



Food and Agriculture  
Organization of the  
United Nations

# Agricultural technology ecosystems in East Africa

**Taking stock in Kenya, Rwanda and Uganda**





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## Executive summary

The Food and Agriculture Organization of the United Nations (FAO) launched an initiative to assess the existing impediments for scaling innovation and technology in food and agriculture (AgTech) and to identify options to improve the enabling environment for AgTech-focused businesses. The initiative offers a tool for decision makers to promote the uptake of AgTech, investment and entrepreneurship in Africa, ultimately to advance agricultural productivity and food security.

Together with the Yield Lab Institute, FAO's Markets and Trade Division (EST) developed a methodology for the assessment and applied it in three East African countries: Kenya, Rwanda, and Uganda. The assessments evaluate the strengths and weaknesses of each AgTech ecosystem across six focus areas that encompass an AgTech ecosystem: finance, human capital/labour, infrastructure, digital preparedness, entrepreneurial culture, and public policy. The assessments were conducted using a two-step analytical approach. First, a Payne scorecard was developed to quantify and compare a country's overall enabling environment, using indicators across each focus area as a basis for the evaluation. Second, a survey and interviews were conducted in each country to collect data and information on the characteristics of the AgTech ecosystem and the experience of its key stakeholders.

The assessments aim to inform a range of stakeholders on the current trends in AgTech development. Specifically, they aim to (i) inform policymakers on how to improve the enabling environment and guide future interventions in AgTech ecosystems; (ii) guide the capacity development efforts of development agencies and inform their corporate planning exercises (such as country programme frameworks); (iii) assist development finance institutions in directing loans, donations and capacity development activities; (iv) ease the due diligence process of venture capital and institutional investors and help them spot emerging investment opportunities; and (v) address the market intelligence needs of entrepreneurs and signal opportunities and constraints that should be accounted for in their business models.

**Kenya** was the best performing AgTech ecosystem among the three East African countries, ranking the highest in the scorecard (68.6). Kenya's strong performance in digital preparedness was a key factor that differentiated it from the other countries. The proliferation of mobile money and market access applications in Kenya have laid the foundation for future technologies.

Kenya, as the most developed economy of the three ecosystems, has a strategic advantage in attracting new entrepreneurs from outside of its ecosystem. A key challenge is to incorporate AgTech into the business environment that already exists around FinTech and software development. Similarly, FinTech, and more generally innovative financing, is not yet reaching the AgTech sector at a similar rate compared to other industries. The ecosystem ranks in the third quartile of development flows to agriculture, weighted by gross domestic product (GDP),

despite the fact that agriculture accounts for as much as 36.7 percent of overall economic output. A key finding of the assessment is that the country's AgTech ecosystem could be strengthened by creating a streamlined policy around start-ups and dedicating resources to the AgTech space. It could be further reinforced by leveraging the country's strong network of agro-industrial companies and organizations in Nairobi.

**Rwanda** was the second best-performing AgTech ecosystem with a score of 63.1 in the scorecard. Rwanda's strong performance in public policy was a key advantage for entrepreneurs, compared to the other AgTech ecosystems. In fact, Rwanda ranked in the fourth quartile in business regulatory environment, regulatory quality, time to start a business, and strength of legal rights.

Being a smaller country, the limited market size puts a heavy burden on the ability of start-up firms to scale out of the marketplace and find business opportunities in neighbouring ecosystems. When weighted by GDP, the financial resources from donor agencies, government funds and traditional investors are also strong points of the Rwandan ecosystem, ranking in the fourth quartile in venture capital and fourth quartile in development flows to agriculture. Focusing on digital technology, with the potential for rapid growth, and making sure that these enterprises are well resourced would allow for Rwanda to become a launchpad into the broader region.

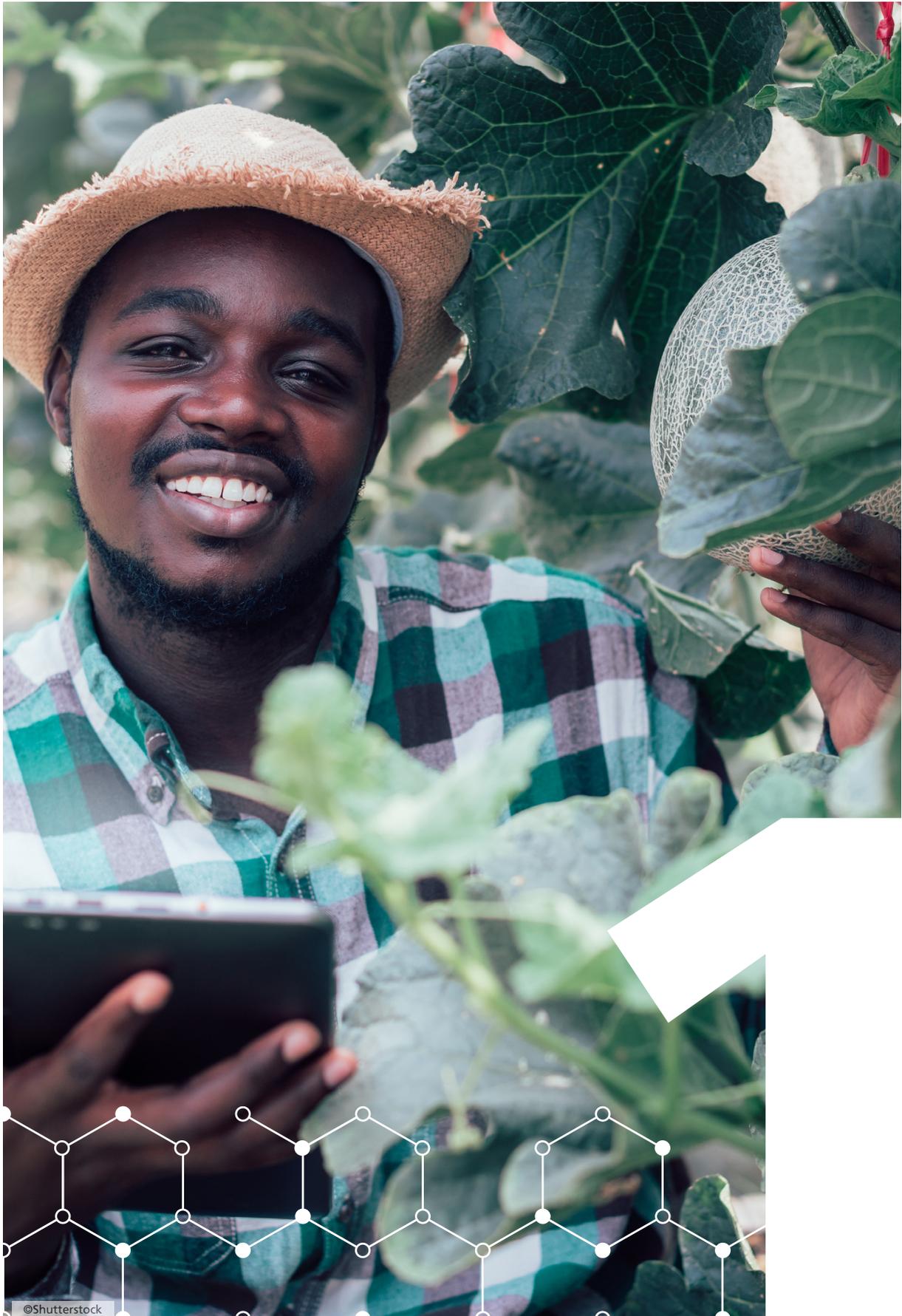
**Uganda** ranked third among the three ecosystems, scoring lowest in the scorecard (52.1). The ecosystem's strongest performance was in infrastructure, largely reflected by ranking in the fourth quartile for Efficiency in the Clearance Process, indicating the ease of conducting business across borders.

Uganda could build on its natural advantage of abundant arable land and its large agricultural workforce to create a hub for input and labour-intensive technologies. The ability to scale out of Uganda into neighbouring ecosystems, after proving an idea in a heavy agricultural economy, makes it an attractive market to many agricultural entrepreneurs. Some also view the lack of clear public policy and government involvement as a positive as they scale, but it mostly favours well-resourced start-ups to the detriment of local Ugandan entrepreneurs. While the country has established initiatives to reach these entrepreneurs, the assessment suggests that the overall business environment needs further improvements to attract additional capital inflows into agriculture and to reap the country's full potential to step up production and improve food security.

**The key takeaways** from across the three country assessments showed several trends across East Africa. The middle gap of financing for start-up firms is one common feature in each country. Many AgTech start-ups across the region are relying on donor funding and grants in the early stages of growth, while not receiving attention from traditional investors until a later stage. There is a lack of bridge funding following donor funding, which is necessary to scale their businesses. Scalability is another key trend, in which many traditional investors and

agro-industrials are hesitant to invest in technologies in the ecosystems due to a lack of options to scale their businesses. Scalability not only requires access to a large market, it also requires the investment of key stakeholders, such as universities, incubators and start-ups, to develop AgTech clusters and promote collaboration through mentorships and other partnerships.

Policymakers play a crucial role in supporting entrepreneurs with public policies and initiatives that allow them to develop and scale AgTech solutions and develop profitable businesses. The assessments highlight a range of public policies that are central to creating enabling environments for AgTech development, some of which include: strengthening digital infrastructure, such as broadband and mobile connectivity, including in rural areas; creating legal systems that enforce patents and intellectual property protection; adapting tax laws to provide incentives for the business development of AgTech start-ups; supporting universities to update and strengthen curricula on business, entrepreneurship and the technical skills to adopt and scale AgTech; and fostering private-public partnerships to create the infrastructure needed in rural areas to adopt and scale new agricultural technologies. Addressing these key policy areas, along with others highlighted in the paper, will help the East African region meet the prerequisites to successfully scale new agricultural solutions. ●



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# Introduction

Innovation and new technologies in food, agriculture, forestry and fisheries are ever more important in the pursuit of the Sustainable Development Goals (SDGs). The SDGs set out an ambitious development agenda that includes ending hunger by 2030 for more than 600 million people. However, with a growing population, changing diets, natural resource scarcity, climate change and food waste, food systems face tremendous challenges to meet the growing demand and to reach this goal. The challenge for global food security and nutrition is that we need to produce more food, while simultaneously using fewer natural resources and other inputs that contribute to greenhouse gas emissions and climate change.

Agricultural innovation and technology (AgTech) has shown real promise in transforming agriculture and addressing some of the key obstacles for food security. However, even with proven concepts, it remains challenging to scale up agricultural innovations into sustainable and profitable businesses. To identify the relevant constraints for scaling up AgTech-focused businesses, FAO launched an initiative to assess existing impediments and identify options to improve the enabling environment. The initiative is based on three country-level assessments and offers a tool for decision makers to promote the uptake of AgTech, investment and entrepreneurship in Africa, ultimately to advance agricultural productivity and food security.

In implementing the assessment, the Markets and Trade Division of FAO (EST) embarked on a pilot project with The Yield Lab Institute,<sup>1</sup> developed a methodology and applied it in three East African countries: Kenya, Rwanda, and Uganda. The assessments evaluate the strengths and weaknesses of each AgTech ecosystem across six focus areas that encompass an AgTech ecosystem: finance, human capital/labour, infrastructure, digital preparedness, entrepreneurial culture and public policy.

## 1.1 Rationale for assessments in Africa

Africa has experienced under-investment in its agricultural sector, holding back the transition from smallholder to commercial farming. As the continent with the highest prevalence of food insecurity, rising food import dependency and a rapidly growing population, Africa must boost its agricultural productivity and output to feed its population. Innovation and technology can play a pivotal role in achieving this goal. AgTech start-up firms and entrepreneurs can help harness productivity reserves and increase food production.

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<sup>1</sup> The Yield Lab Institute is a non-profit AgTech think tank that supports early-stage start-ups and innovations through targeted initiatives.

Agricultural innovation and technology have demonstrated considerable potential in making the continent's food system more efficient and more inclusive. For example, an estimated 264 e-commerce start-up firms are connecting producers to consumers and integrating rural communities into the formal economy.<sup>2</sup> There are also examples of indigenous AgTech solutions, such as Pula, that are going global and expanding to Latin America and Asia and contributing to the success of tropical agriculture.

Despite the growing interest and potential of AgTech in helping transform Africa's agriculture, there has been slow progress in scaling up new technologies. There are a number of challenges for AgTech adoption related to country-level commitment and performance in creating an effective entrepreneurial ecosystem for AgTech. These challenges are specific to each country and region within the country, and are related to human capital development, access to finance, public policies, infrastructure, digital preparedness, and entrepreneurial culture. Strengthening these components and the enabling environment for agricultural technologies in African countries are key to scaling them up.

## 1.2 Target audience

The assessments evaluate the AgTech business environments with a view to inform a range of stakeholders on the current trends in AgTech development, evaluating their strengths and weaknesses. The assessments aim to help stakeholders make evidence-based decisions to select appropriate technologies and markets, in order to harness their full potential. More specifically, the assessments aim to inform:

- **Policymakers:** Good governance is key to creating a conducive enabling environment. Most of the analysed factors are directly impacted by government policies and initiatives, which can foster or disrupt the AgTech ecosystem. The purpose of the ecosystem review is to highlight which policies have been implemented across the region and to understand their impact, allowing policymakers to adjust within their own ecosystems.
- **Development Agencies and Country Offices:** As development agencies plan their work in these ecosystems, they need to be in a position to address knowledge gaps, offer capacity development, and develop and adjust corporate planning exercises (such as Country Programming Frameworks) to support the government in harnessing the benefits of AgTech.
- **Development finance institutions (DFIs):** DFIs are crucial in the early stages of start-up growth across the region. To successfully impact the ecosystem, there needs to be a push to provide de-risking instruments, tailor financing instruments to agricultural development needs, and attempt to engage in collaboration with the private sector in innovative development finance.

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<sup>2</sup> <https://www.weforum.org/agenda/2019/09/8-ways-to-help-african-e-commerce-fulfil-its-potential/>



- **Universities and Incubators:** Universities and incubators are key enablers in a robust AgTech cluster. It is important for them to recognize their importance in building human capital, fostering an entrepreneurial culture, and creating more formal avenues to financing.
- **Venture Capital and Institutional Investors:** The intention is that this research will help venture capitalists understand the investment opportunities that exist on the ground in these ecosystems, as well as some of the challenges. This research also highlights some of the differences in the traditional model of venture funding and what challenges this presents for investors on the ground.
- **Entrepreneurs:** Entrepreneurs need to position themselves for success. In order to do this, they need market intelligence to understand opportunities as well as possible constraints and pitfalls in planning their businesses and implementing their business models.

### 1.3 Methodology

The methodology consists of a two-pronged analytical approach. First, a Payne scorecard was developed to quantify and compare each country's overall enabling environment. The scorecard consists of key indicators across each focus area as a basis for the evaluation. Common data sources for the scorecard include the World Bank, International Monetary Fund (IMF) and FAO databases. Second, a survey and interviews were conducted in each country to collect data and information on the characteristics of the AgTech ecosystem and the experience of its key stakeholders. A questionnaire was designed for each ecosystem, which included both qualitative and quantitative questions across the six focus areas. The survey was administered to help standardize and quantify the stakeholder's experience, while the interviews helped gather evidence on how the AgTech ecosystem functions.

#### 1.3.1 Key stakeholder criteria

The respondents and interviewees were chosen based on their expertise and type of engagement within the AgTech ecosystem. They were factored into a final selection of a group of participants with different backgrounds. The sample includes a range of stakeholders including members of academia, national authorities, entrepreneurs, business leaders and investment fund managers. The stakeholder selection criteria were built with a view to be representative of key research areas, including the following:

#### Finance

- Venture capital, angel investors, community investment efforts, crowdfunding investors—probable providers of capital for opportunity development and/or ideation.
- Persons with direct knowledge of the foreign direct investment landscape.
- Persons with direct knowledge of AgTech-related corporate-sponsored venture capital and/or corporate interest in the local AgTech sector.



### Human capital/labour

- University academics/employees working on student preparedness in AgTech, agriculture, digital competencies, entrepreneurship/business, and/or allied with university incubator spaces.
- Leaders or members of labour or farmer cooperatives, or workforce development programmes aligned with AgTech preparedness.
- Serial entrepreneurs working on AgTech-aligned ideas/projects/companies.
- Graduate-level students working on AgTech-related ideas.

### Infrastructure (physical and digital)

- Founders/employees as well as participating entrepreneurs associated with incubators, accelerators and co-working spaces.
- Persons with direct knowledge of investments and policies supporting growth in underlying physical and digital infrastructure (nationally and regionally) to support AgTech (such as road networks for physical market access/exports, digital connectivity to support broader mobile access penetration for the population, etc.).

### Public policy

- Government officials (both national and regional) with direct knowledge of the supportive policy environment surrounding the growth of the agriculture, business, and entrepreneurial sectors.
- Persons with direct knowledge of the tax environment surrounding new business development (such as tax incentives for entrepreneurs or society-supporting business ideas).
- Persons with direct knowledge of available government assistance related to grants or other funding vehicles available to graduate students or entrepreneurs working on ideas/new businesses.

### 1.3.2 Summary of the scorecard

The Payne scorecard uses weights for each of the six focus areas that are based on the importance of each area in creating an effective enabling environment for AgTech. The assumptions and rationale developed for each focus area are defined below.

**Public policy** – At 30 percent, public policy is weighted the highest in the overall score. The high weight is motivated by the fact that public policies affect every other factor in the scorecard and lay the foundation for a strong ecosystem. A public policy framework cannot be imported or substituted and must come from changes within the country, which are feasible in the short and long term.



**Finance** – The lack of access to finance was mentioned by almost all of the stakeholders that were interviewed. Finance is weighted at 25 percent, reflecting the importance of finance for an ecosystem that is conducive to fostering start-up firms. Insufficient access to sustainable finance has plagued start-ups after the initial funding stages, while success for start-ups comes down to the availability of funding during the early stages.

**Infrastructure** – Infrastructure disproportionately affects agriculture and AgTech in comparison to other industries because rural infrastructure is often the least developed but is central to agricultural production and distribution. Due to this emphasis on agriculture, it is 20 percent of the weighted scorecard. This cannot be directly imported from outside of the country and any changes must come from the government in power. Poor infrastructure can limit everything else within the country (for example, electricity prices).

**Digital preparedness** – Digital preparedness is a key component of many emerging technologies in the AgTech space on the continent. For example, market access applications using digital technologies have become commonplace in most of the ecosystems. Because of the importance of digital preparedness in laying a foundation for the future of AgTech, a weight of 15 percent was given to this focus area. This pillar must be addressed by the public sector, in partnership with the private sector. It requires more extensive learning and practical preparation compared to other factors. It is often limited by available public finance.

**Human capital** – Highly skilled human capital can be imported, as a temporary solution, when it is lacking in a country. Therefore, it was given only 5 percent on the scorecard. A strong base is important so that the ecosystem will continue to self-develop new technologies.

**Entrepreneurial culture** – Entrepreneurial culture relies on many of the other focus areas. In particular, public policy and access to finance are two key components to promote business development and build an entrepreneurial culture. Due to its dependence on the other focus areas, entrepreneurial culture was weighted at 5 percent of the total score. Entrepreneurial culture is being built into many of these ecosystems, but the level of risk-taking is relatively low at the farmer level. This focus area will measure the incubators and wider community that supports risk-taking.

### 1.3.3 Key indicators included in the scorecard

#### Public policy

*Start-up policy* – Start-up policy helps to provide a stable legal framework for business development, and supports start-up firms through initiatives like scholarships, mentorships, incubators and other forms of government support.



*Government involvement* – Tech clusters succeed when the government provides incentives and subsidies to de-risk early-stage technologies.

*Patent system* – Patent systems, when enforced, provide a legal framework for start-ups to establish and maintain a competitive advantage.

*Investment incentives* – Investment incentives provide a runway and a soft landing for resource restricted start-ups.

*Central Bank policy rate* – The Central Bank policy rate is a risk-free rate that affects the investment climate and inflow/outflow of foreign capital. A high policy rate discourages local investment as investors can lend to the government for low risk; this pushes up the internal rate of return (IRR) required to invest in start-up firms.

*Political stability* – Political stability is a macro factor that affects aggregate demand and supply, as well as the business confidence of investors.

*Tax rate* – Tax rates should be tiered and optimized for start-ups and entrepreneurs given that they are resource-constrained.

*Rule of law* – Rule of law affects the establishment and enforcement of contracts and provides for quick remedies in commercial disputes.

*Fiscal policy* – Fiscal policy, especially tax policy and budget allocation, should place emphasis on the economic sectors that have growth potential or those that are in need of assistance.

*Ease of paying taxes* – Ease of paying taxes is a proxy for the government's approach to supporting businesses and how easy it is for businesses to operate.

*Business regulatory environment* – Business regulatory environment measures how friendly and effective the regulatory regime is to businesses.

*Regulatory quality* – Regulatory quality measures the ability of the government to formulate and implement policy and regulations.

*Strength of legal rights* – Strength of legal rights measures the degree to which the rights of investors, owners and contracts are enforced.

*Time to start a business* – Time to start a business measures the number of business days it takes to get a business legally registered.

*Transparency* – Transparency measures the openness and accountability of the government to its constituents.



*Cross border trade* – Cross border trade measures trading across borders for goods and services and the ability to scale from the country.

*Government expenditure on agriculture (AG)* – Government expenditure on agriculture measures budget allocation to agriculture versus the share of agriculture in GDP.

*Farmer organization/database* – Farmer organization/database measures the presence or absence of a government or public/private registry for farmers. The availability of a farmer database highlights the government's efforts to lower the barriers to participate in the AgTech ecosystem.

*Government policy plans* – Government policy plans measure the implementation of government policy.

*Tax policy on AG* – Tax policy on agriculture measures stakeholders' perception of how favourable tax policy is during the production of agricultural goods.

## **Finance**

*Venture funding* – Venture funding measures the total annual assets invested and number of rounds of investment in an ecosystem. It helps measure the flow of outside funding and willingness to invest in new technologies in the ecosystem.

*Corporate venture funding* – Corporate venture funding measures the total annual assets invested and number of rounds of investment in an ecosystem from corporates investing in their industry.

*Domestic venture funding* – Domestic venture funding measures the total annual assets invested and number of rounds of investment in an ecosystem from local investors.

*Number of domestic venture capital (VC)* – Number of domestic venture capital measures the number of firms involved in venture capital.

*Deposit rates* – Deposit rate is the rate local deposits are compensated for saving. Higher deposit rates disincentivize local investors from participating in venture funding.

*Real interest rates* – Real interest rate is a measure of interest rate return after accounting for inflation.

*Foreign aid* – Foreign aid is a measure of foreign assistance as a percentage of GDP.

*Development flows to AG* – Development flows to agriculture measures the amount of foreign assistance extended to agriculture. Donor funding is crucial to early-stage start-ups in African ecosystems.



*Foreign direct investment* – Foreign direct investment is a measure of the foreign capital flowing into an ecosystem; it helps measure the commitment of outside countries investing in the ecosystem.

*Remittances* – Remittances measure diaspora remittances as a share of the population to show a commitment from outside diaspora.

*Land ownership systems* – Land ownership systems indicate where land is owned individually, leased from the government or distributed by local leadership.

*Bank lending rate* – Bank lending rate is the rate at which one can borrow from domestic banks.

*Credit to agriculture* – Credit to agriculture measures credit extended to agriculture as a percentage of total credit.

## **Infrastructure**

*Logistics performance indicator* – Logistics performance indicator is a proxy measure for the efficiency of transport, and import and export infrastructure.

*Burden of customs* – Burden of customs measures the efficiency of customs procedures and government efficiency in cross border trade.

*Access to electricity* – Access to electricity measures the proportion of the population connected to the electrical grid and the infrastructure capabilities of the government.

*Cost of electricity* – Even if infrastructure is present for the population to access electricity, the cost can be a high barrier and can hinder access.

*Access to water* – Access to water measures the proportion of the population with access to piped water and the government's ability to build the infrastructure necessary for agriculture.

## **Digital preparedness**

*Mobile connectivity index* – This score combines data cost, data coverage, and smartphone penetration in the market to measure mobile connectivity, which is an indicator for the functionality of new technologies.

*Mobile subscription* – Mobile subscription is the number of mobile devices per 100 people. Most AgTech solutions require mobile devices.



*Internet penetration* – Internet penetration is the proportion of the population with access to the internet. Most AgTech solutions require internet access.

*Average school years* – Education level is used as a proxy for determining how prepared the population is to adopt new technologies and use them at a rate that is sufficient for scalability.

*Literacy* – Literacy is also used as an indicator of the ability of the population to adopt new technologies and use them at a rate that is sufficient for scalability.

## Human capital

*Government spending on education per capita* – Government spending on education per capita measures the average education expenditures by the government per citizen. This helps to measure the government’s commitment to educating a future workforce.

*Gender inequality* – Gender inequality allows us to measure the inclusion of women in the workforce, and therefore, the amount of the population that is available to fill roles in AgTech start-ups and to generate new ideas.

*Building human resources* – Building human resources acts as a proxy to indicate the ecosystem’s ability to foster and preserve human capital within the ecosystem.

*Presence of outside founders* – This indicates the presence of founders of start-ups that are foreigners in the ecosystem where the company was established and operates. This score was calculated on surveys and interviews conducted in each ecosystem.

*Incubators* – This score was calculated using interviews and surveys in each ecosystem, measuring the perception of incubators and accelerators on how much they help local start-ups.

*Level of collaboration* – This score was calculated using interviews and surveys in each ecosystem, measuring the perception of start-ups’ willingness to collaborate with other companies, academia and the public sector to further the ecosystem.

*Registered new business density* – Registered new business density measures the number of new businesses per 1 000 people, which helps to measure the community’s openness to launching new formal businesses ventures.

*Cost of starting a business* – Cost of starting a business measures the cost of permitting a business as a proportion of gross national income (GNI), which allows us to measure the barriers for new entrepreneurs to create a formal business.





# East African ecosystem review

## 2.1 Country overview

Kenya, as the most developed economy, has a strategic advantage in attracting new entrepreneurs from outside of its own ecosystem. A challenge is to incorporate AgTech into the business environment that already exists around FinTech and software development. FinTech and more generally innovative financing is not yet reaching the AgTech sector at a similar rate compared to other industries. The ecosystem ranks in the third quartile of development flows to agriculture, weighted by GDP, despite the fact that agriculture accounts for as much as 36.7 percent of overall economic output. A key finding of the assessment is that the country's AgTech ecosystem could be strengthened by creating a streamlined policy around start-up firms and dedicating resources to the AgTech space; it could be further reinforced by leveraging the country's strong network of agro-industrial companies and organizations in Nairobi.

Rwanda is the smallest ecosystem in terms of population that was analysed in the ecosystem review. The limited market size puts a heavy burden on the ability of start-ups to scale out of the marketplace and find business opportunities in neighbouring ecosystems. When weighted by GDP, the financial resources from donor agencies, government funds and traditional investors are strong points of the Rwandan ecosystem, ranking in the fourth quartile in venture capital and fourth quartile in development flows to agriculture. Focusing on digital technology, with the potential for rapid growth, and making sure that these enterprises are well-resourced would allow for Rwanda to become a launchpad into the broader region.

**Table 1** | Key agricultural indicators, country overview

Contextual Indicators	Kenya	Rwanda	Uganda
Arable land/total agricultural land, percent (2016/18)	21.0	63.6	47.9
Arable land/total land area, percent (2016/18)	10.2	46.7	34.4
Ag gross output/GDP, percent (2016/18, *2015 for Rwanda)	36.7	34.2	23.8
Ag value added/GDP, percent (2016/18, *2015 for Rwanda)	31.7	28.2	18.3

Uganda could build on its natural advantage of abundant arable land and its large agricultural workforce to create a hub for input and labour-intensive technologies. The ability to scale out of Uganda into neighbouring ecosystems, after proving an idea in a heavy agricultural economy, makes it an attractive market to many agricultural entrepreneurs. Some also view the lack of clear public policy and government involvement as a positive as they scale, but it mostly favours well-resourced start-ups to the detriment of local Ugandan entrepreneurs. While the country has established initiatives to reach these entrepreneurs, the assessment suggests that the overall business environment needs further improvements to attract additional capital inflows into agriculture and reap the country's full potential in stepping up production and improving food security.

## 2.2 Key takeaways across the region

Figure 1 | Key issues across the region

During the course of the study, a few key trends emerged as pain points for the development of the Agtech ecosystem across the region.

<b>Scalability</b>	The scalability of solutions poses a critical impediment to investing in the region. The basic concern is that the domestic market fails to provide the scale to make newly developed products viable, i.e. reap economies of scale and scope.
<b>Middle gap of finance</b>	A common challenge for the region's start-up community is a lack of bridge funding following the donor funding stage, which is necessary to scale their businesses. The traditional venture capital industry, that provides Series A and Series B funding, is still lacking in these ecosystems. These funding rounds are critical in moving from a viable proof of concept product to commercial scale.
<b>Ownership</b>	A common observation in each of the ecosystems was that equity financing is not widely accepted by Domestic Entrepreneurs. Many are hesitant to give up equity to foreign venture capital firms. This reluctance to adopt the traditional model will require Venture Capital to adapt.

Source: Authors.

**Middle gap** – One common feature across all the three East African ecosystems that were studied is a middle gap of financing for start-ups within each country. The middle gap denotes a funding gap between early capital rounds (pre-seed and seed) and later rounds, typically referred to as Series C and Series D rounds. Donor funding has been central to the early-stage funding of start-up firms in Kenya, Rwanda, and Uganda, with many of the start-ups that were interviewed reporting to have received early funding from donor agencies. This has proven critical in de-risking most of these start-ups. Traditional routes of funding seen in other markets, such as friends and family or debt funding from banks, either do not exist or are not implemented. Donor agencies have allowed entrepreneurs to build out their products when no alternative paths exist. Donor funding was not only essential in de-risking the very early development stages, but it also provided early capital and operating capacity that would otherwise have been inaccessible.

A common challenge for the region's start-up community is a lack of bridge funding following the donor funding stage, which is necessary to scale their businesses. The traditional venture capital industry, that provides Series A and Series B funding, is still lacking in these ecosystems. These funding rounds are critical in moving from a viable proof-of-concept product to commercial scale.

In some countries, such as South Africa, **domestic venture capital** bridged this gap, but in Kenya, Rwanda, and Uganda, venture capital firms still must meet this role. Potential investors in these ecosystems have alternatives that are far more secure and profitable than investing in a risky start-up. For example, Kenyan treasury bills yield about 7 percent per year and Uganda has a domestic credit rate of about 20 percent, luring potential investors away from



riskier investments to investments with guaranteed rates of return. As a result, the middle gap has left many entrepreneurs without the financing they need to continue growing after the successful initial phase of their businesses and to attract the attention of follow-on venture capital funding.

**International venture capital** funds in the region have historically declined participation until later rounds of fundraising, given their need for scale and their overhead costs, which often require investment volumes in excess of USD 50 million. While Kenya has seen the largest share of inflows from these “mega-funds” within the region and a higher level of visibility from international firms, there remains a persistent gap in the larger investment options (“ticket sizes”) sought by most international venture capital funds and small and mid-sized enterprises (SMEs).

**Scalability** – The discussions with multinational agricultural companies and venture capital firms also revealed that scalability of solutions poses a critical impediment to investing in the region. Scalability is directly linked to the middle gap in financing. The basic concern is that the domestic market fails to provide the scale to make newly developed products viable, that is, reap economies of scale and scope. That said, Kenya is in a better position than other East African countries due to the larger scale of its agriculture production, its rapidly growing domestic consumer base, and its relative success in penetrating foreign markets (fruits and vegetables, and cut flowers, for example). It also has a higher rate of industrialized farming, increasing the potential uptake of new technologies. Unsurprisingly, smallholder farmers in most of East Africa are hesitant to adopt new technologies, perceiving them as a level of unnecessary risk in a profession where livelihoods are closely linked to the timing and success of a harvest season.

Rwanda is at a disadvantage compared to its neighbours. Its total market size is much smaller than that of Uganda and Kenya, limiting the potential scope of applying and implementing a given technology within the country. In order to address this, Rwanda needs to make it as easy as possible for companies to conduct business abroad. With improved regional market integration, Rwanda could allow its companies to develop and scale in new markets. The Rwandan government has begun to address this with a focus on digital technologies as opposed to inputs. A push for more digitally focused AgTech solutions will allow for faster scalability, beyond the narrow confines of the domestic market.

Uganda has the potential to be a strong launchpad for input, value-added and AgTech-based solutions. Ample access to arable land makes the market ideal for AgTech-focused technologies. The entrepreneurs within the market need to be better prepared for scale beyond the Ugandan market. As entrepreneurs continue to develop new technologies, they tend to do so in a silo. Without considering scalability, many of their AgTech solutions are borne out of experiences in their own ecosystem. This results in duplicate technologies across ecosystems and leaves many entrepreneurs without significant differentiation to attract investment. Ugandan start-ups tend to be in direct competition with those in neighbouring Kenya, requiring the entrepreneurs in the country to differentiate their products during implementation in order to have a competitive advantage when scaling outside of the country.



**Ownership** and formation of companies has emerged as a significant hurdle within the region. A common observation in each of the ecosystems was that equity financing is not widely accepted by domestic entrepreneurs. Many are hesitant to give up equity to foreign venture capital firms. This reluctance to adopt the traditional model will require venture capital to adapt. For example, South Africa’s use of different approaches such as investors moving towards perpetual investment vehicles that offer flexibility in raising equity or debt and infinite investment horizons for longer exits. Due to the necessity to scale beyond borders, exit constraints, and longer adoption periods, a 10-year fund is seldom a realistic financing alternative.

Ownership of information is also a hurdle for many start-ups. The governments in the East African region have shown a reluctance to share their data and information. For example, there is no established farmer database in Kenya or Uganda, forcing every start-up operating in these countries to create their own. This is a massive barrier to entry for a local start-up that has limited resources. Overcoming these barriers also tends to make the ecosystem less likely to partner with one another for fear that their hard work will be copied by someone else. A lack of patent enforceability or other legal protections compounds this issue, forcing some companies to look abroad to register their patents and protect their intellectual property.

This issue is even more prevalent in Uganda as there is less knowledge among entrepreneurs about common financing practices in the industry. Many are hesitant to give up portions of their company to foreign venture capital firms, with some having experienced severe tension where entrepreneurs and investors disagreed over business strategies.

Rwanda’s small size compared to other ecosystems has had a positive effect on the entrepreneurial culture within the ecosystem. Many of the stakeholders have shown a willingness to collaborate on new initiatives, something that is missing in neighbouring ecosystems. The close-knit community of Kigali, for instance, has fostered a level of cooperation and communication that was not evident in the other ecosystems of the region.

**Incubators** – Kenya holds a distinct advantage over the other ecosystems in the region. International attention to the start-up ecosystem and high-profile success with some companies has fuelled the growth of incubators within Nairobi. Unfortunately, AgTech is not given much attention within these incubators, with most focusing on FinTech and other industries. The result of the success in other industries has been a reduction in the quality of incubators in the ecosystem. The interview process revealed that these incubators are acting more as factories, concerned with the number of entrepreneurs moving through, and less concerned about the quality of the companies that graduate from the incubators.

**Regulations** – Enforced regulations are present in Rwanda more so than in other East African ecosystems. These regulations have had both a positive and negative impact on the ease of doing business within the country. Most stakeholders commented on how easy it was to register their businesses in the country and follow the necessary procedures to begin



operating. The challenges occur when new regulations are put into place quickly and without consulting industry leaders. The unforeseen implications of these regulations have hampered some companies' ability to do business. With less flexibility compared to other ecosystems, firms are sometimes forced to change their business models without much time to prepare and account for new policies. Rwanda has laid a strong foundation for rules and processes in the ecosystem, reducing corruption and building out crucial policies for the organized growth of an ecosystem, but has at times hampered the growth of SMEs in the ecosystem.

## 2.3 Scorecard takeaways

Kenya was the best performing AgTech ecosystem among the three East African countries, ranking the highest in the scorecard (68.6). Kenya's strong performance in digital preparedness was a key factor that differentiated it from the other countries. The proliferation of mobile money and market access applications in Kenya have laid the foundation for future technologies. Within the digital preparedness factor, Kenya ranked in the fourth quartile in mobile subscriptions and in the fourth quartile using the GSMA Mobile Connectivity Index.

Rwanda was the second best-performing AgTech ecosystem with a score of 63.1 in the scorecard. Rwanda's strong performance in public policy was a key advantage for entrepreneurs, compared to the other AgTech ecosystems. In fact, Rwanda ranked in the fourth quartile in business regulatory environment, regulatory quality, time to start a business, and strength of legal rights.

Uganda ranked third among the three ecosystems, scoring lowest in the scorecard (52.1). The ecosystem's strongest performance, out of the six weighted factors, was in infrastructure, largely reflected by ranking in the fourth quartile for the customs clearance indicator, indicating the ease of conducting business across borders. This positioning is crucial, as scalability is a concern among investors.

**Table 2 |** Country scores, overall and by dimension

Weighted Factors	Weight (percent)	Kenya Score	Rwanda Score	Uganda Score
Public policy	30.0	18.4	24.4	16.4
Finance	25.0	14.0	10.9	11.6
Infrastructure	20.0	16.4	14.4	11.8
Digital preparedness	15.0	12.4	8.2	7.8
Human capital	5.0	3.8	2.3	1.7
Entrepreneurial culture	5.0	3.6	3.0	2.9
<b>Total</b>		<b>68.6</b>	<b>63.1</b>	<b>52.1</b>





# Kenya

## 3.1 Introduction

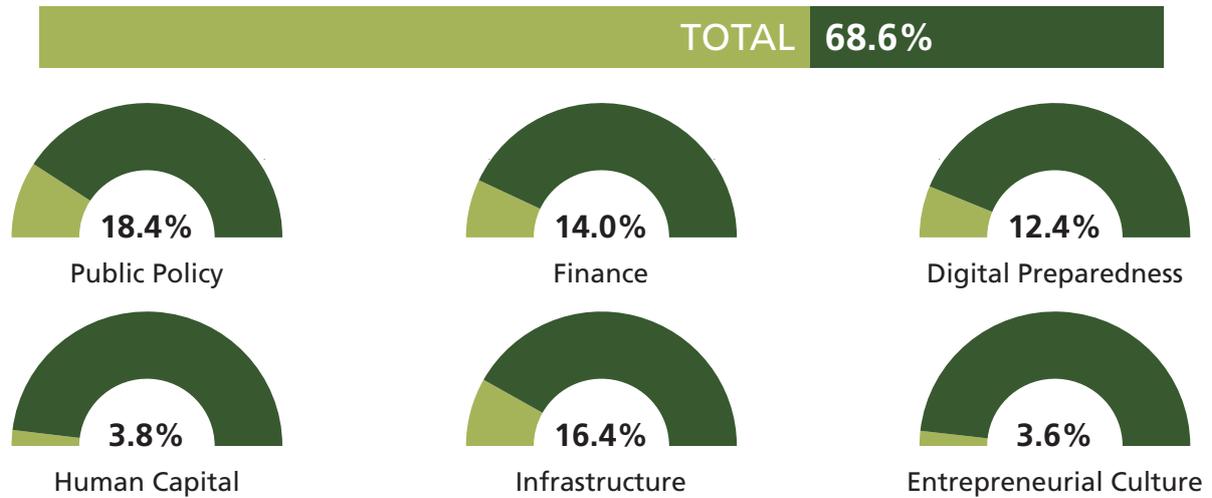
Over the last decade, Kenya has emerged as a hub for innovative technologies on the African continent. The term “Silicon Savannah” has been coined to describe the country’s growing entrepreneurial ecosystem, holding promise for more robust industry expansion. The attention from inventors combined with Nairobi acting as a hub for multinational organizations, both for-profit and non-profit, has helped the country to develop important ecosystem components, allowing start-ups to succeed. Incubators are more widespread than in neighbouring ecosystems, gaining the attention of international agencies. In parallel, Kenya’s success in FinTech and software industries has allowed the country to establish an overall conducive business environment. A key challenge moving forward is to integrate AgTech into this enabling environment.

While there is a general interest in creating a vibrant entrepreneurial environment, Kenya’s AgTech ecosystem is still plagued by a number of pitfalls. These include a lack of involvement from universities, venture capital providers, DFIs and incubators in the AgTech ecosystem that have underpinned success in advanced economies.

Despite the large share of the attention captured by FinTech and software industries, some AgTech solutions have made inroads into Kenya’s agricultural market. Many of these solutions have been established by international founders, a feature that stands out across East Africa. Kenya offers international entrepreneurs a familiar base for their operations to launch and scale innovative ideas across ecosystems. While generally welcome, the presence of international investors can create inequities for Kenyan-founded businesses, which often struggle to compete for international funding and cannot gain the visibility that foreign-run start-ups have managed to attract.

Overall, Kenya has the potential to be a viable AgTech centre within the East African region. With agriculture accounting for 35 percent (USD 95.5 billion) of the nation’s GDP, the sector offers a broad basis for AgTech to contribute to future growth and overall development. The importance of domestic agriculture also suggests a potential to create AgTech markets large enough to reap economies of scale and scope. Together with political stability and solid international integration, these factors have built confidence among multinationals and allowed Nairobi to emerge as a hub for international organizations and companies focusing on agriculture. In addition to the large agricultural market, Kenya boasts a high level of digital preparedness. Importantly, its efficient mobile payment systems have laid the foundation for openness to new technologies and brought many possible early adopters of new technologies into the fold.

Figure 2 | Kenya's Payne scorecard valuation



Source: Authors.

### 3.2 Recommendations

Governments, and the policies they enact, can either encourage or impede innovation and its impacts. The assessment identified concrete and actionable steps that the Kenyan Government can take to promote AgTech innovation and support its ecosystem.

- 1) Legal stability for agriculture in general and for start-ups in particular will help provide clarity and predictability in the ecosystem for both international investors and entrepreneurs on the ground. It is noted in this context that the government of Kenya appears keen to move forward with new policies for start-ups. However, current start-up legislation is still in its draft stage; policies to codify financing for AgTech firms, government support, and ICT for agriculture are still largely missing. There is a need for a coordinated national policy on the adoption of AgTech into agriculture practice. For example, while there is a need to mechanize cereal farming, there is no policy to guide the development of seed varieties that cater to mechanized harvesting.
- 2) It is important to reduce the barriers to entry for domestic entrepreneurs. Maintaining a blanket 30 percent income tax for resource-constrained start-ups poses a heavy burden on profitable cash-strapped companies in their early stages and shorter periods to accumulate carry forward losses (10 years in Kenya versus 20 years in the United States of America). In addition, the government has yet to tailor its tax policies to the idiosyncrasies of emerging industries. They are in particular need of a more stable tax regime which provides them with planning security for burgeoning businesses. The current practice of frequently readjusting tax regimes makes business planning unduly and unnecessarily difficult.
- 3) Across the region, there has been a reluctance by entrepreneurs to share ideas and collaborate on new initiatives. One of the issues fuelling this hesitation is the lack of a clear or enforced patent policy. Naturally, as start-ups build competitive advantages, they are reluctant to



share business information in an environment without strong contract law, recourse to legal remedy and patent protection. Being one of the largest economies in the region, Kenya could set a precedent with a strong patent regime that is clear, transparent and enforceable. An improved sense of security would allow start-ups to focus on mastering technological challenges through collaboration and sharing ideas. Universities can play an instrumental role in fostering start-up collaboration and AgTech development. Therefore, efforts should be made to help universities develop innovation hubs for AgTech and entrepreneurship. Without a critical mass of ideas, it becomes difficult to build momentum and traction within the ecosystem.

- 4) Universities can also help build a stronger overall network across the start-up ecosystem. For instance, there is a possibility to tap into alumni networks for capacity building, investment and industry support for start-ups. Agro-industrials are in a unique position to help foster this growth through investment, research partnerships and viable exit opportunities. They often have industry connections across markets, a committed budget for research and development and industry expertise that can be shared with these start-ups. Again, Kenya is in a strong position compared to the rest of the region with the necessary players already participating within the marketplace. If universities, investors, agro-industrials, government and donor agencies worked together to build this ecosystem, Kenya could continue to build momentum in the AgTech space.
- 5) There is a need for more AgTech-focused incubators and accelerators that can fulfil the requirements of start-ups operating along the entire value chain. These incubators and accelerators could provide valuable support for start-ups, offering the much-needed scale within the country for start-ups to succeed. In addition, Kenya could further leverage its already strong position among foreign founders to attract additional venture capital into the region.

## 3.3 Key findings

### 3.3.1 Public policy

#### National policy

Despite the overall openness to new technologies, there is a lack of clear policies for a vibrant AgTech start-up environment. As FinTech became more prevalent in the country over the last decade, the government began to implement policies aimed at providing some industry regulation and expansion. For instance, the Kenyan Government has implemented a digital economy blueprint that has gained international attention. While it is still unclear how these policies will affect start-ups in the future, a clear and open policy environment should bring comfort to investors looking for agricultural business development in the Kenyan market.

Clear policies for both investors and entrepreneurs are also key to building confidence in the overall AgTech ecosystem. Changing policies make long-term strategies difficult to implement and add unnecessary risk to investments. At the time of preparing this study, the national



government was in the process of drafting a start-up/e-commerce legislation to codify tax policy, visa requirements and financing policy. Most successful AgTech start-ups within Kenya have indicated that they benefited from various existing policies in their efforts to create and implement new technologies. The Kenyan Government, through its banking regulator, the Central Bank of Kenya, has proven receptive to innovations within the finance sector.

Kenya has the most developed legal framework in East Africa, explaining why it leads the space. Money Remittance Regulations, Proceeds of Crime, Anti-Money Laundering Act and Kenya Information and Communications Act govern the remittance and payments sectors. The Data Privacy Bill and the Cyber Crime Bill were recently under consideration. There is, however, little to no implementation or enforcement of these policies by the government.

Central Bank policy has had a disproportionate effect on domestic credit extended to agriculture and AgTech. With a base lending rate of 7 percent, banks require lending rates of between 14 percent and 25 percent to compensate for taking risk. With competition from government bonds and fixed deposits offering returns between 11 percent and 19 percent, investors would be hard-pressed to forgo such low-risk investments to chase returns in the AgTech ecosystem. It was noted that the Central Bank of Kenya put in regulations preventing online lenders from sharing credit profiles with credit bureaus, which had an adverse effect on online lending, even in the agriculture space. Despite the issues that come with this higher rate, 7 percent ranks within the third quartile when compared to other African countries. This leaves Kenya with room for improvement, but in a stronger position than other ecosystems on the continent.

### *Tax policy*

Kenya has implemented a flat 30 percent corporate income tax on all businesses. By comparison, Uganda charges a corporate tax of 22.3 percent and Rwanda charges 25.7 percent (World Bank, 2020a). Given the resource constraints that start-ups face, this is not an optimal strategy and does not incentivize business development or the creation of a vibrant AgTech sector. In fact, according to the World Bank's index of business-friendly tax regulations, Kenya scored 94 (with 1 being the friendliest), while Uganda and Rwanda scored 92 and 38, respectively (World Bank, 2020b).

The national government is trying to increase tax collection by either introducing new taxes or expanding the tax base to a broader range of SMEs. A presumptive tax is charged at 15 percent of the single business permit or trade license, while a turnover tax is charged at a rate of 3 percent of gross sales. Unlike the turnover tax, whose payment is made monthly, the presumptive tax is paid once a year at the point of acquiring or renewing a single business permit or trade license. In addition, tax holidays are available for investors looking to open enterprises from abroad. Local entrepreneurs have noted, however, that these tax holidays are not available to local investors, which is yet another disadvantage for local investors.



### *Agricultural policy*

The Kenyan agriculture sector is an important contributor to both GDP and total employment, accounting for 32 percent of GDP and 58 percent of total employment in 2019. However, the national government spends just 1.8 percent of the budget on agriculture, according to the most recent available data in 2019. When weighted by GDP, Kenya ranks in the lowest quartile of African nations in terms of public expenditure on agriculture, highlighting the importance of agriculture to the national economy despite low government funding.

The Kenyan Government is currently working to update agricultural systems in the following areas: agricultural input management system, a land tenure management system, and an e-voucher system for agricultural subsidies. Despite these efforts, it was noted that the government still lacks some evidence-based systems to distribute agricultural inputs, such as using a national soil map to effectively disperse suitable fertilizers. Additional efforts are also required by the government to continue to improve technological infrastructure within national programmes, such as automating data collection in strategic food stocks.

### *County governments*

Under the new constitution promulgated in 2010, Kenya is administered by two levels of government, a national government and 47 county governments with their own constituent assemblies. The devolved units of government were established in recognition of the rights of local communities to manage their own affairs and provide proximate government services throughout the country. Each county assembly with democratically elected representatives is empowered to make local legislation, raise revenue and ensure equitable access to resources and services.

Although agriculture has been devolved from the national government to the county government, the budget for agriculture was not delegated, with the majority being retained by the Ministry of Agriculture. A point of concern has been tax policy on agricultural produce. While agricultural produce is tax exempt, county governments have implemented a cess tax<sup>3</sup> when agricultural produce crosses county lines defeating the purpose of its tax-exempt status.

Though poorly funded, the county governments have been more aggressive than the national government in partnering with start-ups and entrepreneurs. Formerly marginalized counties are now more heavily represented as they have more ground to make up. In Turkana county, a start-up was allotted land to build a training institute to facilitate training individuals in arid/semi-arid areas on hydroponic farming systems. In Makueni county, another start-up is working with the county government to provide market linkages for the avocado market.

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<sup>3</sup> A cess is a form of tax levied by the government on tax with specific purposes until the time the government gets enough money for that purpose. Different from the usual taxes and duties, like excise and personal income tax, a cess is imposed as an additional tax on top of any existing tax (tax on tax).



Vihiga county has fully digitalized their land records, which helps the county with land usage, urbanization and flooding planning.

## **Business environment**

The key indicators suggest Kenya's business environment hovers around average. Kenya scored in the second, third and fourth quartiles for most metrics used to measure the business environment of the ecosystem, including business regulatory environment (fourth), regulatory quality (third), strength of legal rights (second), cost of start-up business procedures (second), transparency (fourth), and cross border trade (fourth). The average time to start a business is 23 days, which ranks below average in the region. Overall, Kenya's business environment has been conducive for larger companies to operate within the country. This stability in the business environment has allowed Nairobi to act as a hub in the region and continent for multinational companies.

### *Intellectual property*

One metric that can serve as a proxy for innovation is observing intellectual property payments received versus intellectual property payments made. According to the 2019 World Development Indicators, Kenya received USD 63 million in intellectual property payments and made USD 112 million in intellectual property payments (World Bank, 2020a). It shows that with a net outflow of USD 49 million, Kenya is paying to utilize inventions belonging to people or firms that are not located in Kenya.

Several issues for filing intellectual property rights were identified during the interviews. Overall, it was found that intellectual property rights have sufficient legislation in Kenya, but too often those rights are not enforced and/or protected by Kenya's legal system.

### *Start-up policy*

In 2019, the Kenyan authorities announced their plans to enact a policy to support start-up development. A draft of the start-up legislation was published in the Kenya Gazette Supplement No. 163, which states the objectives are “to provide a framework to encourage growth, sustainable technological development and new entrepreneurship employment; to create a more favourable environment for innovation; to attract Kenyan talents and capital; and for connected purposes” (Kenya Gazette, 2020). Kenya joins Ghana and Mali in debating their start-up legislation, while Senegal and Tunisia have enacted their bills (Ashebir, 2020). The legislation provides a framework for the establishment and certification of incubators on a devolved county level, a register for start-ups and fiscal/non-fiscal incentives for start-ups. By enacting laws to codify start-ups, the legislation provides linkages for start-ups to other industries, the national government and county governments. It also provides a lobby and forum through which entrepreneurs and start-ups can petition for favourable laws and regulations.



Tunisian start-up legislation provides an example for other legislation currently under discussion. Tunisia's start-up bill provides one year of leave for public and private employees to create a start-up, which is not included in Kenya's draft bill. In addition, Tunisia provides a three-year tax holiday for graduate-founded start-ups, capital gains tax exemptions on securities sales and one-year start-up scholarships for entrepreneurs. The Kenya draft bill did not address areas such as finance, digital infrastructure, training opportunities, tax regulations or data sharing. In addition, it was reported that the Kenyan Government may be considering legislation that would require 30 percent local ownership for all organizations not domiciled in Kenya.

In the absence of tailored policies for small businesses – and encumbered by a burdensome tax environment – Kenya is likely to see companies that operate within its borders continue to headquarter themselves overseas. Many of the large, well-funded start-ups that were interviewed based their holding entities in Europe, Mauritius or the United States of America. During the current COVID-19 crisis this was particularly evident, as entrepreneurs who were legally domiciled abroad were eligible for emergency COVID-19 relief funds in Europe or the United States of America, but locally registered companies were not. This gave foreign companies a competitive advantage. With clearer benefits for investment in the ecosystem, and more consistent policies for start-ups, Kenya could begin to level the playing field for companies domiciled domestically.

### 3.3.2 Finance

Access to finance is a major concern for entrepreneurs. The Kenyan ecosystem faces several finance-related challenges for start-ups and entrepreneurs. First, during the early investment round for funding a start-up, seed investments rely on friends, family and other angel investors. However, Kenya lacks the wealth accumulation for family and friends to actively participate in seed rounds. AgTech is also yet to be proven as an attractive asset class with successful exits for investor liquidity in comparison to other industries. Even with these issues present in AgTech, Kenya is still within the fourth quartile of ecosystems on the continent in terms of venture capital weighted by GDP. A key challenge moving forward is to divert some of the current venture funding to the AgTech sector.

Venture funding is growing across the African continent. Total venture funding grew by 74 percent year-on-year, reaching USD 2.02 billion in 2019, while the number of deals increased by 52 percent year-on-year to 250 and the average deal size of USD 8.08 million grew by 14 percent. In 2020 this growth decreased, as COVID-19 impacted venture capital funding. Kenya accounted for roughly a quarter (USD 305 million on 52 deals) of the USD 1.43 billion in venture funding raised continent-wide in 2020 (Partech Africa Team, 2020). In 2019, Kenya received net inflows of foreign direct investment of USD 1.13 billion, proportional to 1.4 percent of GDP (World Bank, 2020a).



## Equity financing/institutional venture capital

The ecosystem is characterized by a mismatch between the investment needs of entrepreneurs and the investment volumes of institutional investors. First, institutional investors are reluctant to invest in the angel/seed investment stage, as they do not want to gamble on de-risking early-stage technologies. Second, while entrepreneurs are looking for Series A rounds in the hundreds of thousands, institutional investors don't view this sum (ticket size) as large enough. There have been examples outside of AgTech, but they tend to be the exception and not the norm within the ecosystem. Third, without the concomitant involvement of agro-industrials in investments or exits, it is hard for investors to determine how they will exit their investment. Most funding reported in the news are mega-rounds for successful start-ups and are not representative of the ecosystem, as most start-ups are looking for smaller rounds.

There are concerns that the Silicon Valley model of growth and market share does not work in the Silicon Savannah. The Kenyan ecosystem does not have the same enabling environment, and the growth at any cost model is less viable than the ability to turn a profit as a factor in fundraising. In addition, smart capital is not present. Such capital is very important for successful ventures, whereby investors bring deep technical knowledge and networks in AgTech together with their capital. Venture capital investment comes with a higher price point for AgTech, as it is priced as a riskier investment. Facing these challenges has forced entrepreneurs to adapt to the environment and find greater success approaching foundations and multinationals for corporate social responsibility (CSR) and environmental, social and corporate governance (ESG) investments.

## Debt funding: domestic credit to private sector

In 2019, total credit to agriculture was USD 794 million, accounting for 3.1 percent of total credit extended, while agriculture accounted for 34 percent of GDP (FAOSTAT, 2020). In comparison with the other two ecosystems analysed, Kenya falls between Uganda (13.6 percent) and Rwanda (1.5 percent) in terms of total credit extended to agriculture. Meanwhile, Kenya maintains a lending interest rate of 12.4 percent and a real interest rate of 3.4 percent (World Bank, 2020a).

Low levels of traditional debt funding in Kenya limit growth in the ecosystem. Typically, banks are hesitant to fund new initiatives due to a lack of collateral. It was found that Kenyan entrepreneurs with new ideas often look for funding from their local banks first, with whom they already have a financial relationship, and if declined, entrepreneurs typically choose not to proceed with their ideas.

Domestic debt funding often comes with barriers such as high interest rates and significant risk management requirements. Kenyan entrepreneurs found that the domestic credit sector is plagued by high interest rates and requirements such as overcollateralization and a 10-year financial history. Entrepreneurs reported being offered interest rates as high as 29 percent and being required to have a minimum volume of sales.



While central bank policies generally aim to strike a balance between low inflation with low interest rates to spur lending to new investments, the Central Bank of Kenya has maintained a base rate of approximately 9 percent to 10 percent. This compares to the Bank of Mauritius with a base rate of 1.9 percent. Kenya's high base rate forces constituent banks to lend at a rate above 10 percent.

### **Agro-industrial and corporate financing**

One of the pillars of any AgTech ecosystem is the participation of agro-industrial companies as stakeholders. They provide early-stage financing, research partnerships, business and technical knowledge of the market and consumers, and offer a ready market and/or exit opportunities for entrepreneurs. While Kenya does not suffer a shortage of multinationals and agro-industrial companies, the effect on the AgTech ecosystem is negligible. In fact, we found only one interviewee that received funding from a foreign multinational.

The reason for low corporate involvement is that agro-industrials see Africa as an underdeveloped market, which likely lacks scalability. The sentiment in the Kenyan ecosystem is that solutions do not have the addressable market to scale in Kenya and abroad, and this does not warrant investment or returns at scale. This reinforces the recommendation that entrepreneurs should focus on scalable technologies when developing solutions and that national governments should facilitate cross border interactions.

### **Donor funding and grants**

The largest source of angel/seed funding in the ecosystem is donor funding. Research grants have provided the early funding needed to de-risk early-stage technologies. The most successful example is M-Pesa, the ubiquitous mobile money wallet founded in Kenya. When Vodafone was developing M-Pesa in 2007, the six-month pilot phase was partly funded by the United Kingdom of Great Britain and Northern Ireland's Department of International Development (Centre for Public Impact, 2016).

Donor funding is proving to be invaluable across all rounds of funding. Entrepreneurs noted that their investment ideas get traction in the donor space, but very little attention from other funding sources. Start-ups are segmenting their business into projects that are funded by donor agencies to subsidize their operations. Donor agencies are providing funding, partnerships for research, and contracts and infrastructure with start-ups to expand across Eastern Africa. Start-ups highlighted that some have been approached by donor agencies to expand into countries that they did not yet view as viable.

Most large funded AgTech start-ups in the ecosystem have received donor financing, business development, capacity building and business support from donor agencies. While they no longer qualify for donor support and can sustain themselves in the market, they do engage intermittently in donor projects.



Donor funding also provides “runway to scale”, that is, sufficient finance to ensure growth to reach the scale that makes them competitive in the market. Start-ups require a certain number of users to hit critical mass, exploit network effects and start to realize economies of scale and scope. Only when M-Pesa hit 30 000 users did the company’s growth turn exponential and lead to its current success.

## Other funding outlets

### *Local vs foreign capital*

One aspect of the ecosystem is the predominance of foreign capital used to fund start-ups. The majority of start-up capital is from donor funding, research grants and institutional investors. Most bank lending often originates in Europe or the United States of America. Even for rounds funded by local investment funds, their limited partners tended to be impact investors or DFIs from abroad.

This poses the question of why private pools of local capital in pension funds and insurance companies are not engaged in the ecosystem, compared to more traditional investments such as real estate. Local investors are characterized as having little to no built-up capital, limited ticket sizes, a lack of smart capital, and limited time horizons for exiting investments. Given the lack of examples of recent successful exits or the lack of publicity on the potential returns in AgTech, it becomes a challenge to fundraise from this pool.

Quite often local investors do not consider Kenya to be a safe investment destination and would prefer to invest in more developed countries. This could also be due to the perception that the ecosystem is not mature enough, and while the market for local investors/serial entrepreneurs is developing, it lags behind other developing markets outside of the continent. In addition, local investors, due to high central bank base lending rates, are offered government bonds with annual interest rates of 9 percent to 13 percent and fixed deposits approaching 14 percent to 20 percent. With such high opportunity costs of capital, it becomes hard to justify investments in other asset classes, including AgTech.

One cannot examine an AgTech ecosystem without considering its competition, and those other sectors are all competing for limited capital. Other asset classes, such as FinTech, EdTech and InsurTech, are attracting interest, witnessing successful exits, and spawning more start-ups. Without question, the success in other sectors overshadows the potential in AgTech.

### *Impact investing*

There is growing interest by impact investors to complement donor funding. One entrepreneur noted that impact investors are the second largest active funders, behind donor money, by mostly utilizing convertible notes. We found two start-ups in the market linkages domain that raised the same ticket size from the same impact investor. It is worth noting that it is the impact investors that seek out the start-up rather than the other way around.



### *University support*

Tertiary institutions in Kenya are state-funded and have no mechanisms for endowments, providing very few avenues of funding. This means that university research and university incubators are underfunded with a limited capacity as to what they can achieve.

The Kenyan national government has regularly funded research through institutes; however, university incubators are also finding a warm welcome from county governments. One interviewee noted that their local county government and governor was willing and able to provide financing and support to local entrepreneurs.

### *Crowdfunding and diaspora remittances*

One of the objectives of this research was to try to discover hidden pools of capital that could be brought to bear to sustain the ecosystems. The two proposed pools were crowdfunding and diaspora remittances. In 2020, the Kenyan diaspora sent home USD 3.1 billion, accounting for 3.1 percent of GDP (World Bank, 2020a).

First, the concept of “harambee” has already codified the concept of crowdfunding in the ecosystem. Crowdfunding, with its smaller ticket sizes, appeals to a larger audience and when used effectively, can offer diversification for local investors. While start-ups like MChanga allow for mobile fundraising for social events, it is not a far pivot to use the same platform to fundraise for start-ups. The current hurdle, according to the Africa Crowdfunding Association and Financial Sector Development, is the lack of adequate regulations although conversations have begun with policymakers (FSDA and AlliedCrowds, 2016).

Second, a well-educated diaspora with disposable income provides a potential base of investors that could support the AgTech ecosystem. There is a need for formal structures and regulations to coordinate and codify this industry. The German Government and diaspora have developed the WIDU platform to provide financing to entrepreneurs from Africans in diaspora (WIDU, 2020). Financing ranges from EUR 500 to EUR 5 000, in which the German Government provides 50 percent, a member of the diaspora 25 percent, and the entrepreneur chipping in the remaining 25 percent. Given that the African diaspora in Germany sends home EUR 1.2 billion per year, this could be a huge source of untapped potential to increase start-up financing in AgTech.

### **3.3.3 Infrastructure**

Infrastructure is an important component for agriculture in Kenya since the majority of cash crops for export are grown by smallholders in rural areas. As a result of post-independence policies, development funds have invested in areas with abundant natural resources, good land quality and rainfall, that is, areas promising to yield the highest returns (Kang'ethe, 1994). This has left large swaths of the northern frontier counties sparsely populated and arid/semi-arid counties without adequate infrastructure. According to the Logistics Performance Index (1=low to 5=high) of 2018, Kenya is at a middling level of 2.81, while Uganda and



Rwanda score at 2.58 and 2.97, respectively (World Bank, 2021). The absence of high-quality infrastructure has been a sore point for entrepreneurs operating in the region.

### Reliability and access to electricity

One pillar that supports digital infrastructure is access to electricity. Kenya is plagued by unequal access to electricity, unreliable supply and high energy costs. Although 75 percent of the Kenyan population had access to electricity in 2019 (World Bank, 2020a), the cost of electricity averaged USD 21.5 cents per kilowatt hour, the highest in the region, while the cost in the United States of America averaged USD 10 cents per kilowatt hour (World Bank, 2020b). With a GNI per capita of USD 1 779, electricity costs would consume a disproportionate amount of income.

Average electricity costs in Kenya also outstrip the cost of electricity in developed economies. The cost of electricity by percent of income per capita places Kenya above average and in the first quartile compared to other ecosystems on the continent. This suggests that the issues of energy costs and ensuring a reliable supply must be addressed before the ecosystem can support a more efficient digital infrastructure. Some start-ups have designed their own solutions to use renewable energy or developed niche products that alleviate the need for energy.

### 3.3.4 Digital preparedness

#### Connectivity

On the face of it, mobile and internet connectivity in Kenya ranks above average on the African continent. However, the real challenge for start-ups is the quality of the connection and the types of mobile phones in use. The majority of internet connections only provide 2G connectivity, which limits many modern digital solutions; by contrast, 3G and 4G mobile services are usually limited to urban and peri-urban areas. Feedback from the practical interviews corroborates this finding. Interviewees even claimed that there is a digital divide primarily based on the level of disposable income between rural and urban areas.

In 2020, Kenya had 61.3 million mobile subscriptions, averaging 114 subscriptions per 100 people and ranking in the fourth quartile. Some 22.6 percent of the Kenyan population was using the internet in 2019, which ranks in the third quartile but just above average (World Bank, 2020a). When using the GSMA Mobile Connectivity Index Scores, Kenya ranks in the fourth quartile among African ecosystems, higher than all other ecosystems in the East African region. According to the International Telecommunication Union (ITU), the cost for a high consumption (140 minutes, 70 SMSs and 1.5 GB) subscription was USD 10.12, equivalent to 7.5 percent of GNI (with a 31 percent tax included). Regionally, the cost price for this basket was highest in Uganda at USD 26.83, while the highest tax charged was in Kenya at 31 percent (ITU, 2020).

Feature phones are the dominant choice for average farmers. Smartphone adoption is reported to be very low in rural areas. This likely reflects lower disposable income in rural areas and



higher costs for smartphone data bundles, reinforcing the dominance of feature phones over smartphones.

Without sufficient reliability of available connections, start-ups are forced to design and adapt their solutions to a multitude of situations or abandon initial business models altogether. For instance, one start-up with the plan to build trust in the value chain through a blockchain application had to move to an alternative approach after realising that available connectivity could not support their blockchain-based solution. Another had to re-design their solution around intermittent connectivity by storing data locally and uploading once the device comes online. More generally, the lack of advanced communication technologies is likely to cause longer-term application and implementation costs. For instance, it requires hardwired multi-functionality in many AgTech solutions, which in turn increases capital costs in the long run.

### *Digital infrastructure*

The interviews also revealed that the cost to acquire and operate digital infrastructure in Kenya was high and there was little-to-no after-sale service. As a consequence, the majority of the mega-funded start-ups have chosen to build and host their digital infrastructure on engineering teams either in Europe or in the United States of America.

### **3.3.5 Entrepreneurial culture**

Entrepreneurial culture can be defined as an environment that encourages participants to take risks, innovate, create and extract value. A rudimentary metric to measure entrepreneurship is to examine the rate of self-employment. Given Kenya's large informal sector, many self-employed are represented in Kenya by the informal economy. In 2014, the National Bureau of Statistics estimated that the informal sector represented 82.7 percent of total employment, with 95 percent of businesses and entrepreneurs represented in this sector. Of the 799 700 jobs created in 2014, 700 000 were created in the informal sector (World Bank, 2016).

On average from 2010–2014, the informal sector in Kenya accounted for 30–40 percent of GDP (IMF, 2017). The large size of the informal sector has a direct impact on employment. In general, Kenya's small formal sector is limited by its inability to absorb workers. Given the limited ability of the Kenyan Government to provide income assistance, individuals are forced into self-employment. Slightly more than half of Kenyans are self-employed at 51.8 percent; these form the basis for more than 44 000 new enterprises, or about 1.5 new enterprises for every 1 000 inhabitants (15–64 years) (World Bank, 2020a).



## Demographics and perception of entrepreneurship

Entrepreneurial culture in Kenya's digital AgTech sector is marked by a distinct demographic pattern. Most AgTech entrepreneurs are in the age bracket of 25–34 years. The average age of a Kenyan farmer is as high as 60 years, while the average farm size is as small as 1.2 hectares (Dutch Ministry of Agriculture, 2019). In general, older farmers tend to be less open to AgTech and overall, more risk averse; at the same time, they are often the decision makers for innovation and investments.

### *Attitudes toward entrepreneurial risk*

This part of the study examined social and cultural attitudes favouring entrepreneurship. The findings show that younger entrepreneurs are more open to innovation and riskier investments. One explanatory factor is that youth unemployment (20 percent for 20–29 years) is high compared to overall employment, enticing younger entrepreneurs to identify new income and employment opportunities.

### *Embracing/co-opting disruptive ideas*

Another goal of this study was to gauge the openness of an AgTech ecosystem to new, potentially disruptive solutions. It found that solutions that offer incremental change are generally welcomed and embraced, while truly disruptive solutions are often rejected. For instance, the introduction of tea-harvesting machines as a disruptive technology was largely rejected, potentially causing or augmenting rural unemployment. The spectre of introducing these machines resulted in initial labour disputes, making their immediate introduction impossible. Increasingly tight international competition and eroding profit margins forced producers to adopt the new technology, which was phased in gradually rather than adopted in one big technological leap. As of 2010, a growing number of tea-pickers were gradually replaced by harvesting machines, with multinational companies taking the lead in the process (Nation, 2020). The transition remained incremental in nature, with workers being replaced in the course of natural attrition and planned retirement.

## Partnerships

The level of partnerships between enterprises is another important element for entrepreneurial culture. While individual enterprises can innovate and create value, for an ecosystem to reach critical mass, there needs to be cluster density to enable enterprises to leverage each other's strengths, create institutional memory, develop future talent, and prevent the duplication of costs. We set out to examine if established industries have shown an interest in partnering with innovators as a source of financing, as research partners, or by offering exit opportunities.

Despite some examples of partnerships with the government, other start-ups, and partnering with agricultural suppliers as a sales channel, the interviews found that partnering was the exception and not the rule. In particular, there is a need for more coordination to prevent the



duplication of costs. An example of cost duplication would be in farmer registration drives. Since the national government has yet to develop a unified farmer registration database, it has been left to each start-up to individually and repetitively register the same cohorts of farmers as a competitive advantage. Arifu has engaged 600 000 farmers, Juhudi Kilimo has registered 60 000, FarmDrive has registered 53 000, Tulaa has registered 15 000, HelloTractor has registered 13 000 and AgroCares has registered 10 000 (Kim *et al.*, 2020). While these registers are competitive advantages for the start-ups that built them, it introduces a barrier to entry for newly established start-ups.

### *Availability of incubators/accelerators*

For an ecosystem to be self-sustaining, there is a need for support infrastructure for innovation and business development in the form of incubators, accelerators, tech hubs, working spaces and mentors. Kenya dominates in the region, where most hubs are located, particularly in Nairobi. An Association of Country-Wide Hubs was set up to aggregate hubs in rural and second tier towns to facilitate entrepreneurship outside Nairobi.

Despite the high volume of incubators within the country, there are concerns about the quality of support they are offering to start-ups and their impact on the AgTech ecosystem. There were a number of key concerns highlighted during the interviews by stakeholders involved with incubators. One entrepreneur cautioned that incubators in Nairobi concentrate on software development, which is a need that is already being met. Another critiqued that the hubs run as a 'conveyor belt', with courses taught by consultants rather than being taught by serial entrepreneurs as mentors. Some of the issues mentioned that directly impact the ability of AgTech to benefit from the incubator system were that incubators/accelerators have not developed AgTech expertise, services specific to AgTech, or even a more general understanding of agriculture. The high failure rate for AgTech start-ups was suspected to be due to AgTech technologies being built for a larger market rather than technology being built to address agricultural market needs.

### *Serial entrepreneurs/mentors*

A strong ecosystem needs an organized entrepreneurial community anchored by serial entrepreneurs to provide leadership and mentoring. Every ecosystem has its nuances, and it helps start-ups to have guidance from experienced entrepreneurs that have worked in that ecosystem. Without this support and access to institutional knowledge, it would require entrepreneurs to waste capital repeating the same mistakes instead of learning from each other.

Unfortunately, the Kenyan ecosystem was not found to have strong entrepreneurial knowledge-sharing. It was reported that successful entrepreneurs are not sharing their successes or mentoring the next crop of entrepreneurs. In addition, it was noted that the premier incubators in Nairobi were taught by consultants that provided a theoretical background and were unable to help demystify the Kenyan business environment.



### 3.3.6 Human capital

Regionally, Kenya has one of the most developed human capital pools. Adult literacy ranks in the fourth quartile on the continent with a 2018 literacy rate of 81.5 percent of the 15 and older segment of the population (World Bank, 2020a). In the same year, the Kenyan Government spent 5.3 percent of their GDP on education and 19.1 percent by budget allocation. There is a gender disparity in education and in the labour force in Kenya. According to the Gender Inequality Report of 2019, Kenya ranked 126 out of 162 countries. Women are underrepresented in Parliament, with just 23.3 percent of all seats. In the 25 and older segment, 29.8 percent of females have some secondary school education compared to 37.3 percent of males. In the 15 and older segment, females have a labour force participation rate of 63.6 percent versus 69.1 percent for males (UNDP, 2019).

#### Future workforce

Another characteristic of a self-sustaining ecosystem is its ability to train the next generation of specialists, innovators and entrepreneurs. The shared sentiment is that the education system is not up-to-date and thus is not a reliable pillar for future workforce development. Attention should be paid to developing university curricula to meet future demand in food and agriculture that will drive economic growth, food security and sustainability. Too often it was reported that graduates did not have sufficient technical skills in their area of expertise. There needs to be an alignment between the strategic direction of the agricultural economy, the country's future human capital needs and university curricula/training to fulfil these needs with graduates.

#### *Talent pool and quality of graduate curricula*

Recruiting talent is the second biggest challenge in the Kenyan ecosystem after access to finance. A self-sustaining ecosystem is characterized by a growing pool of domain experts that are up to date on methodologies that can compete on a global level. In Kenya, 11.5 percent of total gross enrolment in education graduated from tertiary institutions (World Bank, 2020a). However, Kenya lacks an adequate talent pool for AgTech start-ups.

The quality of the curriculum was a key concern for AgTech development in Kenya. It was reported that the premier agricultural university had only two classes on computerization and digitization in agriculture. Information technology appears to not be part of the curriculum and there was also no laboratory work for agriculture in some local universities, thereby limiting research and necessitating graduates to pursue this skill set abroad. In addition, a university survey at the premier agricultural university found that 74 percent of students did not have an interest in farming after graduation.

The current practice is for start-ups to train graduates in the specific skill set for designing, operating and monitoring their AgTech solutions. Start-ups have become creative in filtering



for talent, introducing measures ranging from recruiting the top 25 percent of applicants on a standardized test to running rigorous design competitions and hiring interns from the winning cohort. Overall, greater efforts are required to improve the talent pool for AgTech start-ups.

### Foreign human capital

With the current human capital deficit in the ecosystem, start-ups have pivoted to either recruiting foreign talent or basing their workforce abroad. Most mega-funded start-ups in the ecosystem have a mix of local and foreign human capital, with an all-Kenyan run operation being the exception.

Naturally, the Kenyan workforce, like in other African countries, has developed skill sets and expertise in specific technical areas. For example, South Africa is known to have a deeper domain expertise in fields like actuarial science, while Kenya has strong software engineering talent. It was reported that Kenya is weak in product architecture and design. Start-ups reported having to rely on IT infrastructure and workforce from abroad because they were unable to find local talent with the adequate skill sets in Kenya. It was reported that senior technical roles like data science and Chief Technology Officer (CTO) positions are often unavailable in the domestic workforce, while junior and mid-level roles are more often available. Efforts were reported to build up the technology talent on the continent by firms like Andela, which is an American company with African operational campuses.

Despite these challenges with workforce development, Kenya is still viewed as the most developed human capital resource in the region. Start-ups in other ecosystems in the region look to Kenya to fill more advanced openings within their company that cannot be filled elsewhere.

## 3.4 Region-specific problems

### *Smallholder problem*

One recurring hurdle in Kenya's ecosystem are smallholder farmers and their limited disposable income, making entrepreneurs doubt Kenya's viability as a market. While some entrepreneurs expressed concern about the affordability of AgTech solutions for smallholder farmers and even chose not to address this market segment, one should be mindful that not all solutions fit the needs of all farmers. Even some low-tech solutions can be effective and accessible to help smallholder farmers address their challenges, as proven by M-Pesa.

In addition, start-ups have found ways to ameliorate their situations by innovating around the smallholder problem. Noticing the disposable income gap, start-ups have convinced players in the agriculture value chain to price in value-add products as opposed to charging the end consumer. Another solution is to deal with farmers in the aggregate, choosing to conduct



business with cooperatives and farming groups as opposed to individuals. For example, a county government advocated and organized for smallholders to form farmer cooperatives to pool landholding to operations above 300 acres to make mechanization cheaper and scalable.

### *Legal entities*

Another trend in the ecosystem has been the preponderance of start-ups with holding companies domiciled abroad. Mauritius, the Netherlands and Switzerland have been mentioned repeatedly as favoured destinations because of their double-tax treaties. The myriad of reasons ranged from lower tax regimes, research grants, subsidies, human capital requirements, technology infrastructure requirements, ease of doing business and intellectual property laws. In some cases, it happened that the founder of the start-up came from that country and was more comfortable with its legal and corporate environment.

This trend was highlighted during the research, especially with larger, more successful start-ups. Reasons for basing start-ups abroad included the need for stronger legal and justice systems that protect intellectual property, cheaper and more transparent litigation, low tax rates, and a more favourable regulatory environment. One entrepreneur recounted how their legal domicile set up a small business COVID-19 fund for emergency zero percent loans, for up to 10 percent of a company's past five years of revenue, which was disbursed within 30 minutes. These resources were not available to start-ups incorporated within Kenya.

## 3.5 Scorecard

Kenya ranks the highest among the three ecosystems analysed in East Africa, at 68.6. The ranking was driven in part by high scores in human capital, entrepreneurial culture and digital preparedness. These scores corroborated the insight given during the interview process. Most entrepreneurs mentioned that there was capable, but limited talent available in the marketplace, as others in the region look to Kenya as a source of potential talent when building out their start-ups. Digital preparedness has been a strength for Kenya compared to other markets. The growth of mobile money and market access solutions in the ecosystem has facilitated the growth and adoption of new digital technologies. Due to the success of the ecosystem with other industry verticals, such as FinTech, the entrepreneurial culture for start-ups to succeed, for example in incubators, has been well-developed in the ecosystem.

The ecosystem's overall score is limited by scores in public policy and finance. The score for public policy is in the middle range for the region, but there is room for improvement when it comes to the government's involvement in the AgTech space. Implementing a strategy around start-ups, reducing the burdens to starting a new business and increasing the government's involvement in the Ag-Tech space would help to increase the score in the short term, while long-term issues such as transparency need to be addressed. Financing for start-ups does exist



within the ecosystem, but not enough of it is reaching the agriculture sector based on the size of the market. More incentives to entice domestic investors' participation in the sector, as well as increased coordination with donor agencies (who have been crucial to success in the early stages of growth), would help to increase the financial score of the ecosystem.

**Table 3** | Kenya's scores, overall and by dimension

Weighted Factors	Weight (percent)	Score
Public Policy	30.0	18.4
Finance	25.0	14.0
Infrastructure	20.0	16.4
Digital Preparedness	15.0	12.4
Human Capital	5.0	3.8
Entrepreneurial Culture	5.0	3.7
	<b>Total</b>	<b>68.6</b>





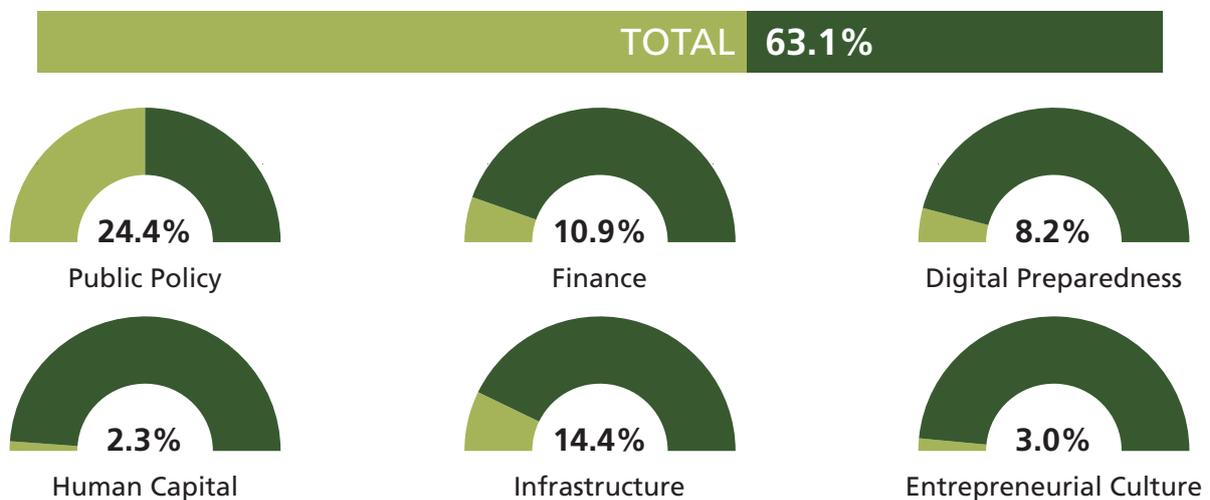
# Rwanda

## 4.1. Introduction

Rwanda has continued to gain international traction as a start-up hub on the continent. There has been a rise in incubators and accelerator programmes as well as a rise in inbound international investment flows. Despite this recent attention to the start-up environment within the ecosystem, the institutions that set out to foster business development tend to move slowly and do not necessarily benefit their target audiences.

The Rwandan government has set out to provide regulations and enforce them to a standard seen in most developed start-up ecosystems. These regulations do not always promote the growth of business – sometimes they act as an impediment – with some companies leaving to start their business elsewhere. However, businesses that are familiar with the system have been found to navigate it with success. Part of the government’s attention to detail has resulted in Rwanda having better statistics and organization in agriculture than some of its neighbours. This can be used to eliminate barriers that many start-ups face in neighbouring countries, such as not having access to agricultural databases.

**Figure 3 |** Rwanda’s Payne scorecard valuation



Source: Authors.

## 4.2 Recommendations

Rwanda has shown initiative and a propensity for fostering an entrepreneurial and innovation-friendly environment. Rwanda could expand these efforts by pursuing the following recommendations.

- 1) The Rwandan government is moving towards a well-regulated economy, which will provide long-term benefits. Multinational organizations and investors appreciate doing business in a stable, transparent and predictable ecosystem, where they can learn how to operate with ease. These regulations have made setting up a business easier in Rwanda compared to other ecosystems and have helped reduce corruption. The Rwandan government can make these regulations more effective by bringing in industry knowledge to better understand policy implications. The government can limit pain points that some entrepreneurs face under new regulations, by slowing down the process of implementing regulations and understanding if the policy objectives and outcomes are aligned.
- 2) Due to the small size of the domestic market, Rwanda must focus on scalable technologies with cross-boundary potential. Companies with successful proofs of concept must be able to scale their products and services also outside of Rwanda. Through government facilitation, investors can be reassured that innovations developed in Rwanda have a future throughout the East African region and beyond. This can be accomplished by eliminating as many barriers to exit as possible and by creating as many soft-landing spots as possible in other regions, through international agreements and investments.
- 3) In the immediate future, Rwanda should continue to make it easier for foreign human capital to be deployed within the country. Rwanda has focused on specialized industries to develop its economy and most of these industries require a workforce with skills that are not readily available in the country. Increasing the ability to recruit around the region will help companies expand beyond the limited workforce in Rwanda. In addition to having an adequate supply of human capital, this method would allow for Rwanda to continue to operate as a launch pad for companies to scale out into the region. The additional network and experience with regional ecosystems would help Rwanda scale its technologies outside of the country.

Foreign human capital should remain a temporary fix as the ecosystem continues to develop talent from within. In order to do so, an updated curriculum for both students within universities and for entrepreneurs trying to develop their own businesses should be included. The universities should also continue to scale the partnerships they have built with outside academic institutions in Europe and the United States of America. These outside partnerships can help train the current cohort of future entrepreneurs, while the universities develop their own programmes to support entrepreneurship. In addition, the government, together with the private sector and donor agencies, should help entrepreneurs improve their business development skills, such as creating business plans, which would help de-risk potential investments. Public-private partnerships can help the ecosystem develop at a faster rate, while also strengthening institutions within Rwanda.



## 4.3 Key findings

### 4.3.1 Public policy

#### National policy

Rwandan national policy performs among the best on the African continent, ranking in the fourth quartile for political stability and fiscal policy in 2020. The rule of law indicator also ranks Rwanda in the fourth quartile among other African countries and higher than Kenya and Uganda (World Bank, 2020c). In 2019, Rwanda averaged 5.1 percent budget expenditure on agriculture, while agriculture accounted for 24 percent of GDP. When budget expenditure on agriculture is ranked relative to other African countries, Rwanda ranked in the first quartile, indicating the agriculture sector's considerable contribution to the national economy relative to government spending.

#### *Tax policy*

Rwanda is considered to have a business-friendly tax regime that is stable and predictable. Rwanda scored a 38 on the World Bank's index of business-friendly tax regulations, where 1 equals the most friendly, while Kenya and Uganda scored 92 and 94, respectively (World Bank, 2020b). In 2019, Rwanda's corporate tax rate was 25.7 percent, which is above the continent's average of 20 percent yet between Kenya (30 percent) and Uganda (22.3 percent) (World Bank, 2020a). Despite a generally positive perspective of the tax regime, entrepreneurs reported that there are too many different types of taxes for businesses, which lead to an overall increased tax burden. Entrepreneurs noted that their preference was to comply with payroll and income-related taxes only.

#### Business environment

Rwanda's overall business environment is among the best performing on the African continent. For example, when reviewing the World Bank's World Development Indicators, Rwanda is a top performer on the African continent for business regulatory environment, regulatory quality, strength of legal rights and the number of days to start a business (4 days) (World Bank, 2020a). When scored by the cost of start-up business procedures as a proportion of gross national income in 2018, Rwanda and Kenya were comparable at 24.7 percent and 22.4 percent, ranking in the third quartile and second quartile relative to other African countries, while Uganda scored 40.5 percent. Rwanda's high-ranking business environment can be attributed to the government's heavy involvement in the economy and its efforts to attract companies to the country. However, heavy government involvement also has the potential to stifle business activities, particularly for companies unfamiliar with the ecosystem.

A high degree of regulation characterizes Rwanda's business environment. These regulations have had both a positive impact and a negative impact on the ability to do business in the



country. A strength of Rwanda's business environment is the government's willingness to work with the private sector and non-governmental organizations. Start-ups have been proactive in engaging with the government to formulate policy and noted that the government was quick to change course on failing initiatives. The cooperation has ranged from the following: investors working with the Rwanda Finance Corporation on tax codes and other policies, establishing Rwanda as an onshore finance base to rival Mauritius, entrepreneurs working with the Rwandan Food and Drug Administration, and streamlining import and export customs procedures for food products. On every government level, stakeholders reported their interaction with the government was positive, and they were able to have a common vision and common goals.

### **Agricultural policy**

The government has launched various initiatives to build momentum within the agriculture sector. This includes a structured push in the coffee sector, orienting it towards premium specialty coffee. Coupled with export financing, clear export procedures and favourable air freight, the sector has mushroomed and provided the government with a working blueprint. The Crop Land Consolidation Policy is looking to, step by step, consolidate, mechanize and then irrigate smallholder farms through cooperatives. The policy has been paralleled with encouraging farm clusters to specialize in certain crops at the district level, making it easier for the government to provide extension services. The Rwanda Youth in Agribusiness Forum was set up as a forum to encourage youth participation within the sector.

### **Start-up policy**

Start-up policy in Rwanda is generally favourable for entrepreneurs. The government has set up a sandbox policy that allows start-ups to proceed with innovation without regulations and requires permits and looks to formalize the start-up in the future once regulatory frameworks are established. In addition, the Ministry of Information and Communications Technology is setting up workshops to support the formulation of a Start-up Act, looking to draft the Start-up Act to formalize and catalyse the ecosystem.

#### **4.3.2 Finance**

In 2020, Rwanda received USD 11.6 million in venture funding across four deals and raised the sixth highest amount of funds, out of USD 1.42 billion raised across the continent, (Partech Africa Team, 2020). Overall, venture funding is growing across the African continent, despite short-term disruptions from COVID-19. Total venture funding grew by 74 percent year-on-year, reaching USD 2.02 billion in 2019, while the number of deals increased by 52 percent year-on-year to 250 and the average deal size of USD 8.08 million grew by 14 percent in 2019. In 2019, Rwanda received net inflows of foreign direct investment of USD 3.8 billion, proportional to 3.7 percent of GDP (World Bank, 2020a).



## Equity financing/institutional venture capital

Equity financing in the Rwandan ecosystem is found to have several funding gaps, which hinder entrepreneurs' ability to develop businesses. The seed investment round is often funded by friends and family to take an idea to the beginning of a business. The friends and family approach to seed investing is handicapped by the fact that Rwandans have not developed the multi-generational wealth and asset base to be able to participate as seed investors. This financing gap is often filled by donor agencies providing research grants, competition prizes, early-stage investments, and partnership in projects. In addition, Rwanda is faced with a middle gap of financing typically between early capital rounds (pre-seed and seed) and later rounds, which are generally referred to as Series C and Series D rounds. This is not due to a lack of investors with willing capital, but rather due to funds looking to invest USD 250 000 –USD 1 million and companies are generally unable to absorb this quantity of funds. It was also noted that entrepreneurs have not encountered venture investors working specifically in the AgTech sector.

The government, having noted the disparities, has made it a priority to develop their financial sector to rival Mauritius as an onshore base for investment funds. An institutional investor reported that start-ups and investment funds chose to base themselves out of Europe, Mauritius or the United States of America because it is easier to fundraise equity or borrow at favourable terms in these domiciles, than in Rwanda. The government is working closely with investors to develop regulations to encapsulate their finance industry. Their model aims to catalyse their ecosystem and cash in on innovation and investment across the subcontinent.

## Debt funding: domestic credit to the private sector

In 2019, total credit to agriculture was USD 31.3 million, accounting for 1.45 percent of total credit extended, while agriculture accounted for 29 percent of GDP. Across the ecosystems, Rwanda has the lowest share of credit to agriculture in total credit, following Kenya (3.1 percent) and Uganda (13.6 percent) (FAOSTAT, 2020). From an interest rate perspective, the IMF reported in 2020 that Rwanda has a Central Bank policy rate of 4.5 percent, while lending rates of 16.3 percent were reported in 2020 (IMF, 2020). Average consumer price inflation averaged 9.9 percent in 2020, while deposit rates averaged 7.6 percent (World Bank, 2020a). This means not only high real saving rates but even higher real corporate capital costs.

The domestic credit market is difficult to access for entrepreneurs in AgTech. Local borrowing rates were reported to be as high as 25 percent, which impacted business models, forcing either higher prices or lower margins. Collateral in the form of a land security or an immovable structural asset is often required by local credit facilities. Given the restrictions around domestic credit, it is common for start-ups to look abroad for funding.



Domestic credit is structured to be purely collateral-based and geared towards the streamlined cash crop export market of tea and coffee. Land in Rwanda is registered with the government making collateral lending seamless, although this might not be the case in other ecosystems. As a result, start-ups focused outside of these sub-sectors can be excluded. There have been reports that even written offtake agreements were insufficient to obtain domestic credit from the bank or the government. The lack of asset-backed financing is a main challenge within the domestic credit sector, with the rent rate for assets almost double the rate of ownership. More recently, commercial banks have begun to lend to agriculture and AgTech-based start-ups, however, only after the government became a guarantor for the sector.

### **Agro-industrial and corporate financing**

The participation of agro-industrials and corporates in the ecosystem is nascent. There are reports of some individual initiatives by corporate lenders to develop strategic partnerships with start-ups to support them financially, develop go-to-market plans and assist them with technical expertise. However, overall, there is very little interaction between AgTech and agro-industrials and multinationals in Rwanda.

### **Donor funding and grants**

One parallel across the ecosystems in Eastern Africa is the predominance of donor funding as the primary source of capital for de-risking early-stage technologies. Donor funding for start-ups has come in the form of direct grants, competition prizes, subsidized loans, investments and tax subsidies. Donors have also provided ecosystem support in the form of capacity building, market linkages, infrastructure support and building value chains.

Donor agencies are taking multiple approaches, offering grants, taking equity and funding debt. Although most grants do not exceed USD 50 000, donors occasionally give grants of up to USD 250 000, in order to bridge the gap between seed and institutional rounds. Donors have also taken the long view, not only providing one-time funding but helping start-ups develop their prototypes, funding their trips to competitions, providing business training and other capacity development programmes, and aiding with procurement of electronic inputs. Donors are also partnering with incubators to help design training programmes, sponsor their implementation, and cover the cost for participants.

### **Other funding outlets**

#### *Local vs foreign capital*

Local investors and local capital are absent from the Rwandan ecosystem. The majority of the capital supporting the ecosystem comes from abroad. Foreign capital is seen to favour foreign start-up founders, because they are often better known than local entrepreneurs who may lack



international venture capital experience. Local investors' reluctance to invest in the agriculture sector is largely because the sector is perceived as a high-risk investment. The sector is unproven as a viable investment opportunity that provides investors with attractive returns.

### *Impact investing*

Impact investing is emerging within the ecosystem as a source of finance. While some entrepreneurs reported engaging with impact investors, it was also noted that impact investing is not well understood by some start-ups in Rwanda. Given that impact investors are almost all internationally based, there is a need to help local entrepreneurs understand impact investor requirements.

### *University support*

Entrepreneurs are increasingly collaborating with universities abroad to fill knowledge gaps and build expertise in areas that are not supported by local universities. Entrepreneurs mentioned a number of examples, including working with Wageningen University on animal protein research and taking online courses from Kobe Institute of Technology in Japan to get up to speed on the latest in IoT (Internet of Things) sensors. A local incubator has also partnered with the African Institute on Mathematical Studies to put together an innovation programme around machine learning and big data for development. The Rwandan and Israeli governments are offering scholarships for students to study agronomy in Israel, with a few students coming back to establish start-ups.

In addition, it was found that there is a resource gap between public and private universities. Public universities have less resources geared towards research and innovation, while the private universities like Carnegie Mellon have the resources and curriculum to host incubators and make-a-space. Carnegie Mellon University also hosts a weekly AgTech forum, which serves as a brainstorming and discussion session. Despite limited resources, some public universities are still focusing on research and entrepreneurship. The University of Rwanda is partnering with local incubators to develop a curriculum on entrepreneurial skills. The University of Rwanda, College of Agriculture is working on improving seeds for local crops like Irish potato, sweet potato, and beans.

### *Government support*

The Rwandan government has by far the most developed support system for technology ecosystems in the region. Having established a mandate to move the Rwandan economy away from 60 percent agriculture dependence to a more service-based economy, the government aims to create an ecosystem that supports innovation and business development. Given the small size of the market and disposable income of Rwandan farmers, the strategy is to support local start-ups to develop solutions that can be transplanted across Eastern Africa.



For example, the government provides financing to the ecosystem through several initiatives. The Business Development Fund provides support for enterprises by offering a credit guarantee of up to 75 percent of required financing under specific criteria, with the entrepreneur offering 25 percent. Other consolidated funds under the Business Development Fund include: the SME Guarantee Fund, the Agricultural Guarantee Fund, the Rural Investment Facility, the Women's Guarantee Fund, and the Retrenched Civil Servants Guarantee Fund. The Rwanda Development Bank also serves as the local bank and conduit for a USD 10 million debt fund set up by donors offering loans at subsidized rates of 10 percent. Lastly, the government set up a COVID-19 relief fund that provides USD 4 billion in zero-rated matching grants for importers and exporters.

The Rwandan government has also created several government initiatives to build the export economy and strengthen domestic agri-food production. The government has invested in positioning Rwandan coffee as a premium specialty coffee, with start-ups mushrooming to provide certification and traceability. On the exports front, the National Agricultural and Exports Board provides storage facilities for exports, field expertise and export financing through the Rwanda Development Bank. One exporter reported receiving subsidized air freight rates through the government.

A distinct advantage of the Rwandan ecosystem is a well-organized and supported farmer cooperative movement. The government has launched initiatives to consolidate land between neighbouring farmers, encouraging them to grow the same crops and join farming groups and cooperatives. With consolidation, it becomes easier for the government to offer specialized agronomy services and support through the cooperatives. The well-organized cooperative movement makes it viable to exploit economies of scale and work with start-ups. In addition, smallholder farmers are registered with the Ministry of Agriculture and local governments, making it easy to set up pilots and work with farmers.

### *Crowdfunding and diaspora remittances*

According to the World Bank in 2020, the Rwandan diaspora sent home USD 241 million, proportional to 2.3 percent of GDP. There have yet to be any formal efforts to tap this channel as a source of capital for enterprises in the ecosystem (World Bank, 2020a).

### **4.3.3 Infrastructure**

With room for improvement, Rwanda was found to have the second-highest infrastructure score in the scorecard among the three countries analysed. When compared to other countries on the continent, Rwanda ranked above average for the logistics performance index, burden of customs, and the cost of electricity, while performing below average for access to electricity and access to water. The interviewed start-ups found it to be easy to leverage government infrastructure. The smaller size of the country perhaps contributed to Rwanda's less pronounced rural–urban divide compared to neighbouring ecosystems, making it easier to build infrastructure throughout the country.



## Reliability and access to electricity

In 2019, the cost of electricity in Rwanda averaged the lowest cost of electricity among the three counties analysed, at USD 13.9 cents per kilowatt hour, while the United States of America averaged USD 10 cents per kilowatt hour (World Bank, 2020b). With a GNI per capita of USD 775, electricity costs consume a disproportionate amount of income. According to the World Development Indicators in 2020, 37.8 percent of the Rwandan population had access to electricity (World Bank, 2020a).

## Water access

According to the latest available World Development Indicators data, in 2020, 60.4 percent of the population had basic drinking water services. In urban areas, 83.0 percent of the population had basic drinking water services, while in rural areas only 55.6 percent of the population had basic drinking water services (World Bank, 2020a).

### 4.3.4 Digital preparedness

#### Connectivity

Connectivity was not considered a major challenge for business development. Connectivity is considered adequate in almost all areas, with few exceptions. For instance, while mobile connectivity is regarded as good in general, dead zones occur due to the country's hilly geography rather than because of infrastructure limitations.

However, Rwanda ranks below average for mobile connectivity and around average for internet usage. In 2019, Rwanda had 9.6 million mobile subscriptions, averaging 76.5 subscriptions per 100 people and ranking in the second quartile. Some 21.8 percent of the Rwandan population was using the internet in 2019, which ranks in the third quartile but just above average (World Bank, 2020a). According to the ITU, the cost for a high consumption (140 minutes, 70 SMSs and 1.5 GB) subscription was USD 6.3, proportionally 9.6 percent of GNI (with a 28 percent tax included). Regionally, the cost price for this basket was highest in Uganda at USD 26.8, while the highest tax charged was 31 percent in Kenya (ITU, 2020).

#### *Digital infrastructure*

Rwanda has a designated team with the Central Bank and the Ministry of Information and Communications Technology (ICT) to push for digital transformation with a target of 55 percent of GDP to be transacted through digital payments in 2024. The Rwandan government has in place the ICT Sector Strategic Plan, a blueprint focused on digital literacy, broadband for all and developing infrastructure across second and third tier cities and towns (MINICT, 2017). The president also established the Connecting Rwanda initiative with the goal of distributing 100 000 smartphones to Rwandan citizens in 2020, in order to catalyse the digital ecosystem (MININFRA, 2020).



### 4.3.5 Human capital

Rwanda's above average literacy rates and low government expenditures on education highlight the potential of the Rwandan workforce, yet there is a need for greater focus on educational training initiatives to develop domestic talent. Adult literacy ranks in the third quartile on the continent, with a 2018 literacy rate of 73.2 percent of the 15 years and above segment of the population (World Bank, 2020a). In the same year, the Rwandan government spent 3.1 percent of their GDP on education and 10.8 percent by budget allocation. According to the Gender Inequality Report of 2019, Rwanda ranked 92 out of 162 countries. Women are well represented in Parliament at 55.7 percent of seats. In the 25 and older segment, 10.9 percent of females have some secondary school education compared to 15.8 percent of males. In the 15 and older segment, females have a labour force participation rate of 83.9 percent versus 83.4 percent for males.

#### Foreign human capital

Rwanda was found to have a workforce that lacks the skill sets needed for AgTech development. Many start-ups must look across Rwanda's borders, to other ecosystems like Kenya and Nigeria, in order to attract the requisite talent. Entrepreneurs reported they often recruit talent from East Africa, South Africa, the United States of America and Europe.

#### Future workforce

Interestingly with a budding tech ecosystem, the Rwandan ecosystem does not have a large talent pool with experienced technologists and serial entrepreneurs. Given the low supply, salaries tend to be high for qualified candidates, putting a financial burden on start-ups.

Local curricula need to be updated to provide a range of skills in business development, agricultural sciences and in agricultural technologies. Some partnerships are underway to help bridge the shortcomings of local universities. Foreign universities, such as Carnegie Mellon, have set up campuses in Rwanda and are looking to fill this gap. The Rwandan government has arranged agronomy scholarships with Israel, and graduates of these scholarships have been reported to be coming back and establishing start-ups in Rwanda.

### 4.3.6 Entrepreneurial culture

In 2019, 68.1 percent of Rwandans were self-employed, creating about 10 635 new enterprises, at about 1.5 new enterprises per 1 000 people (15–64 years) (World Bank, 2020a). Informal employment as a percentage of non-agricultural jobs was 68.9 percent in 2019, signifying that the informal sector remains the predominant employer for many Rwandans. Outside of emigration, entrepreneurship remains the most viable means to provide a livelihood to ordinary Rwandans.



## Attitudes toward entrepreneurial risk

Rwanda has taken a different approach to entrepreneurship, with the government taking a state-sponsored, top-down approach to create a generation of entrepreneurs. Rwanda suffers from the same problems as other ecosystems, namely that the formal sector is unable to absorb the 200 000 youth joining the labour force every year.

The Rwandan government is trying to address the problem of a large informal sector by supporting entrepreneurship. Rwanda is a special case because the government is far ahead of the private sector in regulations and looking for ways to spur the economy. As a result, Rwanda has instituted entrepreneurship classes in its curriculum, funded incubators, provided grants and equity to start-ups, developed infrastructure and improved the ease-of-doing-business ranking.

Given a GDP of USD 10.2 billion and a GDP per capita of USD 801 in 2019 (World Bank, 2020a), the Rwandan ecosystem might be too small to support start-ups looking for mega-million rounds without scaling to other ecosystems. Recognizing this, Rwanda has decided to pitch itself as a proof-of-concept market and to develop itself as an on-shore financial haven to rival Mauritius. The Rwandan government is looking not only to catalyse their ecosystem, but to become a launching pad and base for start-ups looking to expand across the continent. The government can also position their ecosystem as a soft-landing spot for start-ups from outside the continent, looking to establish a footprint.

### *Embracing/co-opting disruptive ideas*

The general consensus among start-ups is that human relationships are the priority when it comes to introducing farmers to their innovation or helping to service their channel. Before a start-up can begin working with a cooperative, they are required to develop a relationship with the local government and cooperative, given that the citizenry trust the government but are suspicious of private industry. Farmers often are only comfortable working with vetted solutions or through an introduction from the government.

## Partnerships

Stakeholders within the Rwandan ecosystem have sported a willingness and ability to leverage each other's strengths and combine synergies across industries. Partnerships are not limited to entrepreneurs and the Rwandan government showing an aptitude for embracing public-private partnerships in delivering government services. Government subsidies for smallholder farmers are currently run through a strategic partnership. Partnerships with farming cooperatives have become the go-to plan when seeking to validate a concept or pilot a product.



*Availability of incubators/accelerators*

One feature creating positive momentum is the multitude of incubators and accelerators within the ecosystem. Most are set up to be sector-agnostic, hosting co-working spaces, community events, workshops, boot camps, hackathons, ideathons, innovation challenges and pitch competitions. The range of courses provided includes design thinking, prototype development, coaching, basic business skills, pitching, investment readiness and investor introductions. Entrepreneurs have not limited themselves to programmes hosted locally but have also participated in programmes hosted abroad. Start-ups in Rwanda have become a magnet for remote acceleration programmes from Ghana, boot camps from South Africa, regional hackathons and incubators based in Europe. One issue that was noted is that there are no AgTech-specific incubators, and most incubator/accelerator programmes are taught by consultants offering general courses but lacking in AgTech-specific offerings.

*Serial entrepreneurs/mentors*

For an ecosystem to be self-sustaining, there needs to be a reliable cycle of serial entrepreneurs to become the next cohort of investors. These entrepreneurs, having mastered the ecosystem, become an institutional knowledge bank and serve as mentors for the next generation of entrepreneurs. It was widely reported that Rwanda lacks mentors, serial entrepreneurs and experts with or without AgTech experience that would form a support system for the ecosystem.

**4.4 Scorecard**

For an emerging market, Rwanda had a strong score, ranking second out of the analysed countries in East Africa. The government initiatives to strengthen the public sector have worked to strengthen the score in public policy, resulting in the highest ranking. There is room for improvement when it comes to regulations around the start-up ecosystem, such as a clear start-up policy, as well as with more government expenditure being directed to the agriculture sector. When weighted by GDP, Rwanda also scores highly in finance. In order to develop into a true financial hub for the region, interest and deposit rates would need to be more regionally competitive.

Limited access to electricity and a lower Logistics Performance Index score held the infrastructure score back, but this is in line with other ecosystems across the region. The digital preparedness score was also in line with other ecosystems, with the exception of Kenya which is in a stronger position with Rwanda's Mobile Connectivity Index score still being in the emerging stage and a low internet penetration percentage.



**Table 4** | Rwanda's scores, overall and by dimension

Weighted Factors	Weight (percent)	Score
Public policy	30.0	24.4
Finance	25.0	10.9
Infrastructure	20.0	14.4
Digital preparedness	15.0	8.2
Human capital	5.0	2.3
Entrepreneurial culture	5.0	3.0
<b>Total</b>		<b>63.1</b>





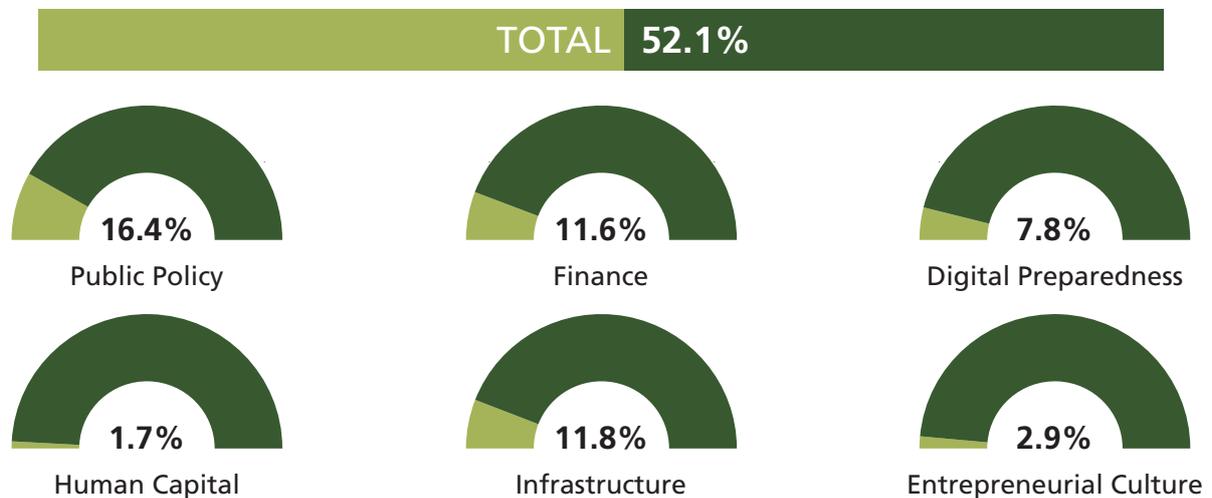
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# Uganda

## 5.1 Introduction

Uganda's large agricultural sector, its central location in the region and developing market status offer entrepreneurs the opportunity to scale their AgTech products. Uganda's market provides a regional sandbox for well-funded start-ups to demonstrate mass scalability and to move to neighbouring markets, such as Kenya. Agriculture is an important pillar of Uganda's economy, accounting for 73 percent of the country's employment. The importance of agriculture in Uganda creates an opportunity to introduce and scale new agriculture technologies. At the same time, Uganda's agriculture is less digitized compared to its neighbours, creating the potential for more impactful technologies. While offering greater potential, a lower level of digitalization also makes scaling innovations within the ecosystem more challenging. Start-ups can seize this opportunity by offering breakthrough solutions for a large user base that uses low technology digital infrastructure. With expanded involvement from donor agencies, government initiatives and the private sector, Uganda can harness the opportunity to facilitate AgTech development and entrepreneurship for a more efficient and productive agricultural sector.

**Figure 4 |** Uganda's Payne scorecard valuation



Source: Authors.

## 5.2 Recommendations

Uganda presents an interesting case for AgTech development, where the existing initiatives help promote innovation overall, but they seem to lack focus and structure. The assessment findings highlight a number of actionable steps and recommendations that can complement and focus the existing efforts.

- 1) There is the need for greater access to early and mid-level financing for business development and growth. The development of funding initiatives through a combination of government, donor agencies and private sector programmes would provide critical resources to the AgTech ecosystem. Uganda's development status makes these programmes even more critical than in some neighbouring ecosystems as capital availability is low in Uganda.
- 2) It is important to focus efforts on the adoption of new digital technologies by farmers. Mobile money has laid the foundation, but in comparison to neighbouring countries, added efforts are needed to ensure that farmers can adopt these technologies. A concentrated effort on simple but useful technologies, such as market access platforms, would put farmers in a position to adopt more advanced technologies in the future. In addition, by digitizing the informal economy, the formal and the informal economies can better link to each other and reap synergies. For instance, high taxes are hindering consumers in moving from feature phones to smartphones. Greater deregulation and enhanced competition could help reduce consumer costs, opening access to more farmers.
- 3) Universities within Uganda are key stakeholders that will help fuel the future success of the ecosystem. Though there are some initiatives within the universities, their involvement is lacking in comparison to other ecosystems around the world. A greater role for universities could build momentum in expanding the size, sophistication and versatility of the current AgTech ecosystem. Importantly, an updated and expanded curriculum on agricultural technologies and entrepreneurship would help strengthen the skill sets of Uganda's workforce to adapt to an evolving agriculture sector. Improving technology literacy through the tertiary education systems would provide another element of support to the ecosystem. Universities can partner with private enterprises, international universities, incubators and donor agencies to build out these programmes without having to divert resources necessary for their survival.

Specifically, venture investing could form a valuable addition to existing curricula. Having a young ecosystem and brief history to study, entrepreneurs have yet to understand the basic tenets of establishing and successfully operating a start-up. They need to understand concepts such as equity capitalization tables, employee-sponsored ownership plans, earnouts, down rounds or convertible debts among other venture capital principles. Currently, no one in the ecosystem is filling the role of providing this expertise, a role that is traditionally filled by universities. As the ecosystem continues to grow, there is opportunity for mentors, donor agencies and incubators to fill this gap to make sure that emerging entrepreneurs are familiar with investment practices.

- 4) Some of the top funded companies within Uganda receive their seed investment after getting a referral from a more established entrepreneur or a commercial client. These investments were based on personal relationships, which are not scalable. Traditional venture capital investors have a smaller track record in Uganda compared to neighbouring ecosystems, such as Kenya. To have successful investments in the future it is important that these investors are familiar with the market and its opportunities, and are comfortable making the investments. In order to do this, there needs to be an effort to develop more formal investment channels for entrepreneurs. Building upon the success of organizations



such as Venture Capital for Africa (VC4A) in the country and updating visibility through international organizations, such as Crunchbase and Angelist, would provide a start.

- 5) Government initiatives in Uganda, such as the Uganda Development Bank, have been an important source of support for start-ups. Further developing these initiatives, together with the help of donor agencies and the private sector, will be critical to the future success of the ecosystem. Uganda's development status makes these programmes even more critical than in some neighbouring ecosystems as Ugandans have less capital available in comparison to competing ecosystems.

## 5.3 Key findings

### 5.3.1 Public policy

#### National policy and business environment

Uganda has shown a higher relative budgetary commitment to agriculture as well as setting funds aside in designated kitties to invest in AgTech. Having recognized its relative lag in policy, Uganda is working hard to catch up on the policy difference that placed it at a competitive disadvantage. Coupled with its advantage in arable land, Uganda is taking steps to be a serious challenger in AgTech.

According to available data, Uganda spent 3.32 percent of its budget on agriculture in 2019, exceeding the respective shares of Rwanda (5.07 percent) and Kenya (1.84 percent). Uganda's regulatory quality reached a score of 37 percent, compared to 36 percent in Kenya and 58 percent in Rwanda. In terms of commitment to the rule of law, Uganda attained a middling position with a score of 42.79 percent, topping Kenya at 31.25 percent, but trailing Rwanda at 56.73 percent. Based on 2019 data, Uganda also underperformed in terms of the cost of start-up business procedures as a proportion of GNI, reaching a score of 40.5 percent compared to Kenya and Rwanda with scores of 22.4 percent and 24.7 percent, respectively. Similarly, Uganda ranked 24th in terms of days required to start a business, while Kenya ranked 23rd and Rwanda ranked 4th.

These challenges notwithstanding, the past few years have seen notable efforts to improve Uganda's regulatory environment. Importantly, the government has been successful in consolidating the registration process for new ventures and in moving government services online, inter alia by the adoption of an electronic invoicing system. The individual interviews corroborated these efforts overall. It was noted that it is now easier to open a business in Uganda, even if the formal documentation process remains difficult. Interviewees also underlined the growing ease of doing business in general, noting for instance that it costs merely USD 200 to register a new business. Similarly, it was felt that compliance with government policies and engaging with government agencies has become easier, even if it still requires specialized knowledge and/or specialized personnel.



There are also several initiatives that aim to ease the establishment and development of AgTech start-ups. Importantly, the Uganda Development Bank now fully embraces AgTech in its lending activities and there is a National Social Security Fund, Hi-Innovator Fund, which aims to support start-ups through equity investments. In addition, the government is forcing incumbent financial players to share credit scoring data with non-traditional players to reduce data access problems around financial services.

Uganda's regulatory environment for the finance industry could overall be described as "laissez faire". Interviewees generally welcomed the relatively low level of governmental control and oversight, which was deemed to essentially offset the otherwise "complex and opaque" constraints arising from Uganda's legal system. Despite reduced government controls and because of the opaque legal system, foreign investors and funds often continue to register their businesses in foreign jurisdictions with more mature legal systems, avoiding complex local regulations and regulatory capture.

Local regulatory issues are aggravated by the high base lending rate set by Uganda's central bank (currently around 15 percent a year), which makes corporate lending expensive and can exclude start-ups from access to credit and, as a consequence, from non-dilutive capital.

Almost unanimously, interviewees bemoaned a considerable degree of risk aversion on the side of policymakers. At an average age of 68, policymakers were deemed to lack the openness to innovation and the entrepreneurial mindset that is necessary to create a thriving AgTech ecosystem. These concerns were highlighted throughout the interviews.

### *Intellectual property*

According to the World Development Indicators (2019), Uganda paid nearly USD 33 million for intellectual property (IP) rights, while it received only USD 16 million in IP payments, resulting in a net outflow of USD 16.9 million for the use of IP (World Bank, 2020a).

Local entrepreneurs and IP owners took different approaches to protecting their competitive advantage. Some innovators submitted patents to the World Intellectual Property Organization (WIPO) and were generally critical of registering and enforcing patents locally. Others chose to register their trademarks and product names with the Uganda Registration Board but remained worried about protecting their products and brands.

### *Tax policy*

In 2019, Uganda charged a 22.3 percent tax on corporate profits, the lowest in the region. By comparison, Kenya charged 30 percent and Rwanda 25.7 percent (World Bank, 2020a). This leaves Uganda with a rank of 92 on an index of business-friendly tax regulations, compared to Rwanda at 38 and Kenya at 94 (World Bank, 2020b).



Uganda provides investment incentives to foreign investors, offering a 10-year tax holiday for investments above USD 2 million and free land allocations. While attractive to foreign investors, this has created an implicit disincentive for local investors who complain that they cannot compete without the same incentives.

### **Start-up policy**

Feedback from the interviews on start-up legislation suggests that the government has yet to formulate a cogent overall legal framework to support the start-up ecosystem. In the absence of such a framework, many start-ups are forced to rely on the general laws and regulations which were drafted for the operation of all businesses regardless of their size or maturity. Interviewees identified the lack of dedicated/specialized bills and policies as a key reason for the high failure rate of start-ups.

### **5.3.2 Finance**

#### *Key findings*

Compared with Kenya, Uganda received a smaller number of investment deals and a lower overall amount of venture capital. Compared to Rwanda, it received a smaller amount of funding, but reached a comparable number of deals. According to Partech Partners in 2020, out of USD 1.42 billion raised continent-wide in 2020, Uganda received USD 11.3 million in venture funding within the establishment of four major deals (Partech Africa Team, 2020). In 2019, total venture funding (USD 2.02 billion) grew by 74 percent across the continent, while the number of deals (currently 250 per year) increased by 52 percent and the average deal size rose by 14 percent. In 2019, Uganda received net inflows of foreign direct investment of USD 1.2 billion, equivalent to 3.6 percent of GDP (World Bank, 2020a).

According to the IMF, Uganda has a Central Bank policy rate of 7 percent (IMF, 2020). Average lending rates, however, reached nearly 20 percent in 2018. Average consumer price inflation was at 3.8 percent (IMF, 2020), while deposit rates averaged 8.65 percent (World Bank, 2020a). This means not only high real saving rates but even higher real corporate capital costs.

#### **Equity vs debt financing/institutional venture capital**

In Uganda, debt financing plays a greater role than equity financing, notably for large infrastructure investments. For instance, out of USD 55 million invested in 190 deals for capital-intensive investments (off-grid energy and mobility), USD 40 million was debt-financed. It should be noted that these credits were denominated in United States of America dollars and available at single digit rates. However, a possible depreciation of the national currency may offset or even exceed the nominal interest rate advantage.



An important factor weighing on the development of start-ups is an early-stage financing gap. Early-stage start-ups without funding from angel investors, friends and family or other sources of finance (grants) are facing a “valley of financing death” from the very start of their businesses, according to one of the sources interviewed. Even with access to early-stage finance (pre-seed and seed rounds), start-ups are often confronted with gaps in their Series A expansions, even for overall envelopes not exceeding USD 500 000.<sup>4</sup> The interviews also revealed that these early financing gaps are wider in Uganda than in Kenya or Rwanda.

The interviews further revealed that there are diverging interests between financial investors and strategic investors. Local gaps in human capital and expertise, and the need to expand to other markets, supports strategic investment. Strategic investors, however, often require exclusivity, and full operational oversight and control.

### **Debt funding: domestic credit to private sector**

In 2019, credit to agriculture reached a total of USD 583 million, accounting for 13.6 percent of total credit, while agriculture accounted for as much as 21.7 percent of GDP. At 13.6 percent, Uganda attained the highest share of agriculture in total credit, followed by Kenya at 3.12 percent and Rwanda at 1.46 percent (FAOSTAT, 2020).

According to the World Development Indicators (2019), Uganda maintains a lending interest rate of nearly 20 percent and a real interest rate of almost 15 percent (World Bank, 2020a). At such high real interest rates, domestic credit has become a rare source of capital for start-ups, even at a more mature stage of financing. Other sources of loan financing are even more expensive with microfinance loans reaching 120 percent per year. There are also stark differences across sectors. Construction and real estate, for instance, can access loans at 5 percent, reflecting lower risks and the superior collaterals associated with such investments.

There is a consensus among AgTech investors that expensive credits heavily weigh on profit margins and force entrepreneurs either to pass high credit costs on to users through higher product prices or to borrow abroad in United States of America dollars and at lower rates; the latter, however, comes at the risk of higher repayment costs as the domestic currency tends to depreciate against the dollar.

### **Agro-industrial and corporate financing**

Interviewees also mentioned that they have approached local agro-industrial companies for investment and/or research partnerships. These efforts were met with mixed success. While

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<sup>4</sup> Investors in the Ugandan ecosystem are leaning towards perpetual holding entities as opposed to limited life funds. The consensus is that limited time horizons push the investor to look for quick returns at the expense of the business. These entities have less urge to exit, can raise equity and debt and have the flexibility to allow their management to deploy capital.



agro-industrials are partnering in innovation and incubation, they are rarely skilled and experienced as venture investors.

Some start-ups have forged business ties to foreign agro-industrials looking for options to transfer technologies into promising local markets. For instance, foreign investors with supply capacity and delivery networks for inputs to small-scale farmers expanded into the national market by partnering with a brewery with established market linkages to smallholder farmers.

### **Donor funding/grants**

Donor funding was repeatedly mentioned as an apt and desired source of capital to de-risk early-stage technologies. Most Ugandan start-ups lack the funds from seed/angel investors, a gap that donor funding can help fill. Indeed, donor funding comes in the form of prizes, direct grants, partnerships in commercial projects, anonymous donations and subsidized training programmes. Additionally, there are tailor-made donor programmes catering to special groups of entrepreneurs, including women. In several instances, gender-specific support was reported. Such gender-specific donor funding was either in cash or in kind, the latter often as United States of America dollar branding courses or management training.

DFIs are also active in the Ugandan ecosystem. They generally act as investors, either supporting local ventures directly or through venture capital funds. In addition to local grant funding, DFIs have financed the expansion of national businesses into other markets, however only in a few occasions thus far.

### **Other funding outlets**

#### *Local vs foreign capital*

The interviews also corroborate the fact that foreign investors and foreign funding dominate the Ugandan start-up world. This reflects not only lower capital costs, but also a general lack of local experience in investing in high-risk ventures. Where there was local interest, local AgTech investors often demanded too much equity, failing to value the target companies correctly. Finally, local investors are “conservative” in their investment behaviour, focusing on known technologies and tangible assets rather than fancy disruptive technologies and intangible assets, including software and brands. This rather conservative investment attitude has given rise to new approaches to mobilize capital, including the emergence of angel networks organized by the Ugandan diaspora.

#### *University support*

Universities are gradually emerging as important players in the national innovation system. Above all, there is the University of Makerere, which is hosting an incubator. It also acts as a knowledge and resource hub, developing research partnerships with foreign institutions



and entrepreneurs. The university has been active in numerous start-ups (focusing on GPS innovations, food science and nutritional content), helping develop and refine technologies or providing initial ancillary services.

### *Government support*

University efforts are actively supported by the government, channelling funds to various universities to spur entrepreneurship among graduates. For instance, the Ministry of Science, Technology and Innovation has set up a President Innovation Fund, which is administered through the University of Makerere. In addition, the government is diversifying its pension funds by investing limited amounts of the National Social Security Fund into start-ups. The National Social Security Fund, Hi-Innovator Fund, is providing grants of up to USD 20 000 and/or convertible debt to start-ups. Similarly, the National Initiative Support programme provides grants to start-ups through the Ministry of Information and Communications Technology in the range of USD 10 000 to USD 150 000. However, there was the general feedback that the criteria for government support remains opaque.

### *Crowdfunding*

The concept of crowdfunding is well known and established for donations. Extending the concept to fund small ventures would be possible in principle, but this would require adjusting the existing regulatory framework for charity fundraising. Again, this calls for a comprehensive regulatory framework.

## 5.3.3 Infrastructure

The bulky nature of agricultural goods and the often long distances between producers, processors and final consumers make infrastructure a key factor in the competitiveness of every agricultural system. At the same time, investments in infrastructure are expensive, gaps are difficult to fill and, while options to leapfrog infrastructure investments exist, they have generally been limited.

Infrastructure challenges and shortages abound in Uganda. According to the Logistics Performance Index (1=low to 5=high) of 2018, Uganda scored lowest at 2.6, compared to Kenya at 2.8 and Rwanda at 3.0 (World Bank, 2002a). What is more, Uganda's current infrastructure investments favour urban areas. Road networks in rural areas remain of poor quality and are generally underdeveloped, raising costs for all rural entrepreneurs both to deliver outputs and to source inputs. This has enticed AgTech entrepreneurs to target urban dwellers as their client base, where they benefit from superior transportation roads and more efficient logistics networks.



## Reliability and access to electricity

Access to electricity remains a challenge. According to the World Development Indicators (2020), only 41 percent of the Ugandan population has access to electricity (World Bank, 2002a) and availability is intermittent, which makes planning and production difficult. Uganda also suffers from high electricity costs, at least compared to developed economies, which makes it difficult for many energy-intensive enterprises to become price competitive. In 2019, the costs per kilowatt hour averaged around USD 17.1 cents, compared to the United States of America with USD 10 cents per kilowatt hour (World Bank, 2020). At a GNI of USD 756, these high prices suggest precariously low affordability levels. High costs, compromised availability, and limited affordability of electricity have a direct effect on the use of technology and the selection of products to be produced, including in AgTech. These factors also help explain why only 16 percent of Ugandans have a smartphone (GSMA, 2019). Many Ugandans still use feature phones, which have lower electricity consumption than smartphones. This weighs directly on the adoption rates of advanced AgTech solutions.

Not only is electricity expensive and, where available, unreliable, but there are also extra costs to connect to the grid. These extra costs are particularly high in remote rural areas, where the grid is limited in its reach. Farmers and entrepreneurs who want to connect to the grid have to pay for their own transformer, wiring, inputs, and labour for the final connection. At the same time, early connectors are not allowed to pass on the high connection costs to other users, who connect later and benefit from the infrastructure (transformers, etc.) paid for by the early adopters/pioneers. These high costs to connect to the grid have also given rise to an increasingly decentralized power system. Particularly in remote areas with high connection costs, solar panels to provide power to farmers and entrepreneurs are becoming increasingly popular.

## Water access

According to the World Development Indicators (2020), only 55.85 percent of the Ugandan population has access to basic drinking water services (World Bank, 2002a). Just like for electricity, the reliability of supplies also remains limited, particularly in rural areas. While 79 percent of the population have access to basic drinking water services in urban areas, only 48 percent have the same options in rural areas (World Bank, 2002a). With low penetration rates and limited reliability, many AgTech companies in need of clean water have resorted to drilling their own boreholes to meet their water needs.



### 5.3.4 Digital preparedness

#### Connectivity

According to the World Development Indicators, Uganda had 25.4 million mobile subscriptions in 2020, equivalent to 60.5 subscriptions per 100 inhabitants. Some 23.7 percent of the population was using the internet (World Bank, 2002a). The cost for a high consumption (140 minutes, 70 SMSs and 1.5 GB) subscription was USD 26.8, proportionally 51.93 percent of GNI with an included tax of 18 percent. Regionally, the price for this basket was the highest in Uganda at USD 26.8, while the highest tax charged was in Kenya at 31 percent (ITU, 2020).

There are large differences in connectivity and internet speeds between Uganda's urban and rural areas. With rural areas as natural homes of AgTech companies, this is arguably the most important infrastructure constraint faced by the industry. To overcome these constraints, some start-ups have designed their solutions so that they can work both online and offline. Others have resorted to foreign suppliers and vendors for equipment and connectivity to run their operations. Such workarounds add to the cost of production and service delivery.

While internet and mobile phone penetration rates are high, Uganda also has the highest data costs and the slowest internet speeds. On top of the costs charged by service providers, users are faced with taxes on data services and over-the-top (OTT) fees to access social media, creating high overall costs for connectivity.

#### *Digital infrastructure*

In addition to the workarounds outlined above, many AgTech companies have opted to move to cloud-based solutions using foreign service providers such as LimeWire, GCP, AWS and Microsoft. These solutions give them guaranteed uptime and allow them to continuously innovate at lower costs.

#### *Mobile money systems*

Mature mobile money systems have become an indispensable prerequisite to penetrate modern service markets, including in rural Africa. They also provide the basis for start-ups to bundle subscriptions and invoices and reduce friction around financial services.

### 5.3.5 Human capital

In 2015, Uganda spent 2.5 percent of GDP on education, equivalent to 10.9 percent by the overall budget. The country has an adult literacy rate of 76.5 percent (World Bank, 2020a). In contrast, Kenya has a literacy rate of 81.5 percent, and spends 5.3 percent of GDP and 19 percent of its budget on education, while Rwanda has a literacy rate of 73.2 percent, and spends 3.1 percent of GDP and 10.8 percent of its budget (World Bank, 2020a).



In terms of gender inequality, Uganda ranked 131 out of 162 countries. Women are also underrepresented in Parliament where they occupy 34.9 percent of the seats. Some 27.5 percent of women at age 25 and above have some secondary school education compared to 35.1 percent of men. At age 15 and older, the labour force participation rate of women is 67 percent compared to 73.9 percent for men (UNDP, 2019).

### Foreign human capital

Skilled and specialized labour from foreign countries has been crucial in bridging local skills gaps in Uganda. Expatriates have not only provided skills and services, but have also imported ideas, spotted opportunities and helped address gaps in the ecosystem.

Expatriates also funded the two top connectivity/mobility start-ups operating in the Ugandan ecosystem. It was generally acknowledged that Ugandan specialists were a few years behind colleagues from Kenya, for example, and that they were more reserved and less creative. Not only do funders come from abroad, they typically also fill top positions with foreign experts.

### Future workforce

Filling skills gaps with foreign experts is generally expensive and subject to considerable staff fluctuations. To overcome these challenges, start-ups have begun to train their own staff. Their better-trained staff are however in high demand, poached away by competitors or demanding higher salaries. This in turn provides a strong disincentive to those companies who upgrade the skill sets of their staff at their own expense; it calls for a systemwide and sustainable solution.

Universities could, at least in principle, play an important role in addressing the skills gap. In practice however, their graduate curricula are often outdated,<sup>5</sup> seldom catering to the demands of a vibrant AgTech ecosystem with a voracious appetite for savvy specialists. Upgrading university curricula and training the local trainers is arguably the most immediate and sustainable solution. The skills gap also opens an opportunity for international organizations (including FAO), private companies and non-governmental organizations (for example, with foreign mentors to train local staff) to offer relevant curricula and training programmes. Investing in skills for an AgTech industry that helps produce food more efficiently could be regarded as a worthwhile investment in local food security.

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<sup>5</sup> Despite the University of Makerere's participation in the AgTech ecosystem, concerns were voiced regarding the quality of their curriculum with similar concerns observed across all three ecosystems. It was repeatedly noted that existing curricula entirely failed to cover venture investing and capital markets. Similarly, it was felt that entrepreneurs need to be educated in writing project proposals for grant funding and, again, that universities failed to provide these skills.



### 5.3.6 Entrepreneurial culture

#### Attitudes toward entrepreneurial risk

According to the Uganda Bureau of Statistics, the informal sector accounts for over 50 percent of Uganda's GDP and for more than 80 percent of its labour force. With the formal sector only able to employ 20 percent of the workforce, the prospect of becoming self-employed or a formal entrepreneur becomes a natural alternative. Data from the World Bank shows that the rate of self-employment for Ugandans in 2020 was about 78 percent; these self-employed persons helped create 18 862 new enterprises, equal to nearly one new enterprise per 1 000 people (15-64 years) (World Bank, 2020a).

#### Partnership

Partnership between the government, the private sector at large, and start-ups in particular can help an ecosystem to grow and reach a critical mass. These partnerships exist in Uganda and the interview responses obtained in this study clearly suggest that they are generally successful. Many start-ups are partnering and finding ways to leverage each other's synergies and competitive advantages. For instance, instead of building a delivery network, there are growing partnerships with organizations that already have an existing network. Another encouraging trend is that start-ups partner across borders and ecosystems. Similarly, investors mentioned that they sign memoranda of understanding with incubators to crowdsource innovative start-ups. Finally, there is an emerging trend of start-ups partnering with government agencies. For instance, the National Agricultural Research Organization helps develop agricultural inputs specific to Uganda.

#### *Availability of incubators/accelerators*

The government, through the Ministry of Information and Communications Technology and National Guidance, has built its own government incubation centre. There are currently about 30 incubators and/or accelerators in Uganda. There is also evidence that their number is rapidly growing, albeit largely outside of AgTech and agriculture. Although there are no specialized AgTech incubators/accelerators, most of them (an estimated 80 percent) cover and address the needs of AgTech companies.

Firms also have access to international incubators and accelerators. Incubators from the United States of America and Thailand were explicitly mentioned, as providing mentoring and courses to start-ups on how to pitch their businesses, assess market potential, budget expenses and market their products. In addition, there are active fellowship programmes with China, an incubator programme from Germany and an accelerator programme from the United Kingdom of Great Britain and Northern Ireland.



## 5.4 Scorecard

Within the East African ecosystem, Uganda ranks third with a total score of 52.1; overall, this is comparable with the average of its peers in East Africa. Uganda attained its highest individual score for its infrastructure endowment, but findings from interviews and the literature suggest that electricity prices remain high and services unreliable.

While Uganda's overall score is comparable with the East African average, there is ample room to develop and improve its ecosystem. Quick wins include improvements in public policy, addressing remaining issues in the regulatory business environment, improving legal rights and overall regulatory transparency for businesses. It also includes stepped up initiatives by Uganda Development Bank in helping to de-risk some of the most promising start-ups, notably those providing strong positive externalities (social or environmental). Moreover, the government could help with a clear start-up policy to provide additional tax incentives, training facilities and, overall, more regulatory clarity for start-ups.

The amount of private sector funding from international investors, domestic investors and agro-industrials is low compared to the country's GDP. Aligning incentives for participation in AgTech among domestic investors and providing clarity around investment policies for international investors would help to attract more private capital and, of course, increase this score.

Digital preparedness in Uganda is in line with many other ecosystems in the region but still low compared to Kenya, the regional leader. Low mobile subscription is a notable constraint.

Human capital and entrepreneurial culture are also comparable with the other regional ecosystems. They could be raised by upgrading university curricula, educating entrepreneurs, promoting incubators, and fostering a community of collaboration.

**Table 5 |** Uganda's scores, overall and by dimension

Weighted Factors	Weight (percent)	Score
Public policy	30.0	16.4
Finance	25.0	11.6
Infrastructure	20.0	11.8
Digital preparedness	15.0	7.8
Human cCapital	5.0	1.7
Entrepreneurial culture	5.0	2.9
<b>Total</b>		<b>52.1</b>





## AgTech ecosystems in the context of COVID-19 pandemic

The analysis of these ecosystems took place during the COVID-19 pandemic and the effects of the pandemic were mentioned during the interviews that we conducted. During our conversations several common trends emerged across the region.

Government lockdowns across the region had provided high levels of growth for market access applications and delivery applications. This occurred primarily in cities, as wealthier citizens in the ecosystem turned to delivery services, in order to receive the products they normally would purchase at the market. These applications have struggled to maintain this success as government lockdowns have ended and customers have returned to their normal buying habits. One interviewee in the software-as-a-service market noted that new business had slowed, with sales involving high upfront capital expenditure due to human interaction and in-person pitches.

Offshore start-ups were able to gain a competitive advantage in the marketplace. Being based outside developed markets allowed them to access COVID-19 relief funds that were not available to domestic organizations. Low interest loans and other subsidies helped these start-ups to increase their available resources for future expansion. Venture capital funds have delayed sourcing for new investments during the pandemic, instead choosing to financially support their portfolio companies through the pandemic.

The governments of the region diverted much of their attention to slowing the spread of the virus across their respective countries. This in turn halted plans for initiatives that were focused on the development of the ecosystems. An example of this was the rollout of the Connecting Rwanda initiative to distribute 100 000 smartphones that was intended to digitize the farmer base throughout the country (MININFRA, 2020). The Ministry of Information and Communications Technology had only managed to distribute 3 000 smartphones due to COVID-19 restrictions.

Mobile money has become an unintended benefactor of the pandemic, as governments such as Kenya have moved to encourage mobile payments and a cashless economy to mitigate exchanging pathogens through the handling of hard currency (MININFRA, 2020). The Central Bank of Kenya doubled the daily transaction limit for mobile money to 300 000 shillings

(USD 3 000) from 140 000 shillings (USD 1 400) and waived transaction fees for transfers under 1 000 shillings (USD 10) (MININFRA, 2020). The Central Bank also mandated that banks and financial service companies remove charges for customer transfers between mobile wallets and bank accounts. While mobile money volumes are projected to increase, Safaricom, the dominant telecom provider, has forecast a 7 percent decrease in annual revenue from the removal of charges from peer-to-peer transfers. ●

## References

**Centre for Public Impact.** 2016. Mobile Currency in Kenya: The M-Pesa. Centre for Public Impact (CPI). <https://www.centreforpublicimpact.org/case-study/m-currency-in-kenya/>.

**Dutch Ministry of Agriculture.** 2019. Opportunities and Challenges for ICT Companies in Agriculture in Kenya. Ministerie van Landbouw, Natuur en Voedselkwaliteit. <https://www.agroberichtenbuitenland.nl/landeninformatie/kenia/achtergrond/studies--factsheets/opportunities-and-challenges-for-ict-companies-in-agriculture-in-kenya>.

**FAOSTAT.** 2020. FAOSTAT database. <http://www.fao.org/faostat/en/#data>.

**FSDA and AlliedCrowds.** 2016. East Africa Crowdfunding Landscape Study: Reducing Poverty Through Financial Sector Development. Financial Sector Deepening Africa and AlliedCrowds. [https://www.fsdafrica.org/wp-content/uploads/2019/08/16-11-07-Crowdfunding\\_Report-final-1-compressed.pdf](https://www.fsdafrica.org/wp-content/uploads/2019/08/16-11-07-Crowdfunding_Report-final-1-compressed.pdf).

**IMF.** 2017. Regional Economic Outlook: Sub-Saharan Africa: Restarting the Growth Engine. IMF. <https://www.imf.org/en/Publications/REO/SSA/Issues/2017/05/03/sreo0517>.

**IMF.** 2020. IMF Database. IMF. <https://data.imf.org/?sk=388dfa60-1d26-4ade-b505-a05a558d9a42>.

**ITU.** 2020. Measuring Digital Development ICT Price Trends. ITU. [https://www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2019/ITU\\_ICTPriceTrends\\_2019.pdf](https://www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2019/ITU_ICTPriceTrends_2019.pdf).

**Kim, J., Shah, P., Gaskell, J. C., Prasann, A. & Luthra, A.** 2020. Scaling Up Disruptive Agricultural Technologies in Africa. International Development in Focus. World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/33961> License: CC BY 3.0 IGO.

**KNBS.** 2020. Quarterly Labour Force Report. Kenya National Bureau of Statistics (KNBS). <https://www.knbs.or.ke/?wpdmpro=quarterly-labour-force-report-quarter-2-2020>.

**MININFRA.** 2020. Ministry of Infrastructure and Agencies Support Connect Rwanda Challenge with 1,159 Smartphones. Ministry of Infrastructure (MININFRA). <https://www.mininfra.gov.rw/updates/news-details/ministry-of-infrastructure-and-agencies-support-connect-rwanda-challenge-with-1159-smartphones>.

**MINICT.** 2017. ICT Sector Strategic Plan ‘Towards Digital Enabled Economy.’ Republic of Rwanda Ministry of Information and Communications Technology. [https://www.minict.gov.rw/fileadmin/user\\_upload/minict\\_user\\_upload/Documents/Policies/ICT\\_SECTOR\\_PLAN\\_18-24\\_.pdf](https://www.minict.gov.rw/fileadmin/user_upload/minict_user_upload/Documents/Policies/ICT_SECTOR_PLAN_18-24_.pdf).



**Nation.** 2020. KTDA Sparks Row with Tea-Plucking Kit Tender. Nation.

<https://nation.africa/kenya/business/ktda-sparks-row-with-tea-plucking-kit-tender-165226>.

**Partech Africa Team.** 2020. 2019 Africa Tech Venture Capital Report. Partech Partners.

<https://partechpartners.com/news/2019-partech-africa-report-here-and-its-best-yet-us-2-02-b-raised/>.

**Reuters.** 2010. 80,000 Kenyan Tea Workers Strike over New Technology. Reuters,

<https://www.reuters.com/article/ozatp-kenya-tea-strike-20101018-idAFJ0E69H0FI20101018>.

**The Kenyan Gazette.** 2020. The Startup Bill. The Kenyan Gazette Supplement No 163.

[http://kenyalaw.org/kenya\\_gazette/](http://kenyalaw.org/kenya_gazette/).

**UNDP.** 2019. Gender Inequality Index (GII). UNDP.

<http://hdr.undp.org/en/content/gender-inequality-index-gii>.

**WIDU.** 2020. WIDU.

<https://widu.africa/discover>.

**World Bank.** 2016. Informal Enterprises in Kenya. World Bank.

<https://documents1.worldbank.org/curated/en/262361468914023771/pdf/106986-WP-P151793-PUBLIC-Box.pdf>.

**World Bank.** 2020a. World Development Indicators. World Bank.

<https://databank.worldbank.org/source/world-development-indicators#>.

**World Bank.** 2020b. Doing Business Indicators. World Bank.

<https://databank.worldbank.org/source/doing-business>.

**World Bank.** 2020c. World Governance Indicators. World Bank.

<https://databank.worldbank.org/source/worldwide-governance-indicators>.



# Appendix

## Payne Valuation | All scores are rounded

Weighted Factors	Overall Weight	Purpose	Weighted Adjustment
<b>Public Policy</b>	30.0%	Public policy affects every other factor in the scorecard and lays the foundation of a strong ecosystem. It cannot be imported or substituted and must come from changes within the country, which are feasible in the short and long term.	
<b>Start Ups</b>	7.5%		
Start-up Policy		Start-up policy helps to provide a stable legal framework for start-ups, and creates benefits like scholarships, incubators and government support for start-ups	1.88
Government Involvement		Tech clusters succeed when the government provides incentives and subsidies to de-risk early stage technologies.	1.88
Patent System		Patent systems, when enforced, provide a legal framework for start-ups to establish and maintain a competitive advantage.	1.88
Investment Incentives		Investment incentives provide runway and a soft landing for resource-restricted start-ups	1.88
<b>National Policy</b>	7.5%		
Central Bank Policy Rate		Central Policy Rate as a risk-free rate affects the investment climate and inflow/outflow of foreign capital, high policy rate discourages local investment as investors can lend to the government for low risk and pushes up the IRR required to invest in start-ups	1.25
Political Stability		Political stability is a macro factor that affects aggregate demand/supply and the business confidence of investors	1.25
Tax Rate		Tax rates should be tiered and optimized for start-ups and entrepreneurs given that they are resource-constrained	1.25
Rule of Law		Rule of law affects the establishment and enforcement of contracts and quick remedy in commercial disputes	1.25
Fiscal Policy		Fiscal policy, especially tax policy, and budget allocation should lay emphasis on the sectors in the economy that have growth potential or those in need of assistance	1.25
Ease of Paying Taxes		Ease of paying taxes is a proxy for government approach to business and how easy it is for businesses to operate	1.25
<b>Business Environment</b>	7.5%		
Business Regulatory Environment		Business regulatory environment measures how friendly and effective the regulatory regime is to businesses	1.25
Regulatory Quality		Regulatory quality measures the ability of the government to formulate and implement policy and regulations	1.25
Strength of Legal Rights		Strength of legal rights measures the degree to which the rights of investors, owners and contracts are enforced	1.25
Time to Start a Business		Time to start a business measures the number of business days it takes to get a business permit	1.25

UGANDA			KENYA			RWANDA		
Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score
		16.4			18.44			24.38
	<b>2.34</b>			<b>4.22</b>			<b>4.22</b>	
0	0		0.5	0.94		0.5	0.94	
0.5	0.94		0.5	0.94		0.75	1.41	
0	0		0.5	0.94		0.5	0.94	
0.75	1.41		0.75	1.41		0.5	0.94	
	<b>6.25</b>			<b>5.94</b>			<b>7.5</b>	
0.75	0.94		0.75	0.94		1	1.25	
0.5	0.63		0.5	0.63		1	1.25	
0.75	0.94		1	1.25		1	1.25	
1	1.25		0.75	0.94		1	1.25	
1	1.25		1	1.25		1	1.25	
1	1.25		0.75	0.94		1	1.25	
	<b>5</b>			<b>5.94</b>			<b>7.5</b>	
0.75	0.94		1	1.25		1	1.25	
0.75	0.94		0.75	0.94		1	1.25	
0.5	0.63		0.5	0.63		1	1.25	
0.5	0.63		0.5	0.63		1	1.25	

Weighted Factors	Overall Weight	Purpose	Weighted Adjustment
Transparency		Transparency measures the openness and accountability of the government to its constituents	1.25
Cross Border Trade		Cross border trade measures trading across borders for goods and services and the ability to scale from the country	1.25
<b>Agricultural Policy</b>	<b>7.5%</b>		
Government Expenditure on AG		Government expenditure on agriculture measures budget allocation to agriculture versus agriculture share of GDP	1.88
Farmer Organization/ Database		Farmer organization/database measures presence or absence of a government or public/private registry for farmers. The availability of a farmer database highlights the government's efforts to lower the barriers to participate in the AgTech ecosystem	1.88
Government Policy Plans		Government policy plans measures the implementation of government policy	1.875
Tax Policy on AG		Tax policy of agriculture measures how favourable tax policy is towards agricultural goods	1.875
<b>Finance</b>	<b>25.0%</b>	Lack of finance has crippled start-ups after the initial funding stages while success for start-ups comes down to how much they can spend during the early stages. If finance is available, it draws in industry from around the world and creates a viable market. Lack of local capital can be substituted by foreign capital	
<b>Equity</b>	<b>6.3%</b>		
Venture Capital in African Context		Venture funding measures the total annual assets invested and number of rounds of investment in an ecosystem. It helps measure the flow of outside funding and willingness to invest in new technologies in the ecosystem	1.25
Corporate Venture Funding		Corporate venture funding measures the total annual assets invested and number of rounds of investment in an ecosystem from corporates investing in their industry	1.25
Domestic Venture Funding		Domestic venture funding measures the total annual assets invested and number of rounds of investment in an ecosystem from local investors	1.25
# of Domestic VC		Number of domestic VC measures the number of firms involved in venture capital	1.25
Deposit Rate		Deposit rate is the rate local deposits are compensated for saving. Higher deposit rates disincentivize local investors from participating in venture funding	1.25
<b>Debt Funding</b>	<b>6.3%</b>		
Real Interest Rate		Real interest rate is a measure of interest rate return after accounting for inflation	6.25
<b>Donor Funding</b>	<b>6.3%</b>		
Foreign Aid		Foreign aid is a measure of foreign assistance as a percentage of GDP	1.56
Development flows to AG (FAO)		Development flows to agriculture measures the amount of foreign assistance extended to agriculture. Donor funding is crucial to early-stage start-ups in African ecosystems	1.56

UGANDA			KENYA			RWANDA		
Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score
0.75	0.94		1	1.25		1	1.25	
0.75	0.94		1	1.25		1	1.25	
	<b>2.81</b>			<b>2.34</b>			<b>5.16</b>	
0.5	0.94		0.25	0.47		0.75	1.41	
0	0		0	0		0.5	0.94	
0.5	0.94		0.5	0.94		1	1.88	
0.5	0.94		0.5	0.94		0.5	0.94	
		11.59			14.01			10.89
	3.13			2.81			2.81	
0.75	0.94		1	1.25		1	1.25	
0.5	0.63		0.5	0.625		0.5	0.625	
0.5	0.63		0	0		0	0	
0.5	0.63		0.5	0.625		0.5	0.625	
0.25	0.31		0.25	0.3125		0.25	0.31	
	<b>1.56</b>			<b>4.69</b>			<b>1.56</b>	
0.25	1.56		1	6.25		0.5	3.13	
	<b>4.30</b>			<b>3.90</b>			<b>3.90</b>	
0.5	0.78		0.75	1.17		0.25	0.39	
0.75	1.17		0.75	1.17		1	1.56	

Weighted Factors	Overall Weight	Purpose	Weighted Adjustment
Foreign Direct Investment		Foreign direct investment is a measure of the foreign capital flowing into an ecosystem. It helps measure the commitment of outside countries investing in the ecosystem	1.56
Remittance		Remittance measures diaspora remittances as a share of population to show a commitment from outside diaspora	1.56
<b>Agricultural Finances</b>	<b>6.3%</b>		
Land Ownership Systems		Land ownership systems indicates where land is owned individually, leased from the government or owned by the crown	2.1
Bank Lending Rate		Bank lending rate is the rate at which one can borrow from domestic banks	2.1
Credit to Ag		Credit to agriculture measures credit extended to agriculture as a percentage of total credit	2.1
<b>Infrastructure</b>	<b>20.0%</b>	Infrastructure disproportionately affects Agriculture and AgTech in comparison to other industries because it is a direct component of cost of production. This cannot be directly imported from outside of the country and any changes must come from the government in control. Poor infrastructure can limit everything else within the country ex. electricity prices	
<b>Logistics</b>	<b>6.7%</b>		
Logistics Performance Indicator		Logistics performance indicator is a proxy measure for the efficiency of transport, import and export infrastructure	3.33
Efficiency of the clearance process		Efficiency of the clearance process measures the efficiency of customs procedures and allows us to measure government efficiency regarding cross border trade	3.33
<b>Electric</b>	<b>6.7%</b>		
Access to Electricity		Access to electricity measures the proportion of the population connected to the grid and the infrastructure capabilities of the government	3.33
Cost		Even if infrastructure is present in the country for the population to access, cost is a high barrier for many in the ecosystems	3.33
<b>Water Access</b>	<b>6.7%</b>		
Access to Water		Access to water measures the proportion of the population with access to piped water and the government's ability to build infrastructure necessary for ag	6.67
<b>Digital Preparedness</b>	<b>15.0%</b>	Digital preparedness must be addressed by the governments in control. It has a long learning curve compared to other factors and is limited by financial growth. Not all technologies are dependent on this though	
<b>Connectivity</b>	<b>7.5%</b>		
Mobile Internet Connectivity Score		This score combines data cost, data coverage, and smartphone penetration in the market. High cost and low-quality data and smartphones limit the functionality of new technologies	2.5
Mobile Subscription		Mobile subscription is the number of mobile devices per 100 people, most of the AgTech solutions in the African ecosystems require mobile devices to access	2.5

UGANDA			KENYA			RWANDA		
Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score
0.75	1.17		0.25	0.39		0.75	1.17	
0.75	1.17		0.75	1.17		0.5	0.78	
	<b>2.60</b>			<b>2.60</b>			<b>2.60</b>	
0	0		0	0		0.5	1.04	
0.25	0.52		0.75	1.56		0.5	1.04	
1	2.08		0.5	1.04		0.25	0.52	

		11.77			16.43			14.35
	<b>5.83</b>			<b>6.67</b>			<b>6.67</b>	
0.75	2.5		1	3.33		1	3.33	
1	3.33		1	3.33		1	3.33	
	<b>2.21</b>			<b>5.66</b>			<b>3.66</b>	
0.413	1.38		0.70	2.32		0.35	1.16	
0.25	0.83		1	3.33		0.75	2.5	
	<b>3.72</b>			<b>4.11</b>			<b>4.03</b>	
0.56	3.72		0.62	4.11		0.60	4.03	

		7.79			12.37			8.15
	<b>3.98</b>			<b>5.56</b>			<b>4.47</b>	
0.75	1.88		1	2.5		0.75	1.88	
0.61	1.51		1	2.5		0.82	2.05	

Weighted Factors	Overall Weight	Purpose	Weighted Adjustment
Internet Penetration		Internet penetration is the proportion of the population with access to the internet, most of the AgTech solutions in the Africa ecosystems require internet access	2.5
<b>Human Users</b>	<b>7.5%</b>		
Average School years		This is used to measure how prepared the population is to adopt new technologies and use them at a rate that is sufficient for scalability	3.75
Literacy		This is used to measure how prepared the population is to adopt new technologies and use them at a rate that is sufficient for scalability	3.75
<b>Human Capital</b>	<b>5.0%</b>	Human capital at a high level can be imported if all of the other factors offer an opportunity. A strong base is important so that the ecosystem will continue to self-develop new technologies.	
<b>Future workforce</b>	<b>2.5%</b>		
Government spending on education per capita		Government spending on education per capita measures the average education spend of the government per citizen. This helps to measure the government's commitment to educating a future workforce	0.83
Gender Inequality		Gender inequality allows us to measure the inclusion of women in the workforce, and therefore the amount of the population that is available to fill roles in AgTech start-ups and generate new ideas	0.83
Building Human Resources		The ability to develop and maintain a workforce	0.83
<b>Foreign Human Capital</b>	<b>2.5%</b>		
Presence of Outside Founders		This score was calculated on surveys and interviews conducted in each ecosystem	2.5
<b>Entrepreneurial Culture</b>	<b>5.0%</b>	Entrepreneurial culture is built into many of these ecosystems, but the level of risk taking is relatively low on the farmer level. This is directly affected by finance opportunities and public policy. Here we will measure more in detail the incubators and community that supports the risk taking.	
<b>Partnerships</b>	<b>2.5%</b>		
Incubators		This score was calculated using interviews and surveys in each ecosystem, measuring the perception of incubators and accelerators and how much they help the local start-ups	1.25
Level of Collaboration		This score was calculated using interviews and surveys in each ecosystem, measuring the perception of start-ups' willingness to collaborate to further the ecosystem	1.25
<b>Attitudes Toward Entrepreneurships</b>	<b>2.5%</b>		
Registered New Business Density		Registered new business density measures the number of new businesses per 1 000 people	0.83
Cost of Starting a Business		Cost of starting a business measures the cost of permitting a business as a proportion of GNI, this allows us to measure the barriers for new entrepreneurs to create a formal business	0.83

UGANDA			KENYA			RWANDA		
Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score
0.24	0.59		0.23	0.56		0.22	0.54	
	<b>3.81</b>			<b>6.81</b>			<b>3.68</b>	
0.25	0.94		1	3.75		0.25	0.94	
0.77	2.87		0.82	3.06		0.73	2.75	

		1.67			3.75			2.29
	<b>1.04</b>			<b>1.88</b>			<b>1.67</b>	
0.25	0.21		1	0.84		0.5	0.42	
0.25	0.21		0.25	0.21		0.5	0.42	
0.75	0.63		1	0.83		1	0.83	
	<b>0.63</b>			<b>1.88</b>			<b>0.63</b>	
0.25	0.63		0.75	1.88		0.25	0.63	

		2.92			3.65			3.02
	<b>1.25</b>			<b>1.56</b>			<b>1.56</b>	
0.5	0.625		0.75	0.9375		0.5	0.63	
0.5	0.63		0.5	0.63		0.75	0.94	
	<b>1.67</b>			<b>2.08</b>			<b>1.46</b>	
0.75	0.625		0.75	0.63		1	0.83	
0.5	0.42		0.75	0.63		0.5	0.42	

Weighted Factors	Overall Weight	Purpose	Weighted Adjustment
Patent Receipts versus Payments		Patent receipts versus payments measures innovation by proxy by measuring the proportion of receipts for patents versus payments by country	0.83
<b>Contextual Indicators</b>			
Agriculture, forestry, and fishing, value added (% of GDP)		Agriculture, forestry, and fishing, value added (% of GDP) measures the proportion of GDP represented by agriculture, forestry and fishing	
Agricultural land (% of land area)		Agricultural land (% of land area) measures the proportion of arable land versus total land area	
GDP		Size of the market	
Employment in agriculture (% of total employment) (modelled ILO estimate)		Employment in agriculture (% of total employment) measures the proportion of the population employed in the agriculture industry	
Self-employed, total (% of total employment) (modelled ILO estimate)		Self-employed is a proxy measure for entrepreneurship by measuring the number of people employed in small and medium enterprises that they started themselves.	

UGANDA			KENYA			RWANDA		
Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score	Ranking	Weighted Score	Total Score
0.75	0.63		1	0.83		1	0.21	
21.92			34.15			24.07		
71.89			48.55			73.44		
34.4B USD			95.5B USD			10.1B USD		
72.67			54.44			62.41		
78.39			51.56			68.06		
	<b>TOTAL</b>	<b>52.13</b>		<b>TOTAL</b>	<b>68.65</b>		<b>TOTAL</b>	<b>63.08</b>



Markets and Trade Division - Economic and Social Development stream

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