengerema Living Lab, State University of Zanzibar, Zanzibar Innovation Centre, Tanzania Youth Icon, Apps & Girls, Niwezeshe Labs, COSTECH, HDIF
E-mails, telephone calls and physical visits	Mbeya Living Lab, Stic Lab, UDCTI, Tigo Reach for Change, DTBi, Iringa University, Iringa Living Lab, Buni Hub, Anza, Twende, SIDO,

Data Pipeline

Survey data used in this report originated with this custom survey and was initially retrieved in raw JSON (JavaScript Object Notation) format. Data was converted to CSV (commas separated values), combined with raw data from additional sources, then cleaned of outliers and testing data. Nodes without location data, and locations without geocodes, were passed through the Google Maps application programming interface (API) in order to obtain standardized location data wherever possible. This new dataset was deduplicated using a process that marked similarities between names, e-mail addresses, URLs, and dates. Entities that were determined to be likely duplicates were then merged, maintaining all existing data and privileging more recent data in the event of conflict. Duplicate edges resulting from this process were removed. Finally, college majors and company industries were categorized using a machine learning approach that used a set of manually categorized responses to predict category based on word similarity. From this cleaned and augmented dataset, panel and graph data datasets for analysis were then generated.

Limitations

It is difficult to determine whether the sample is representative. The collection of the data was heavily dependent upon the participation of individuals in existing networks – for example, the social coordinator at one of the incubators in the Tanzanian ecosystem sent the survey out to all of the individuals working with that incubator, resulting in a sample that likely has a disproportionate representation from this incubator's network. To a certain extent, this bias is not problematic, as it means that our data and analysis document those individuals and nodes that are actively and currently engaged in developing the ecosystem. This suggests that they are also more likely to participate in and respond to policies designed to develop the ecosystem. However, since there are few other databases with which to compare the data, it is difficult to examine exactly whether the sample is truly representative.

The sample is small and influenced by outliers. To address this, where possible medians rather than means were used as descriptive statistics. Some of the analysis (for example, that of “successful” start-ups, rely on very small portions of the dataset, and thus give relatively weak information on unobserved, population-level characteristics.

Data cleanliness is difficult to evaluate. Missing data could represent a true lack of connection in the ecosystem, or potentially could be the result of some respondents failing to complete all survey questions or a lack of interest from potential respondents. Sometimes conflicting data or meta information was recorded from multiple sources, in which case the source closest to the entity (that is, the founder) was privileged. In addition, respondents were expected to accurately select names of entities already in the database through an autofill mechanism in order to properly attribute new information to existing entries. Although a machine learning driven data deduplication process was employed before analysis, this may not have resolved every duplicated entry, and such fuzziness may affect exact numbers in the social network analysis.

The sample is highly influenced by survivorship bias. Entrepreneurs that are so successful that they leave the ecosystem were not captured. For example, the lack of serial entrepreneurs in Tanzania may suggest that, once they have had one successful venture, they pursue subsequent start-ups in other more developed ecosystems, rather than that they do not repeatedly start businesses. Currently there is no simple way to capture data on those individuals that leave, or a way of identifying them in the dataset. In addition, the survey only captures entrepreneurs who were active during the survey period, and as such it does not capture failed entrepreneurs who have dropped out of the ecosystem.

Analysis

Stakeholders in the Tanzanian start-up ecosystem can be represented using a social network comprised of nodes (people, organizations, groups, and events), and edges, which are the relationships between them. For the social network analysis, an edge was considered as a part of the ecosystem if either of its endpoints are in the region. From these edges, relevant nodes for the network were extracted. Technically, the network is multipartite. However, given that individual investors can function similarly to institutional investors, founders of small start-ups are practically synonymous with their companies, and events and groups are often start-ups themselves, the network is treated as if it only contains one type of entity in order to simplify exploration.

Nodes are never removed from the dataset, even if the represented entity no longer exists. In other words, once a start-up has appeared in the dataset, it remains there for all subsequent years (see Figure A.1). There were two reasons for this decision. First, accurate end-dates for start-ups were difficult to gather. Second, the primary interest was in mapping the social dimensions of the start-up network, not

creating a year-by-year catalogue of start-ups. Although start-ups may close, socially they still function as nodes within the urban innovation ecosystem that may introduce other nodes to second-order connections.

FIGURE A.1 CUMULATIVE SUMMARY OF NODES

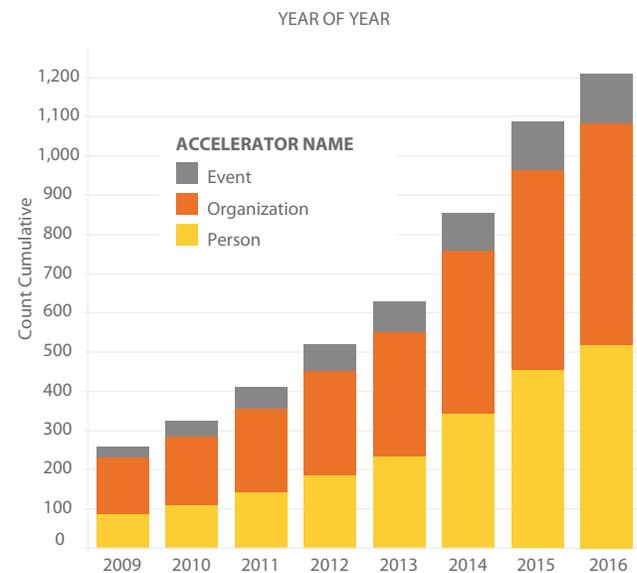
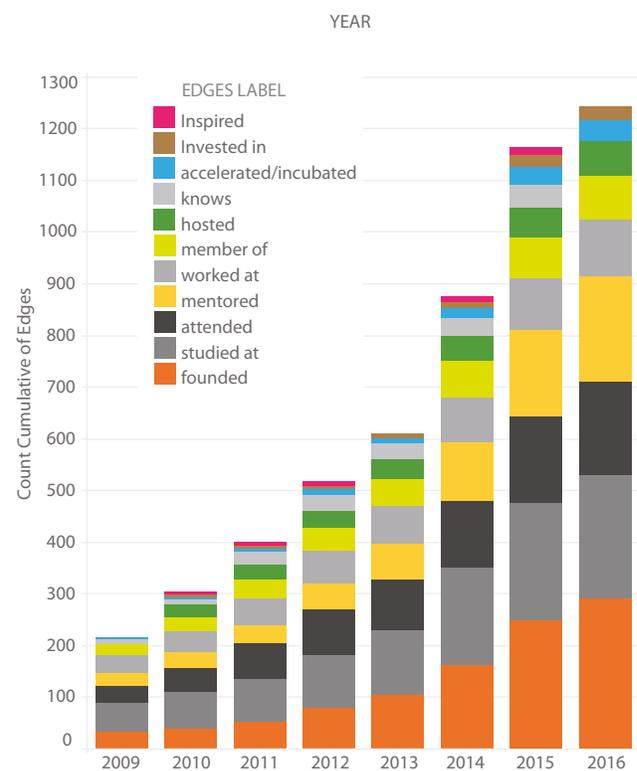


FIGURE A.2 CUMULATIVE SUMMARY OF EDGES



Edges can be further grouped into categories in order to create different types of networks and narrow the focus of analysis.

TABLE A.3 TYPES OF NETWORKS

Primary Edges:	Founded, Invested in, Accelerated/incubated, Acquired, Partnered with, or Mentored
Investment Edges	Invested in, Accelerated/incubated
Job Edges	Founded, Worked at
Social Edges	Hosted, Attended, Member of
Education Edges	Studied at, Accelerated/incubated

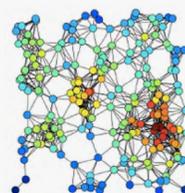
BOX A.1 WHAT IS CENTRALITY?

By calculating centrality measures of stakeholders in the dataset, key players in the community can be identified quantitatively.

The diagrams below, while not specific to our dataset, help illustrate the definition and interpretation of each type of centrality. Red indicates higher centrality values. Blue indicates lower centrality values.

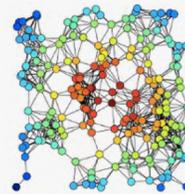
Degree centrality measures the number of other nodes within the ecosystem each node is directly connected to. It does not take into account any second-order connections.

Degree centrality



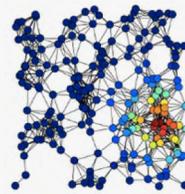
Closeness centrality measures a node’s social distance to other nodes. It is expressed as the inverse of the average distance from each node to every other node in the network. A low closeness centrality indicates that the firm is on the edge of the network.

Closeness centrality



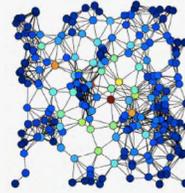
Eigenvector centrality augments degree centrality by taking into account the connectivity of the nodes a node is connected to. Highly connected nodes within highly interconnected clusters have high eigenvector centrality.

Eigenvector centrality



Betweenness centrality measures how many times a node acts as a gateway in the network. The higher the betweenness centrality of a firm, the more paths run through that firm to connect two other firms. High betweenness centrality means that a node is a key bridge or facilitator between different clusters.

Betweenness centrality



Source: Diagrams are from <https://en.wikipedia.org/wiki/Centrality>.

Calculating centrality measures on different subnetworks in the data builds understanding of which players in the ecosystem are the most important. In the case of Dar es

Salaam, the analysis reveals that accelerators and incubators are the most connected of all key players.

TABLE A.4 CENTRALITY OF KEY PLAYERS IN NETWORK WITH ALL EDGES

	Degree	Betweenness	Eigenvector	Closeness
Accelerator	7.71429	101.381	0.145957	7.2721E-07
Founder	4.15966	8.55122	0.035004	7.26092E-07
Investor	4.22222	3.44444	0.0336266	7.26982E-07
School	2.04902	1.27451	0.0138073	7.22488E-07
Start-up	1.98101	0.117993	0.0242286	7.22515E-07

TABLE A.5 CENTRALITY OF KEY PLAYERS IN NETWORK WITH PRIMARY EDGES

	Degree	Betweenness	Eigenvector	Closeness
Accelerator	4.85714	6.28571	0.143656	2.56725E-06
Founder	2.04641	1.32068	0.0225922	2.55495E-06
Investor	2.11111	0.222222	0.0463585	2.56109E-06
School	3	Negligible	Negligible	2.54776E-06
Start-up	1.93671	0.0253165	0.0317955	2.54786E-06

TABLE A.6 CENTRALITY OF KEY PLAYERS IN NETWORK WITH SOCIAL EDGES

	Degree	Betweenness	Eigenvector	Closeness
Accelerator	5.5	13	0.147682	7.44538E-06
Founder	2.25	Negligible	0.0416781	7.41881E-06
Investor	2	Negligible	0.00243833	7.40437E-06
School	1	Negligible	3.76317E-19	7.37421E-06
Start-up	1.25	Negligible	0.130622	7.38423E-06

Short-Term Success

A fixed effects logit model was used where the dependent variable is the probability of the start-up raising funding in a given year of existence³⁶ and the explanatory variables are lagged in order to gauge the effect of centrality in the investment network on a start-up's short-term success. Only the degree centrality is a direct measure of the number of investors a start-up has. Eigenvector and closeness centrality capture the effects of second-order and beyond connections to investors.

The greater a start-up's eigenvector centrality, the more likely it is to raise funding in the next year. In other words, if a start-up is well connected within a cluster of accelerators, investors, and funded start-ups, it is more likely to receive investment. This effect is offset by the finding that the more direct investment connections the start-up has, the less likely it is to receive funding in the next year. The latter effect is likely due to the fact that once a start-up has received funding once, it is less likely to need it in future periods.

These results suggest that there appears to be an inner circle in the investment ecosystem, outside of which raising capital is difficult. This hypothesis is supported by a comment from a

survey respondent who stated, "On many occasions, start-ups in Tanzania, unless housed at the few existing hubs, have little to no access to programs inside and outside of Tanzania that can help them get funding or participate in competitions."

Long-Term Success

In the long-term, we are interested in a start-up's ability to create jobs for the ecosystem. As such, we use a logit model where the dependent variable is hiring occurrence weighted by years of existence, such that we capture the percentage of years that the firm hires employees.³⁷ For simplicity, we can also interpret this number as the average probability a firm will hire in a given year.

The likelihood that a given firm in the ecosystem will hire in a given year is 7 percent.³⁸ One additional mentor increases hiring probability by 60 percent. One additional member on a founding team increases the odds that a firm will hire in a given year by 45 percent. One additional previous founding experience or investor increases the likelihood of job creation by more than 100 percent. There is no significant impact of educational factors on job creation.

TABLE A.7 EFFECT OF CENTRALITY IN INVESTMENT NETWORK ON SHORT-TERM FUNDING SUCCESS

Estimate	Std. Error	z value	Pr(> z)
startup_prev_degree_all_investment	-2.209e+00	1.030e+00	-2.145e+00 0.0345 *
startup_prev_eigenvector_all_investment	2.279e+16	6.304e+07	3.615e+08 <2e-16 ***
startup_prev_closeness_all_investment	1.228e+03	8.190e+02	1.499e+00 0.1371
year_existence	3.232e-02	1.108e-01	2.920e-01 0.7712

TABLE A.8 EFFECT OF START-UP CHARACTERISTICS ON LONG-TERM FUNDING SUCCESS

Estimate	Std. Error	z value	Pr(> z)
sum_acceleration_occurrence	-4.187e-01	3.642e-01	-1.150 0.25026
sum_funding_amount	-2.496e-06	4.014e-06	-0.622 0.53400
num_distinct_investors	1.775e+00	7.646e-01	2.321 0.02028 *
num_distinct_investor_regions	9.030e-01	9.118e-01	0.990 0.32198
num_distinct_mentors	4.688e-01	1.512e-01	3.101 0.00193 **
num_distinct_founders	3.688e-01	1.687e-01	2.186 0.02881 *
sum_founder_previous_startups_founded	7.386e-01	3.451e-01	2.140 0.03235 *
sum_founder_previous_jobs	-1.595e-01	1.830e-01	-0.872 0.38336
sum_bachelor_master_professional_doctorate_degrees	-1.832e-01	3.035e-01	-0.604 0.54602
sum_associate_bootcamp_certificate_degrees	-4.558e-01	5.135e-01	-0.888 0.37478
(Intercept)	-2.638e+00	3.829e-01	-6.889 5.6e-12 ***

NOTES

1. <https://startupgenome.com/>.
2. <http://www.digital.nyc/>.
3. <http://www.techmap.london/>.
4. <https://www.galidata.org/>.
5. <http://www.devinfo.org/CensusInfoTanzania/libraries.aspx/Home.aspx>.
6. See "Outreach Partners" in Appendix A for full list of partners
7. See "Limitations" section in Methodology section of Appendix A for more information on the limitations to our approach.
8. <https://techcrunch.com/2015/03/22/mentors-are-the-secret-weapons-of-successful-startups/>.
9. The data collected for this analysis suffers from an inherent survivorship bias, the precise impact of which is difficult to quantify (see "Limitations" section in Appendix A for more details).
10. Reported by Studio 19 in their post-survey assessment.
11. Of 261 instances of founding, only 41 percent (109) of those instances have the age of the founders available.
12. <http://nyctechmap.com/>.
13. Gross enrollment in tertiary education in Tanzania for both sexes was 3.5 percent in 2015 (<http://data.uis.unesco.org>).
14. No founders indicated having a doctorate. Professional degrees are defined as postgraduate qualifications in law, business, or medicine.
15. Of 261 instances of founding, only 39 percent (103) of those instances have major available.
16. <http://nyctechmap.com/>.
17. Of 429 instances of work history at the time of founding, only 25 percent (111) have job functions listed.
18. <http://www.buni.or.tz>.
19. <http://www.sido.go.tz>.
20. <http://www.teknohama.or.tz>.
21. Ratio of accelerated firms that received investment over nonaccelerated firms that received investment. A ratio of 1 means equal opportunities. A ratio below zero means nonaccelerated firms are more likely to receive investment. A ratio of more than one means accelerated firms are more likely to receive investment.
22. 38 distinct start-ups received funding out of a total of 159 unique start-ups.
23. Ratio of the number of investments received by funded start-ups that were accelerated divided by the number of investments received by funded start-ups that were not accelerated.
24. <https://techcrunch.com/2015/03/22/mentors-are-the-secret-weapons-of-successful-startups/>.
25. Entrepreneurs also provided comments on mentorship, with one respondent suggesting that "to have a larger impact, business incubated in places like DTBI should be given the responsibility mentor other organizations."
26. This is confirmed by survey respondents, who ranked finance as one of their key constraints.
27. Debt financing generally refers to interest-bearing loans. Equity financing gives a certain percentage of ownership in a start-up in exchange for funding.
28. This is confirmed by respondents to the survey. One participant stated that, "Players in the ecosystem, for example, incubators, hubs, accelerators, and so on, should work together to build a stronger ecosystem rather than competing and dividing opportunities."
29. This last factor is the least significant when compared to all others, suggesting that its influence depends on multiple factors (for example, how much complementary experience the additional founder brings, how well the team work together, and so on).
30. <http://www.skilledup.com/articles/the-ultimate-guide-to-coding-bootcamps-the-exhaustive-list>.
31. <https://tampere.demola.net/>.
32. <https://tech.cornell.edu/jacobs-technion-cornell-institute/overview>.
33. <http://bdlaccelerate.com/2016/>.
34. <http://www.startupchile.org/>.
35. <http://www.k-startupgc.org/>.
36. The amount of funding raised is not accounted for, since this is heavily influenced by the type of business and prone to outliers.
37. The number of employees hired is not accounted for, since this is heavily influenced by the type of business and prone to outliers.
38. 7 percent is $e^{-2.638}$.

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