



Taking stock in Kenya, Rwanda and Uganda

Summary



Agricultural technology ecosystems in East Africa

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1. Background and objectives

Agricultural innovation and technology (AgTech) have shown real promise in transforming Africa's agriculture sector, and in addressing some of the key challenges for food security. However, even with proven concepts, it remains challenging to scale up agricultural innovations into sustainable and profitable businesses. In an effort 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,¹ 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: finance, human capital/labour, infrastructure, digital preparedness, entrepreneurial culture and public policy.

The assessments evaluate the AgTech business environments with a view to inform a range of stakeholders on the current trends in AgTech development, evaluating strengths and weaknesses. 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 [CPF]); (iii) assist development finance institutions (DFIs) in directing loans, donations and capacity development activities; (iv) ease the due diligence process of venture capital (VC) 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.

¹ The Yield Lab Institute is a non-profit AgTech think tank that supports early-stage start-up firms and innovations through targeted initiatives.



2. Methodology

The methodology consists of a two-step analytical approach. First, a Payne scorecard was developed to quantify and compare a 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 anecdotal evidence on how the AgTech ecosystem functions. The respondents and interviewees were chosen based on their expertise and type of engagement within the AgTech ecosystem, which were factored into a final selection of a group of participants with different backgrounds. The sample includes a range of stakeholders such as academia, national authorities, entrepreneurs, business leaders and investment funds.

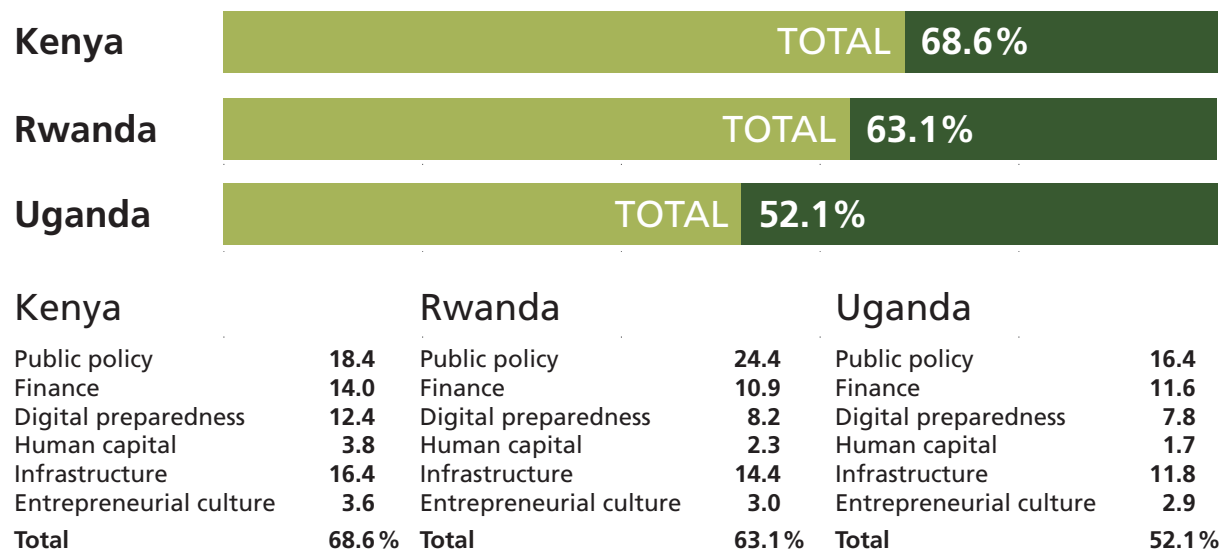


3. Country overview

Kenya, as the most developed economy of the three, 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 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-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.

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 mainly 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-up firms 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 to step up production and improve food security.

Figure 1 | Country comparison of Payne scorecard



Source: Authors.



Rwanda is the smallest ecosystem that was analysed in the ecosystem review. The country's 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 strong points of the Rwandan ecosystem, ranking in the fourth quartile in venture capital and development flows to agriculture. Rwanda has the potential to become a launchpad into the broader region if it focuses efforts on digital technology and ensures that such enterprises are well resourced.

3.1 Kenya

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-up firms to succeed. Incubators are more widespread than in neighbouring ecosystems, gaining the attention of international agencies. In parallel, Kenya's success in the fintech and software industries has allowed the country to establish a conducive overall business environment. A key challenge moving forward is to integrate AgTech into this enabling environment.

While there is a general interest in AgTech, there are still a number of pitfalls to address. 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.

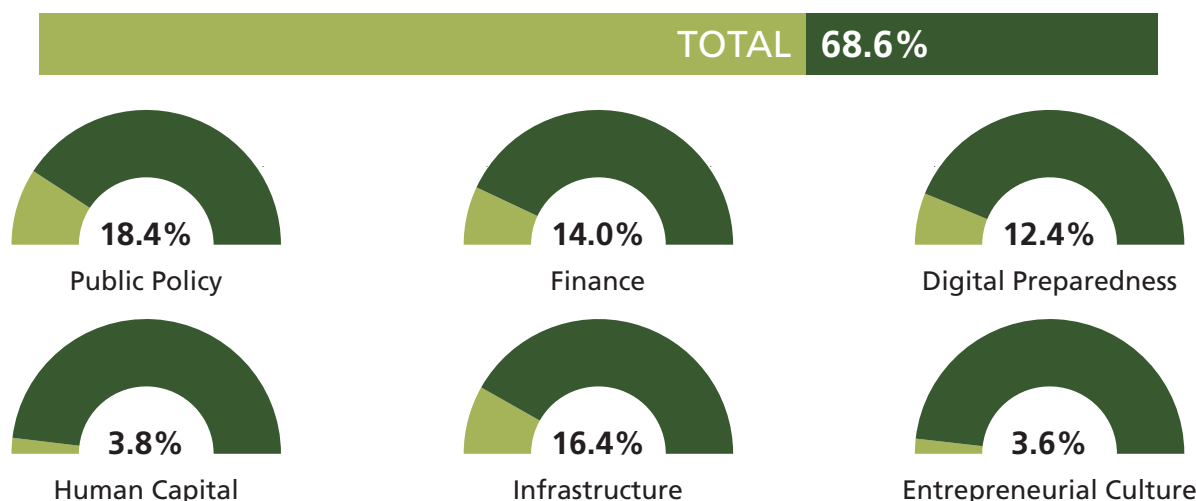
Despite the large share of attention that has been captured by the fintech and software industries, some AgTech solutions have made inroads into Kenya's agricultural market. Many of these have been established by international founders, a feature that is not often replicated across East Africa. Kenya 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-up firms have managed to attract.

Overall, Kenya has the potential to be a viable AgTech centre within the East African region. At a high level, AgTech has a promising future in Kenya's economy with agriculture accounting for around 35 percent (USD 95.5 billion) of the nation's GDP. The importance of domestic agriculture also suggests the 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, helping to sensitize many possible early adopters.

Figure 2 | Kenya's Payne scorecard valuation



Source: Authors.

Public policy: The key indicators suggest Kenya's business environment hovers around average. For example, Kenya scored in the second, third and fourth quartiles for most metrics used to measure the business environment of the ecosystem, such as business regulatory environment (fourth), regulatory quality (third), strength of legal rights (second) and the cost of start-up business procedures (second). In contrast, the average time to start a business is 23 days, which ranks below average in the region. Globally, Kenya ranks 94th in terms of business friendliness of taxes. Notwithstanding these issues, Kenya remains the largest economy in the region with a strong international network based in Nairobi that continues to fuel opportunities and innovation.

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 eventually affect start-up firms 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, a Start-up Bill was announced in the *Kenyan Gazette*. Most successful AgTech start-up firms within Kenya have indicated that they benefited from various policies in their efforts to create and implement

new technologies. The Kenyan Government through its banking regulator, 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 Bills were recently under consideration.

There is, however, little to no implementation or enforcement of these policies by the government. 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-up firms 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, Kenya could begin to level the playing field for companies that are domiciled domestically.

Finance: Kenya ranks in the fourth quartile for GDP-weighted venture capital investment on the continent, but the middle gap in financing is still a major obstacle for entrepreneurs trying to scale their businesses within the country. Even with a stronger middle class and more disposable income in the market compared to other ecosystems in the region, investment alternatives are still preferred over risky start-up firms. Even at the current levels of VC funding, Kenya has seen an influx of international funds as the ecosystem continues to scale. Most of these funds have been focused on InsureTech and fintech leaving AgTech behind. A key challenge moving forward is to divert some of the current venture funding to the AgTech sector.

Digital preparedness: Mobile money has paved the way for digital technologies to expand across Kenya and increased the willingness of Kenyans to adopt new technologies. These features make Kenya an attractive investment destination in general and the most developed ecosystem in terms of digital preparedness in the region. 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. Kenya still has the potential to improve upon the connectivity of the ecosystem, moving away from 2G and feature phone technologies.

Human capital: Though Kenya has its challenges with workforce development, regionally it is still viewed as having the most developed human capital pool. Start-up firms in other ecosystems in the region look to Kenya to fill more advanced openings that cannot be filled with applicants from their home markets. The Kenyan ecosystem needs to continue to develop the curricula offered in universities throughout the country, in order to be more relevant to industry demands and build out the mentorship that is needed to foster a new generation of domestic entrepreneurs.



Infrastructure: Infrastructure is an important component for agriculture in Kenya since most cash crops for export are grown by smallholders in the 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. The cost of electricity by percentage of income places Kenya above average and in the fourth quartile compared to other ecosystems on the continent. However, average electricity costs in Kenya outstrip the cost of electricity in developed economies. 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.

Entrepreneurial culture: Despite the large number of incubators within the country, there are concerns about the quality of support they offer to start-up firms and their overall impact on the AgTech ecosystem. There were several key concerns highlighted during the interviews with 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 are run like “conveyor belts”, in which courses are taught by consultants rather than offering serial entrepreneurs as mentors. Some of the issues raised that directly impact the ability of AgTech to benefit from the incubator system include: (i) incubators/accelerators have not developed AgTech expertise, (ii) there are no services specific to AgTech, and (iii) a more general understanding of agriculture is missing. The fact that AgTech is generally being built for a larger market, rather than offering tailored technologies to address specific agricultural market needs, was seen as one of the key reasons for the high failure rate of AgTech start-up firms.

Actionable 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 in agriculture and for start-up firms will help to provide clarity and predictability in the ecosystem for both international investors and entrepreneurs on the ground. The Government of Kenya appears positioned to move forward with new policies for start-up firms. Current legislation is in the draft stage, and it appears policies may be missing to codify financing for AgTech firms, government support, and ICT for agriculture. There is a need for a coordinated national policy on the adoption of AgTech into agriculture practice. For example, there is a need to mechanize cereal farming, but 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-up firms poses a heavy burden on cash-strapped companies at their early stages of development. In addition, the government has yet to tailor tax policies to emerging industries. A more stable tax regime would be beneficial for business development. For instance, tax exemptions are frequently readjusted, making business planning difficult.
- 3) Across the region, entrepreneurs have been reluctant 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-up firms 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 is in a position to set a precedent in the region with a strong patent regime that is clear, transparent and enforceable. An improved sense of security would allow start-up firms to focus on mastering technological challenges by collaborating 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 to research and development and industry expertise that can be shared with these start-up firms. 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 meet the needs of start-up firms operating along the entire value chain. These incubators and accelerators could provide valuable support for start-up firms, offering the much-needed scale within the country for start-up firms to succeed. In addition, Kenya could further leverage its already strong position among foreign founders to attract additional venture capital into the region.

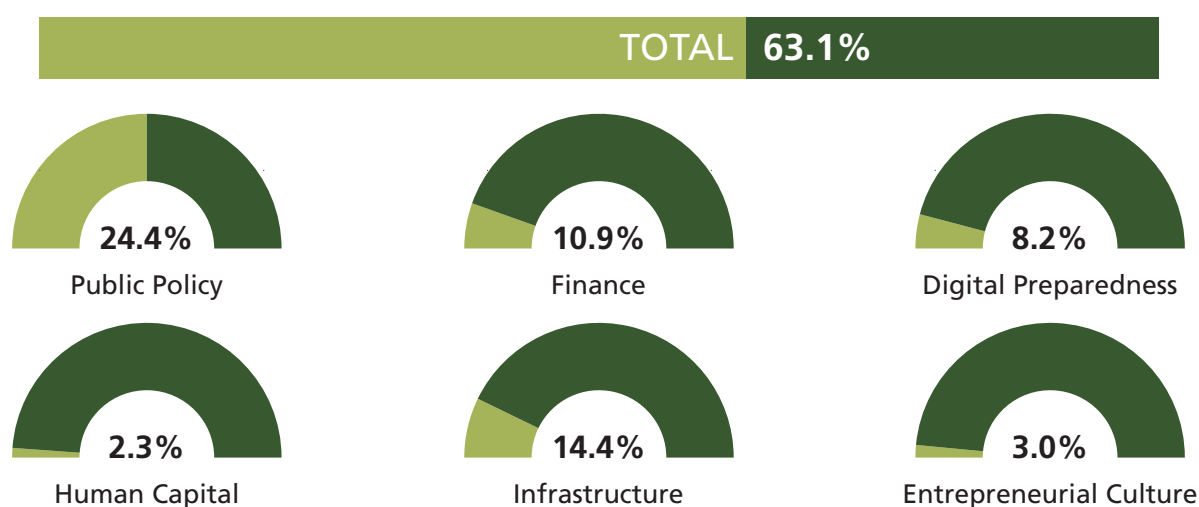


3.2. Rwanda

Rwanda has continued to gain traction internationally as a start-up hub on the continent. There has been a rise in incubator 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 the target audience.

The Rwandan Government aims 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, those businesses 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-up firms face in neighbouring countries, such as not having access to agricultural databases.

Figure 3 | Rwanda's Payne scorecard valuation



Source: Authors.

Public policy: Rwanda is one of the smaller countries in the East African region, which brings its own set of challenges. Given the small market size, it is imperative that start-up firms have a clear strategy in place to expand into neighbouring markets. Rwanda's ecosystem has the potential to serve as a launchpad for AgTech companies trying to make inroads into the region. Currently, there are political barriers, such as border closures and disputes with Uganda, that prevent entrepreneurs from being able to scale across the region, limiting the country's ability to act as a true launchpad for AgTech start-ups.

From both a financial and technological standpoint, the government has tried to attract outside investment with some success. Because of its smaller size and limitations on scaling AgTech solutions, this has been assessed by interviewees as a move in the right direction. At the same time, there was also a call for further steps to ensure investors that Rwandan-developed technologies have a future outside of the ecosystem. An important step is to provide companies with access to financial resources internally and initially and then support them as they move abroad and scale their businesses.

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, rule of law, and the number of days to start a business (four days) (World Bank, 2021). In addition, Rwanda ranked 38th in the world in terms of the business friendliness of taxes. 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 positive and negative impacts on the ability to do business in the country. Most stakeholders commented on how easy it was to register their businesses and follow the necessary procedures to begin operating. The challenges occur when new regulations are put into place hastily 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 address 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 small and medium-sized enterprises in the ecosystem.

Finance: The middle gap of financing seen throughout the region also exists in Rwanda. Most start-up firms must rely on donor funding or government programmes to survive. That being said, Rwanda as a finance destination is attracting the highest levels of GDP-weighted VC investment on the continent, overshadowing Uganda in the amount of venture funds raised. Rwanda has attempted to position itself as a launchpad for international ventures in the region and this initiative could be further strengthened to help make Rwanda a financial hub in the region.

Digital preparedness: Rwanda has set ambitious targets when pushing for the digitalization of its economy, with a target of 30 percent of GDP (National Bank of Rwanda, n.d.) to be transacted through digital payments in 2024 and plans to distribute 100 000 smartphones throughout the country (MININFRA, 2020). In addition, connectivity is 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 can occur due to the country's hilly geography rather than because of infrastructure limitations.

Human capital: Rwanda's workforce lacks the skill sets needed for AgTech development. Many start-up firms must look outside of Rwanda's borders, to other ecosystems like Kenya and Nigeria, to attract the requisite talent. Although Rwanda's above average literacy rates and low government expenditures on education highlight the potential of the Rwandan workforce, there remains a need for greater focus on educational training initiatives to develop domestic talent.

Infrastructure: While there is room for improvement, Rwanda has the second highest infrastructure score in the scorecard (Table 1) among the three countries analysed. When compared to other countries on the continent, Rwanda ranked above average for the logistics performance index, customs clearance and the cost of electricity, and performed below average for access to electricity and access to water. The interviewed start-up firms 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.

Entrepreneurial culture: The smaller size of the start-up community in Rwanda, specifically in the Kigali area, has resulted in a more close-knit community willing to partner with one another. In addition, Rwandan incubators have received increased attention from international funders, which has helped Rwanda build a strong entrepreneurial culture. As the community continues to grow, it is crucial that the ecosystem continues to focus on collaboration and mentorships.

Actionable 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 proof of concepts must be able to scale their products and services also outside of Rwanda. Through government facilitation, investors can be reassured that their 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 the country 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 launchpad 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.

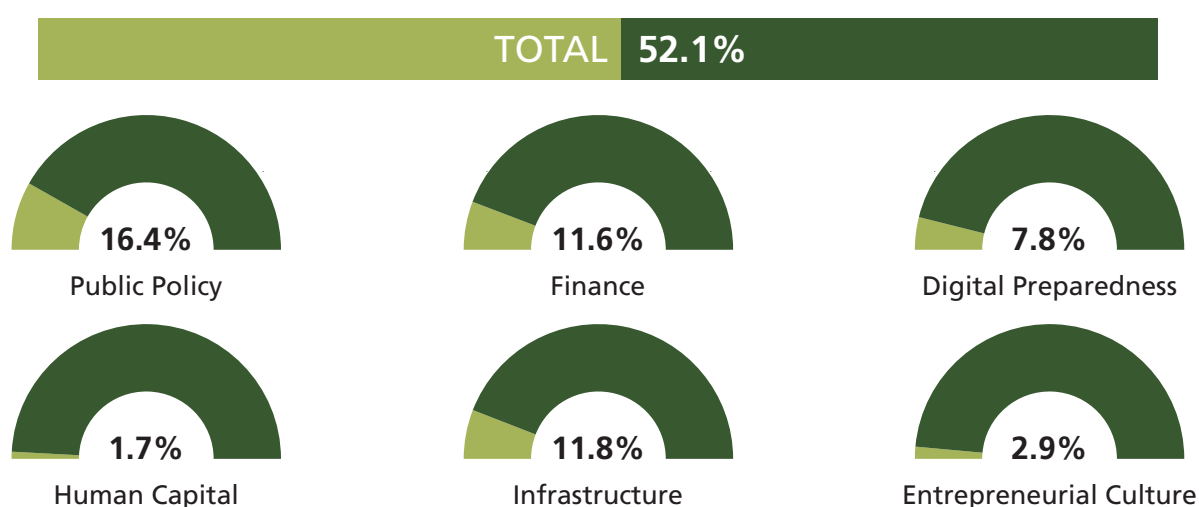
Foreign human capital should remain a temporary fix as the ecosystem continues to develop talent from within. In order to do so, an updated curriculum for both students within universities and for entrepreneurs trying to develop their own businesses should be included. The universities should also continue to scale the partnerships they have built with 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 and other aspects of operating a start-up, 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.



3.3 Uganda

Uganda's large agricultural sector, its centralized location in the region and developing market status also offer entrepreneurs the opportunity to scale their products. Uganda's market provides a regional sandbox for well-funded start-up firms to demonstrate mass scalability and to move to neighbouring markets such as Kenya. Agriculture accounts for roughly 70 percent of Uganda's employment. The importance of agriculture for the country's overall economy also creates an opportunity to introduce and scale new agriculture technologies. At the same time, Uganda's agriculture sector is less digitalized 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-up firms can seize this opportunity by offering breakthrough solutions for a large user base that use 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.

Public policy: The overall ranking of Uganda's general business environment is slightly lower than Kenya's – many of the key indicators are below average. The main difference with Kenya is that Uganda lacks the general network and market size to overcome the lower positioning from an investor's perspective. It ranks 92nd in the world in terms of the business friendliness of taxes, its Rule of Law score stands at 42.8 and the average time to start a business is 24 days. Uganda has one of the most agriculturally dependent economies in the region. In addition, the sandbox environment together with lower government interference in the early stage helps it stand out to some AgTech investors.

A feature of the Ugandan ecosystem is a lack of government support for companies as they initially try to develop their businesses. For example, policies and clear regulations are missing that incentivize growth and innovation for AgTech companies, such as a specific tax policy. The implications of the lack of government intervention in the AgTech space is two-fold. On the one hand, most companies do not see government regulations impact their business until they achieve a certain size. Therefore, low government interference adds to the opportunities created by Uganda's large market and its central position in the region. This is favoured among those who have the resources to test their products. On the other hand, for those that do not have sufficient resources, the government's lack of involvement is a challenge. Many Ugandan-founded businesses with homegrown ideas flounder as they struggle to finance those ideas. There are local organizations that are positioned to play a greater role in AgTech business development, such as the Ugandan Development Bank, but there has been limited success reaching AgTech businesses. Scaling out these initiatives will open the door to more entrepreneurs tackling industry-wide issues.

Finance: There is a small network of VC within Uganda, which ranks Uganda in the lower limits of the 3rd quartile for GDP-weighted VC investment on the continent. Despite Uganda's above average regional VC investment ranking, the middle gap in financing is still a major challenge. The assessment suggests there is insufficient government financial support to overcome the middle gap in financing and help entrepreneurs to scale their businesses. Many of the existing government initiatives were found to be difficult to access and sometimes opaque in their implementation procedures. That said, some interviewees mentioned the Ugandan Development Fund has an initiative that provides relief to start-up firms in some instances and has helped them scale their businesses. Overall, donor funding plays a major role in early-stage financing for AgTech start-up firms in Uganda, through both grants and accelerator programmes. Donor funding, as in other ecosystems, has helped to de-risk early-stage technologies and allowed entrepreneurs to prove their business models.

Digital preparedness: Uganda suffers from an urban-to-rural digital divide with a large difference in connectivity and internet speeds. In addition, excessive taxation is having a detrimental impact on consumers as they try to move from feature phones to smartphones. This has a direct impact on agriculture and AgTech given their predominance in rural areas. Start-up firms have designed their solutions to work both online as well as offline, in order to innovate around connectivity issues, but these workarounds add to the cost of production and service delivery. There is a need to deregulate the sector, spur competition to increase the number of service providers and help reduce consumer costs, and push to digitalize the farmer base.

Infrastructure: Infrastructure remains a challenge in Uganda given that infrastructure investments favour urban areas. The infrastructure that is accessible tends to come at a high cost to the start-up firms in the ecosystem. These constraints emerged in both secondary sources and interviews on the ground. The high cost of electricity and unreliability of services, especially in telecommunication connection standards, have forced entrepreneurs to adapt



and change their business plans in order to be able to operate within the ecosystem. Reducing these burdens would allow companies to be more efficient and enable them to release products in accordance with business plans.

Human capital: A lack of domestic human capital has led to foreign workers being employed to fill in the gaps for specialized skills. This has resulted in a “brain gain” for Uganda, as expatriates bring in new ideas, spot business opportunities and help address the pitfalls and gaps that they identify in the ecosystem. A lack of the appropriate skill sets also extends to Uganda’s tertiary education system and requires start-up firms to fill the skills gap. For instance, having recognized a gap between graduate curricula and market demands, start-up firms had to embark on their own training activities and prepare staff for the needs of a vibrant entrepreneurial ecosystem. However, they now suffer the consequences of poaching by other sectors and countries, perpetuating the need for education and vocational training. An updated curriculum from the country’s leading universities as well as more participation in the ecosystem would go a long way toward solving these issues.

Entrepreneurial culture: Entrepreneurs in the ecosystem have complimented the incubator and accelerator programmes in the country. Though none of these incubators are dedicated to AgTech, there is a willingness to accept AgTech entrepreneurs in the programmes. This differs from some neighbouring ecosystems that are primarily focused on fintech and other software development technologies. There is also willingness from the government to foster the entrepreneurial culture, notably through the Ministry of Information and Communications Technology and National Guidance, which has been forward-looking and has built its own government incubation centre.

Actionable recommendations

Uganda presents an interesting case for AgTech development, where the existing initiatives help promote innovation overall, but seem to lack focus and structure. The assessment findings highlight several 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, greater effort is 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 digitalizing



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) A key stakeholder in helping to fuel the future success of the ecosystem are the universities within Uganda. Though there are some initiatives within the universities, their involvement is lacking in comparison to other ecosystems around the world. Universities could play a greater role to 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 skillsets of Uganda's workforce to adapt to an evolving agriculture sector. Improving technology literacy through the tertiary education system 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 firm. They need to understand concepts such as equity capitalization tables, employee-sponsored ownership plans, earnouts, down rounds and convertible debts. 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 an opportunity for mentors, donor agencies and incubators to fill this gap to make sure that emerging entrepreneurs are familiar with investment practices.



4. Key takeaways across the region

Figure 5 | 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.

- | | |
|------------------------------|--|
| Scalability | 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. |
| Middle gap of finance | 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. |
| Ownership | 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 three East African ecosystems analysed is a middle gap of financing for start-up firms 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 (pre-seed and seed) of start-up firms in Kenya, Uganda and Rwanda, with many of the start-ups that were interviewed reporting that they have received early funding from donor agencies. This has proven critical in de-risking most of these start-up firms. 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, Uganda and Rwanda, venture capital firms still must meet this role. Potential investors that are present in these ecosystems have alternatives in these markets that are far more secure and profitable than investing in a risky start-up. For example, Kenyan treasury bills yield about



7 percent a 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 a 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 firms.

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, to 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.

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 Ag-Tech-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-up firms 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.

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 to apply and implement 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.

Ownership. 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 ten-year fund is seldom a realistic financing alternative.

Ownership of information is also a hurdle for many start-up firms. 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 the space 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 was 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.

The small size of Rwanda 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.



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Appendix

Payne Valuation | All scores are rounded

| Weighted Factors | Overall Weight | Purpose | Weighted Adjustment |
|---------------------------------|----------------|--|---------------------|
| Public Policy | 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. | |
| Start-ups | 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 |
| National Policy | 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 |
| Business Environment | 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 |

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

| 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 |
| Agricultural Policy | 7.5% | | |
| 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 |
| Finance | 25.0% | 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 | |
| Equity | 6.3% | | |
| 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 |
| Debt Funding | 6.3% | | |
| Real Interest Rate | | Real interest rate is a measure of interest rate return after accounting for inflation | 6.25 |
| Donor Funding | 6.3% | | |
| 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 |

| KENYA | | | RWANDA | | | UGANDA | | |
|---------|----------------|-------------|---------|----------------|-------------|---------|----------------|-------------|
| Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score |
| 1 | 1.25 | | 1 | 1.25 | | 0.75 | 0.94 | |
| 1 | 1.25 | | 1 | 1.25 | | 0.75 | 0.94 | |
| | 2.34 | | | 5.16 | | | 2.81 | |
| 0.25 | 0.47 | | 0.75 | 1.41 | | 0.5 | 0.94 | |
| 0 | 0 | | 0.5 | 0.94 | | 0 | 0 | |
| 0.5 | 0.94 | | 1 | 1.88 | | 0.5 | 0.94 | |
| 0.5 | 0.94 | | 0.5 | 0.94 | | 0.5 | 0.94 | |

| | | | | | | | | |
|------|-------------|-------|------|-------------|-------|------|-------------|-------|
| | | 14.01 | | | 10.89 | | | 11.59 |
| | 2.81 | | | 2.81 | | | 3.13 | |
| 1 | 1.25 | | 1 | 1.25 | | 0.75 | 0.94 | |
| 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 | | 0.5 | 0.63 | |
| 0.25 | 0.3125 | | 0.25 | 0.31 | | 0.25 | 0.31 | |
| | 4.69 | | | 1.56 | | | 1.56 | |
| 1 | 6.25 | | 0.5 | 3.13 | | 0.25 | 1.56 | |
| | 3.90 | | | 3.90 | | | 4.30 | |
| 0.75 | 1.17 | | 0.25 | 0.39 | | 0.5 | 0.78 | |
| 0.75 | 1.17 | | 1 | 1.56 | | 0.75 | 1.17 | |

| 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 |
| Agricultural Finances | 6.3% | | |
| 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 |
| Infrastructure | 20.0% | 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 | |
| Logistics | 6.7% | | |
| 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 |
| Electric | 6.7% | | |
| 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 |
| Water Access | 6.7% | | |
| 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 |
| Digital Preparedness | 15.0% | 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 | |
| Connectivity | 7.5% | | |
| 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 |

| KENYA | | | RWANDA | | | UGANDA | | |
|---------|----------------|-------------|---------|----------------|-------------|---------|----------------|-------------|
| Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score |
| 0.25 | 0.39 | | 0.75 | 1.17 | | 0.75 | 1.17 | |
| 0.75 | 1.17 | | 0.5 | 0.78 | | 0.75 | 1.17 | |
| | 2.60 | | | 2.60 | | | 2.60 | |
| 0 | 0 | | 0.5 | 1.04 | | 0 | 0 | |
| 0.75 | 1.56 | | 0.5 | 1.04 | | 0.25 | 0.52 | |
| 0.5 | 1.04 | | 0.25 | 0.52 | | 1 | 2.08 | |

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

| | | | | | | | | |
|---|-------------|-------|------|-------------|------|------|-------------|------|
| | | 12.37 | | | 8.15 | | | 7.79 |
| | 5.56 | | | 4.47 | | | 3.98 | |
| 1 | 2.5 | | 0.75 | 1.88 | | 0.75 | 1.88 | |

| Weighted Factors | Overall Weight | Purpose | Weighted Adjustment |
|---|----------------|---|---------------------|
| 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 |
| 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 |
| Human Users | 7.5% | | |
| 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 |
| Human Capital | 5.0% | 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. | |
| Future workforce | 2.5% | | |
| 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 |
| Foreign Human Capital | 2.5% | | |
| Presence of Outside Founders | | This score was calculated on surveys and interviews conducted in each ecosystem | 2.5 |
| Entrepreneurial Culture | 5.0% | 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. | |
| Partnerships | 2.5% | | |
| 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 |
| Attitudes Toward Entrepreneurships | 2.5% | | |
| Registered New Business Density | | Registered new business density measures the number of new businesses per 1 000 people | 0.83 |

| KENYA | | | RWANDA | | | UGANDA | | |
|---------|----------------|-------------|---------|----------------|-------------|---------|----------------|-------------|
| Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score |
| 1 | 2.5 | | 0.82 | 2.05 | | 0.61 | 1.51 | |
| 0.23 | 0.56 | | 0.22 | 0.54 | | 0.24 | 0.59 | |
| | 6.81 | | | 3.68 | | | 3.81 | |
| 1 | 3.75 | | 0.25 | 0.94 | | 0.25 | 0.94 | |
| 0.82 | 3.06 | | 0.73 | 2.75 | | 0.77 | 2.87 | |

| | | | | | | | | |
|------|-------------|------|------|-------------|------|------|-------------|------|
| | | 3.75 | | | 2.29 | | | 1.67 |
| | 1.88 | | | 1.67 | | | 1.04 | |
| 1 | 0.84 | | 0.5 | 0.42 | | 0.25 | 0.21 | |
| 0.25 | 0.21 | | 0.5 | 0.42 | | 0.25 | 0.21 | |
| 1 | 0.83 | | 1 | 0.83 | | 0.75 | 0.63 | |
| | 1.88 | | | 0.63 | | | 0.63 | |
| 0.75 | 1.88 | | 0.25 | 0.63 | | 0.25 | 0.63 | |

| | | | | | | | | |
|------|-------------|------|------|-------------|------|------|-------------|------|
| | | 3.65 | | | 3.02 | | | 2.92 |
| | 1.56 | | | 1.56 | | | 1.25 | |
| 0.75 | 0.9375 | | 0.5 | 0.63 | | 0.5 | 0.625 | |
| 0.5 | 0.63 | | 0.75 | 0.94 | | 0.5 | 0.63 | |
| | 2.08 | | | 1.46 | | | 1.67 | |
| 0.75 | 0.63 | | 1 | 0.83 | | 0.75 | 0.625 | |

| Weighted Factors | Overall Weight | Purpose | Weighted Adjustment |
|---|----------------|---|---------------------|
| 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 |
| 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 |
| Contextual Indicators | | | |
| 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. | |

| KENYA | | | RWANDA | | | UGANDA | | |
|-----------|----------------|-------------|-----------|----------------|-------------|-----------|----------------|-------------|
| Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score | Ranking | Weighted Score | Total Score |
| 0.75 | 0.63 | | 0.5 | 0.42 | | 0.5 | 0.42 | |
| 1 | 0.83 | | 1 | 0.21 | | 0.75 | 0.63 | |
| | | | | | | | | |
| | | | | | | | | |
| 34.15 | | | 24.07 | | | 21.92 | | |
| 48.55 | | | 73.44 | | | 71.89 | | |
| 95.5B USD | | | 10.1B USD | | | 34.4B USD | | |
| 54.44 | | | 62.41 | | | 72.67 | | |
| 51.56 | | | 68.06 | | | 78.39 | | |
| | TOTAL | 68.65 | | TOTAL | 63.08 | | TOTAL | 52.13 |



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