



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



FEED THE FUTURE BANGLADESH DIGITAL AGRICULTURE ASSESSMENT FOLLOW-ON

AN UPDATED REVIEW OF THE AGTECH LANDSCAPE FOR FEED THE FUTURE

PUBLIC VERSION

Prepared through the Digital Frontiers Project

June 2020



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List of Acronyms

a2i	Access to Information
AIS	Agricultural Information Service
agtech	Agriculture technology
AWS	Amazon Web Services
B2B	Business-to-business
ERP	Enterprise resource planning
GDPR	General Data Protection Regulation
IVR	Interactive voice response
KII	Key informant interview
LTE	Long-term evolution
MFS	Mobile financial services
MNO	Mobile network operator
PII	Personally identifiable information
PoC	Proof of concept
SaaS	Software as a Service
SIA	Strategic Impact Advisors
SMEs	Small and medium enterprises

Executive Summary









As digital solutions for agriculture continue to grow around the world, a landscape teeming with numerous actors and tools has emerged in Bangladesh. Feed the Future commissioned this study as a follow-on to a 2018 assessment in order to deepen and update its understanding of the country’s digital agriculture landscape. Under the Digital Frontiers Activity, Strategic Impact Advisors conducted this assessment in March through May of 2020. The report contains the findings of remote consultations with 37 institutional actors in Bangladesh’s agriculture technology (agtech) sector and 16 digital tool users – including farmers, livestock service providers, and extension workers.

A database of 43 active digital tools identified by the assessment was provided to Feed the Future under this report. A modified version¹ of 31 active tools is attached to this public version (see Annex 1), allowing the user to search tools by a number of characteristics. Almost all of the tools were developed in Bangladesh.

Key Findings

The infrastructure and usage of **enabling technologies**, upon which agtech relies to operate and reach users, continue to grow. Socio-cultural and financial barriers to usage of mobile phone and internet are declining, while high-speed mobile network coverage expands, and mobile money use has become widespread. However, significant gender inequalities remain in the ownership of mobile phones and internet usage; a lack of understanding of how mobile phones and internet work was the most commonly cited barrier among women.

The many purposes that digital agriculture tools offer can be classified into **eight categories**, defined in the Solution Categories section of the report. Among surveyed tools:

	16 offer user-specific diagnostics		10 have supply chain management functions
	15 provide general agricultural advisory information		9 include a significant data collection function
	14 provide information and advice around shifting conditions		6 allow or facilitate financial services
	11 offer market linkages		5 support value-added services

¹ To protect commercially sensitive information and honor our confidentiality agreement with respondents, the public list excludes tools in development, in major decline, or with a failed proof of concept. Competitive and sensitive information has been removed.

Many **stakeholders** are active in Bangladesh's agtech landscape. Farmers are key targeted users, but face skill and access limitations around using smartphones, and generally are unwilling to pay for digital services. Agribusinesses of all sizes are targeted users of agtech, and some larger companies develop digital tools themselves; however, multiple large agribusinesses indicated limited awareness of Bangladesh-grown agtech. Bangladesh's tech start-up landscape is rapidly growing – with venture capitalists, angel investors, and incubators now supporting start-up firms – and has seen some initial investments in agriculture. Financial institutions and mobile network operators are engaged as developers and partners of agtech tools. Bangladesh's government is involved in agtech as a tool developer/owner, user, and funder that also plays an important role in promotion. NGOs also develop and promote tools and may act as a funder for the development of others, on behalf of the donors for which they implement. **Gender** inequality is evident throughout the agtech landscape, with reduced participation of women in most stakeholder groups. Women are rarely targeted users by commercial tech developers, as they are underrepresented in roles for which the solutions are designed.

Respondents gave a wide variety of answers around the **results** their tools have achieved. Much of the quantitative data was operational or commercial (e.g., number of new customers, value of orders received); others gave some insight into outcomes with behavior change data reported by users. Four solutions reported quantitative impact-level data, generally around increased yields and increased revenues or profit margins of users. Frequent **challenges** cited by tool proponents include: limited digital skills of users, limited high-speed network coverage, hesitance around digital adoption, changing behaviors and relationships among users, limited willingness to pay, and donor restrictions.

We evaluated surveyed digital tools along five categories to provide a snapshot estimation of their quality, scalability, and sustainability. Tools have high **accessibility** when their intended users can very easily access and use the necessary technology; the most accessible tools targeting farmers do not require more than a basic mobile phone. Amid the many factors around **data and user security**, compliance with international standards and protocols are positive signs. **User experience** is informed by user perspectives or reviews when possible; where relevant, customer help lines indicated commitment to client experience, while abrupt suspension of other tools raised questions around causing harm to users. A number of tools have very uncertain **finances** to continue; many are dependent on raising more donor funding. Among the 25 tools intended to earn revenue, around half are currently generating revenue and two report profits. Many tool proponents had very few specifics on their **growth** plans, though some demonstrate recent increases in user numbers and are pursuing a concrete plan to grow.

The assessment's consultations occurred within 1-7 weeks of Bangladesh's **COVID-19 shutdown**, which commenced on March 22. Respondents reported a mix of impacts. Most tools with an e-commerce function have seen a significant increase in use. Some tools providing information to farmers have seen an uptick in usage, but another has seen reduced use and is scaling down call agent hours. Data collection tools are providing valuable insights into market conditions in areas that are difficult to reach. Limited mobility has delayed testing and roll-out of new tools, while private funding pipelines have frozen amid uncertainty. Nonetheless, some respondents were optimistic that the results of the shutdown will lead to increased interest among Bangladeshis in using digital services in the future.

I. Introduction

As digital technology transforms the world and ushers in the Fourth Industrial Revolution, it is harnessed to strengthen production and markets in myriad ways. USAID’s Digital Strategy, released April 2020, tasks the agency to use digital technology to improve development outcomes while strengthening the openness, security, and inclusiveness of national digital ecosystems. Innovations using digital technology to strengthen agriculture rapidly emerge around the world, and private, public, academic, and non-profit actors pursue diverse solutions to improve agricultural production and strengthen agricultural market systems. The Feed the Future initiative recognizes the power of agricultural technology and seeks to leverage it across its country programs.

Agriculture is Bangladesh’s largest economic sector and employer, while food security is a challenge in the world’s most densely populated country that is highly vulnerable to natural disasters. Feed the Future programs in Bangladesh aim to support inclusive and sustainable agriculture-led growth, strengthen resilience, and enhance private sector competitiveness; many of its activities have integrated agricultural technology solutions. The Bangladeshi government’s “Digital Bangladesh” initiative, which envisions the country transforming into a middle-income, digitally-based economy, underscores national policies and investments around digital development, including agricultural technology. As interest in digital agriculture solutions abounds in Bangladesh, a landscape of many actors and tools has emerged.

This study builds on a previous Feed the Future assessment of the digital agriculture ecosystem in 2018. USAID commissioned this assessment in order to build a deeper, up-to-date understanding and organization of the country’s digital agriculture landscape. USAID seeks to better understand the specific digital tools and technologies that exist in Bangladesh, with a focus on solutions that have reached a level of scale that can be leveraged across the Feed the Future portfolio to improve the reach of activities to the 28 million people in the Zone of Influence.

The terms “agtech” and “digital agriculture” are used synonymously in this report, as are digital “tools” and “solutions”. Per the instruction of USAID, any initiatives using mobile phones were considered relevant (e.g., a call center), as they use digital technology. The types of agtech with which technology users interact include apps, websites, SMS, interactive voice response (IVR) / outbound dialing, call centers, and radio. The content behind some of these interfaces relies on remote sensing and other technologies. The agriculture technology we focus on here is distinguished from what has traditionally been known as “agricultural technology” – referring to agricultural techniques that farmers can adopt for the cultivation, harvesting, and processing of crops that can be adopted by farmers – though agtech can be a means of spreading information about these strategies.

Following a description of our methodology, we present the findings of our assessment. We look at how the enabling technology environment has changed since the previous report, and then describe trends within Bangladesh’s agriculture technology industry – including the different purposes that the solutions aim to serve; the actors involved as tool users, developers, owners, and funders; the types of hardware used; geographies where tools are active; the types of results tools have achieved; and common challenges faced. We evaluate agricultural technology solutions along five key factors: i. Accessibility, ii. Data & Security, iii. User Experience, iv. Finances, and v. Growth Potential. This report is supplemented by a database of active digital tools in Bangladesh (Annex 1).

II. Methodology

A. Methods

Strategic Impact Advisors (SIA) commenced the study with desk research, reviewing the previous assessment conducted in 2018 as well as online resources. On March 11, SIA sent an online survey to 15 project implementers and 280 agribusinesses. Created in SurveyMonkey, the survey asked respondents to describe the digital agricultural tools they use. We received responses from five implementers and two agribusinesses.

In-person key informant interviews (KIIs) were planned under this assignment. However, with the declaration of COVID-19 as a global pandemic in the assignment's third week, and subsequent restrictions on both international and in-country mobility, KIIs were done remotely. SIA conducted 31 KIIs with institutions (program implementers, technology firms, agribusinesses, etc.) using remote conferencing between March 30 and May 7. For most interviews, we used a structured interview format, focused on the details of the digital tools that interviewee organizations use and, in many cases, had developed. The list of interviewed organizations is included as Annex 2 and the interview question set as Annex 3. In May, SIA sent follow-up emails to a number of interviewees to solicit additional details. Many, but not all, responded.

In-person KIIs with digital tool users had also been planned. Under the remote approach, we asked institutions to share phone numbers of some of their users with us. Two institutions provided them. Between April 20 and May 20, interviews were conducted via phone in Bangla with 16 individual users, including farmers, livestock service providers, and extension workers.

B. Limitations

Most of the information in this report is self-reported by the developers and owners of digital tools. Because SIA had very limited ability to independently verify the information, it is worth acknowledging that some answers could be skewed. In particular, some interviewees may have overrepresented the reach of their tools. Many tool developers and owners are actively trying to promote their tool, either to capture more users or funders, or as part of a general goal to promote their organization. In responding to an assessment conducted for Feed the Future, a major funder, it is likely that a number of respondents were incentivized to be overly positive about their tool.

It is also possible that user KII answers are skewed, as tool owners are likely to give numbers for the more active, positive users. SIA took this possibility into account when analyzing user feedback.

III. Findings

A. Enabling Technology in Bangladesh

Agtech tools rely on existing infrastructure and usage of enabling technology. This section offers a current look at three of these: mobile phones, mobile internet, and mobile financial services (MFS), with a focus on changes since the 2018 assessment.

i. Mobile Phones

Since July 2018, the number of mobile phone subscriptions in Bangladesh has increased by approximately 13.1 million to **165.6 million**.² Growth has occurred across all four mobile network operators (MNOs), and respective market shares have remained almost identical, as shown in Figure 1.³ Basic network coverage now spans almost all of the country; some delta islands in the southwestern most part of the country (Khulna division) remain without service.⁴

FIGURE 1

Mobile phone subscriptions

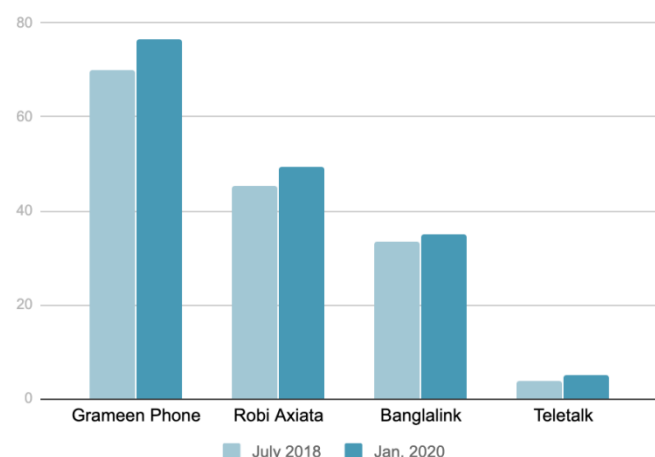


TABLE 1: Mobile ownership in Bangladesh

	Men	Women
Basic phone	19%	13%
Feature phone	31%	26%
Smartphone	36%	21%

GSMA's 2019 data in Table 1⁵ shows that 86% of adult Bangladeshi men own a mobile phone, versus 61% of women — a much larger gender gap than seen in most other countries, and just slightly a narrower gap than measured in Bangladesh in 2017 and 2018.⁶

While ownership of mobile phones did not change much between the two years, GSMA found significant changes to the most important barriers to ownership cited. Affordability has declined as a barrier, as has accessibility (e.g., network coverage). Family disapproval was also less often cited as a key barrier; though it was still cited by 11% of women as the primary barrier they face. Security-related concerns have remained low. Perceived lack of relevance is still a significant factor, though it declined by almost 50% among women. Skills remain a key barrier among both sexes. More women cite mobile use skills as a challenge, while men heavily cite reading and writing difficulties as their main skills challenge.

² This figure, roughly equal to the population of Bangladesh, is not the number of unique mobile users; some mobile users have multiple phones.

³ Bangladesh Telecommunication Regulatory Commission, btrc.gov.bd, accessed 9 March 2020.

⁴ GSMA Network Coverage Maps, accessed 21 May 2020

⁵ GSMA, The Mobile Gender Gap Report, March 2020

⁶ GSMA, The Mobile Gender Gap Report, February 2019

GSMA, The Mobile Gender Gap Report, February 2018

TABLE 2: IMPORTANT BARRIERS CITED BY NON-MOBILE OWNERS				
	2018 data ⁷		2019 data ⁸	
Do you own a mobile phone?	Men	Women	Men	Women
Yes	86%	58%	86%	61%
If no, which of the following are important factors stopping you from owning a mobile phone?				
Affordability: Handset / SIM cost	25%	25%	12%	8%
Affordability: Credit cost	10%	4%	2%	1%
Skills: Do not know how to use a mobile	25%	25%	19%	31%
Skills: Reading / writing difficulties	39%	24%	46%	21%
Relevance: Mobile is not relevant for me	25%	30%	24%	16%
Safety: Personal safety	2%	3%	2%	4%
Safety: Strangers contacting me	2%	5%	0%	1%
Safety: Information security	10%	3%	4%	2%
Accessibility: Battery charging	10%	6%	4%	2%
Accessibility: Network coverage	10%	6%	0%	5%
Accessibility: Family does not approve	19%	23%	6%	11%
Accessibility: Access to support agent	6%	2%	2%	2%
Accessibility: ID	10%	4%	6%	3%

Mobile phone data specifically around smallholder farmers is several years old; in 2016, 73% of smallholder farmers owned a mobile phone.⁹ The proportion has likely increased since then. As the barriers to mobile phone ownership decrease, we can expect to see mobile penetration grow to even higher levels in Bangladesh. Increasing mobile literacy could accelerate expanded mobile use, especially among women.

ii. Mobile Internet

Investment during 2018 and 2019 extended the footprint of LTE infrastructure,^{10,11} though limited rural 3G/4G coverage is still an issue cited by a number of interviewees. In total, Bangladesh has **95.2**

⁷ GSMA, The Mobile Gender Gap Report, February 2019

⁸ GSMA, The Mobile Gender Gap Report, March 2020

⁹ CGAP National Surveys of Smallholder Households, 2018

¹⁰ <https://www.budde.com.au/Research/Bangladesh-Telecoms-Mobile-and-Broadband-Statistics-and-Analyses%20>, accessed 9 March 2020

¹¹ Long-Term Evolution (LTE) is a standard for wireless broadband communication for mobile devices and data terminals

million mobile internet subscribers.¹² GSMA found that the proportions of men and women using mobile internet both increased by 3% from the 2018 data to 2019. There was a dramatic decline in the proportion of both women and men who reported that they did not use mobile internet because they do not think it is relevant for their lives, from 41% to 16%. The most commonly cited barriers are now handset cost and literacy difficulties; interestingly, a higher proportion of men cited these as barriers than women. After relevance, the most commonly cited barrier for women was disapproval of family.

As a mobile phone user, do you use mobile internet?	2018 data ¹³		2019 data ¹⁴	
	Men	Women	Men	Women
Yes	30%	13%	33%	16%
If no, which of the following are important factors stopping you from using the mobile internet?				
Affordability: Handset cost	16%	15%	21%	11%
Affordability: Data cost	13%	8%	9%	7%
Skills: Do not know how to access internet on a mobile	19%	8%	14%	10%
Skills: Do not know how to use a mobile	12%	9%	6%	4%
Skills: Reading / writing difficulties	25%	16%	20%	12%
Skills: Do not have time to learn how to access internet	9%	9%	12%	4%
Skills: Not sufficient support in learning to use internet	8%	7%	5%	4%
Relevance: Internet is not relevant for me	41%	41%	16%	16%
Relevance: Insufficient content in local language	10%	8%	6%	7%
Safety: Harmful content (self/family)	2%	9%	7%	9%
Safety: Strangers contacting me	5%	7%	4%	7%
Safety: Information security	4%	6%	3%	5%
Accessibility: Internet drains my battery	6%	2%	6%	6%
Accessibility: Network coverage	6%	5%	7%	13%
Accessibility: Family does not approve	4%	16%	4%	13%
Accessibility: Access to support agent	1%	2%	1%	1%

¹² Bangladesh Telecommunication Regulatory Commission, March 2020

¹³ GSMA, The Mobile Gender Gap Report, February 2019

¹⁴ GSMA, The Mobile Gender Gap Report, March 2020

Accessibility: Slow connection / Cannot do what I want	6%	6%	3%	4%
Accessibility: No access to internet-enabled phone	5%	4%	4%	2%

Mobile internet usage is expected to increase, as high-speed coverage expands, the cost of handsets goes down, and doubts over its relevance subside.

iii. Mobile Financial Services

There are approximately **30 million** active MFS accounts in Bangladesh, up from 21 million in early 2018. As of February 2020, 15 banks offer mobile financial services.¹⁵ The number has declined by three from 2016; several banks withdrew their licenses after finding that they could not operate in the market as hoped. bKash continues to dominate the market, capturing around 80% of market share.¹⁶ Much of the remaining market share is captured by Rocket, at 17%.¹⁷

A crucial aspect of MFS is the network of agents, through whom customers are able to make deposits and withdrawals, among other services. There are nearly 1 million agents deployed across the country.¹⁸ Agents are a critical part of the MFS ecosystem, and have proven to be one of the most effective service delivery channels for small-scale agricultural lending; Bangladesh Bank offers agents a 0.5% commission for each agricultural loan deployed to encourage outreach to the smallholder farmer segment.

While MFS have taken off for individuals and consumer-to-business transactions, business-to-business (B2B) transactions are still emerging. While electronic and card-based payments can be used for B2B transactions, the Bangladesh Mobile Financial Services Regulations did not allow for B2B transactions until 2018, and they have not yet been fully realized in practice. A number of agtech developers expect significant value could result from integrating B2B payment functions into their platforms.

The lack of interoperability between providers has been a challenge for MFS. In December 2019, the ICT Division and Bangladesh Bank signed an MoU to create an Interoperable Digital Transaction Platform. The platform is intended to allow a wide array of transaction types (including financial transactions, transfers, e-commerce, M-commerce, bill payment, merchant payments, remittance exchanges, machine-to-machine payments) across financial service providers.¹⁹ Such a platform would enable clients of financial service providers, including mobile money products, to transact from one provider account to another for a minimal cost, and would support agtech solutions by providing a more streamlined payment experience for their users. As of late 2019, the platform was expected to become operational within a year;²⁰ it is still pending at the time of writing.

¹⁵ Bangladesh Bank, <https://www.bb.org.bd/fnansys/paymentsys/mfsdata.php>, Accessed 8 May 2020

¹⁶ United News of Bangladesh, "Fintech MFS: Mobile Wallet for Easy Money Transfer, Payment & Savings in Bangladesh," 1 March 2020

¹⁷ United News of Bangladesh, "Fintech MFS: Mobile Wallet for Easy Money Transfer, Payment & Savings in Bangladesh," 1 March 2020

¹⁸ Mamun Rashid, "Financial inclusion: Banking going beyond banks," *The Daily Star*, 18 February 2020

¹⁹ *ibid*

²⁰ "MFS Interoperability in a year: Palak," *The Daily Star*, 10 November 2019

B. Agtech Tools and Stakeholders

SIA collected information for 43 agtech solutions; much of the information is shown in the public database of active tools,²¹ linked in Annex 1. All of the solutions included in the database are either in active use or being prepared for future use. Solutions that were not included in the full database are:

- Tools that were previously active but no longer have active users;
- Digital finance tools that may provide value to actors within the agricultural market system but are not specifically targeting them (these fall under the category of enabling technology, addressed in the previous section);
- Tools used only for internal monitoring and evaluation purposes; and
- Tools that were not identified through the course of this assessment.

Almost all of the tools were developed in Bangladesh.

i. Agtech Solution Categories

Many tools have multiple purposes; on average, individual tools pursued 2 of the eight product offering categories. Below is a summary of the tools and categories:



16 tools offer user-specific diagnostics: With data generally provided by photos or sensors, the solutions use human expertise or automated data processing to send farmers a diagnosis of an issue and prescribed remedy.



15 tools provide general agricultural advisory information: Static content that exists independently of shifting conditions, this information is generally focused on tips for effective cultivation of specific crops.



14 tools provide information and advice around shifting conditions: Most of these solutions have a weather forecast component; a smaller number provide current information around disease/pest outbreaks or market prices. The tools may also provide advice on specific actions to take.



11 tools offer market linkages: These tools help users identify and/or do business with providers or buyers. This category includes e-commerce platforms.



10 tools have supply chain management functions: These platforms collect supply chain data that helps agribusinesses make data-driven decisions, especially in areas like procurement and inventory. Enterprise Resource Planning (ERP) solutions are included in this category, as are Farmer Management Information Systems and Traceability functions; the latter two are still forming and will probably be more robust in a future landscape.

²¹ To protect commercially sensitive information and honor our confidentiality agreement with respondents, the public list of 31 tools excludes tools in development, in major decline, or with a failed proof of concept. Competitive and sensitive information has been removed.



9 tools include a significant data collection function: A number of respondents noted the increasing value of data on last-mile markets in Bangladesh, which has historically been difficult and expensive to obtain. In addition to commercial and financial data uses, some tools also collect valuable data for researchers and policymakers.²²



6 tools allow or facilitate financial services: Some tools integrate digital payments so transactions can be conducted directly, while others facilitate data for loan or insurance applications and selection. The number should be interpreted in the context of general mobile money tools being excluded from the list.



5 tools support value-added services for agriculture: These tools help providers organize and deliver services used by farmers, such as mechanization and veterinary care.

Some tools are made to target specific branches of agriculture. We found:



24 with specific content or design for crops



10 designed for livestock



6 targeting aquaculture

Most of those tools target only one branch, but several tools target two or all three branches.

ii. Agtech Stakeholders

This section profiles the types of agtech stakeholders in Bangladesh, including:

- **Developer:** Plays a lead role in conceptualizing and designing tools
- **Owner:** The ‘provider’ of the tool who ensures it is operational and maintained; may hold proprietary rights and receive revenues
- **Partner:** May support the development, operations, and/or promotion of a tool, technically or financially
- **Funder:** Provides partial or full, one-time or ongoing funding in the form of a grant, contract, loan, or equity investment
- **User:** The customer who uses the tool to support corporate or individual activities in agriculture

Many actors can play multiple roles; for example, an agribusiness can be a developer, owner, and user of agtech solutions.

²² Multiple implementers mentioned the use of mobile data collection tools for project monitoring and evaluation; however, these were generally only used for internal purposes rather than for the general agricultural system, and excluded from the database.

Women are underrepresented in many of the stakeholder groups. A combination of social norms, household and childcare responsibilities, and personal perceptions of safety mean women tend to be less mobile and involved in commercial interactions than men. While digital technology might seem to offer a promising solution, the underrepresentation of women as stakeholders in the agtech space means that products will rarely be designed for them. Below, we offer quick observations on gender in multiple stakeholder groups, followed by a longer analysis focused on women farmers.

The most notable change to the stakeholder landscape since 2018 is the **rapid growth in the start-up industry**. One player estimates that the number of start-up companies and enabling institutions have grown by a factor of 10 since then.²³ Institutions that support start-ups generally offer a combination of fundraising, networking, and mentorship opportunities.²⁴ Interviewees involved in this sector note that it is still in its infancy. Though investment in agtech is scant — with the exception of food e-commerce — multiple investors express significant interest in agtech. One speculates that they see fewer start-ups in agtech because they cannot be easily developed in the capital, Dhaka, but expects to see their prevalence grow as a result of the COVID-19 pandemic, as actors see a reliance on manual transactions limiting the efficiency of food distribution during a crisis.

FARMERS

As users: Farmers, especially smallholders, are often targeted users of digital tools. There is general agreement that smallholders have little willingness to pay for digital services — especially beyond modest amounts of network data — as they have been accustomed to getting information and extension services for free from government and NGOs. Because smartphone ownership is limited among low-income, smallholder households, many digital tools targeting smallholders are designed to work with basic or feature phones. Initiatives using an app may distribute smartphones and data to lead farmers,²⁵ who may be expected to share the information with farmers or even take on an aggregation role.

Gender: Women’s share of the agricultural labor force is estimated at over 50%,²⁶ but women’s roles in farming tend to differ from men’s. (See longer text box below.)

AGRIBUSINESSES

Diverse actors comprise the agribusiness category, ranging in size from individual agripreneurs to international companies, who work on the inputs and/or outputs sides of crop production. Large companies noted a lack of digitization in the supply chain, and some plan to digitize further once the smaller enterprises they do business with adopt more digital technology. As lack of data and transparency at the last mile compound challenges in doing business with smallholder farmers, multiple products are under development to improve supply chain data.

²³ Tina Jabeen, Investment Advisor, Startup Bangladesh, 7 May 2020

²⁴ These include: Bangladesh Angels, Bangladesh University Startup Accelerator, Grameenphone Accelerator, Robi Ventures (r-ventures), Startup Dhaka, and the government’s own incubator called Startup Bangladesh.

²⁵ Called “ICT Champions” by some programs

²⁶ FAO, *The State of Food and Agriculture 2010–11. Women in agriculture: closing the gender gap for development*, 2011.

As users: Agripreneurs such as livestock service providers, small traders, and retailers are more likely than smallholder farmers to use a smartphone; consequently, apps are more commonly developed for their use. They may also be engaged to help smallholders participate in online activities. A step larger than agripreneurs, small and medium enterprises (SMEs) are also targeted users of tools, especially those to support financial record keeping and access to finance. Large companies use off-the-shelf software products for finance and ERP. Some of the larger companies reported looking into using tools that have been developed in Bangladesh, but none said that tech companies have marketed to them. Tech companies, in turn, have cited a lack of IT budgets as a constraint in getting subscriptions from agribusinesses.

Gender: Women-owned agribusinesses are generally smaller than men's in terms of revenues and number of employees.²⁷

As developer-owners: Some large companies develop digital tools themselves that inform and engage others in their supply chain. Some are self-funded, while a number rely on donor co-funding to varying degrees.

CONSUMERS

As users: Some digital tools engage the end of the supply chain: consumers. Sometimes, consumers are linked directly with producers, or they shop in an online store. To date, these e-consumers are concentrated in Dhaka and are in the middle-upper economic strata.

Gender: It is in this category that women are estimated to form the greatest share of users.

TECHNOLOGY COMPANIES

As developer-owners: Tech companies that develop and often own digital tools are of different sizes and have different business models. Start-ups are increasingly prevalent in the landscape. This category also includes some consultancy firms with technology departments that develop technology to serve and expand their client base. Some IT firms may be contracted to build specific software pieces or functionalities of tools, but they are not an area of focus under this assessment.

Gender: One respondent estimated that 20% of tech start-ups are women-led. All of the tech companies behind tools in this assessment's database are run by men.²⁸

FINANCIAL INSTITUTIONS

As developer-owners: Mobile money tools developed and/or owned by financial institutions may facilitate lending or insurance arrangements.

As users: Many more financial institutions are intended users of tools that collect information on potential borrowers in the agriculture sector, offering an alternative data source that can be used

²⁷ Md.Shajahan Kabir, Mirjana Radovic Markovic and Dejan Radulovic, "The Determinants of Income of Rural Women in Bangladesh," *Sustainability*, 21 October 2019

²⁸ A possible exception could be argued with Win Miaki, which has a male CEO but female Chair.

during underwriting. Financial institutions may also integrate tools into their lending or insurance approaches; if farmers have the information to improve their crop or avoid damage, more loans may be repaid or fewer insurance claims filed.

MOBILE NETWORK OPERATORS (MNOS)

Key to the functioning of any mobile-based agtech tool, MNOs have multiple types of involvement. Their commercial incentive is likely to increase data use and build customer stickiness,²⁹ though some claim social impact is the primary goal.

As developer-owners: Some MNOs have (co-)developed and own their own agtech tools, such as Grameenphone's Smart Farm solution.

As partners: MNOs may offer free services of the tool to their subscribers, such as free calls to call centers, and may capture a share of the revenue.

GOVERNMENT

As developer / owners: The government of Bangladesh has developed many of its own digital tools. Other tools are developed by an NGO in collaboration with the government and then handed over to the government to maintain. The government is owner of an important foundational technology resource for agtech, the Bangladesh Meteorological Department, which uses satellite, radar, and other technology to generate the weather forecasts used by many tools.³⁰

As users: Uses for digital tools within government include support to data-based decision making and provision of information to the public. In addition, extension workers are critical government-employed users, as digital tools help them access information and communicate with farmers without in-person visits.

As funders: While the government receives outside funding for some of its tools, it also acts as a funder for start-up tech firms and new ideas – through Startup Bangladesh, housed in the ICT Division, as well as through the Access to Information (a2i) service's innovation lab.

Gender: In 2012, 7% of the extension staff at the Department of Agricultural Extension were female.³¹

RESEARCHERS

As users: Researchers are sometimes secondary users in the tools examined under this assessment. In one case, the research agenda became a major driver in the tool's rollout, which in hindsight is seen as a contributor to the tool's decline among intended farmer users.

²⁹ 'Stickiness' is the extent to which customers continue to use a particular company's product or services.

³⁰ The Department has also put out its own free, Android weather app, which gets a 4.4-star rating from 697 reviewers on Google Play.

³¹ Malone et al 2013 in M. Mamun-ur-Rashid, M. Kamruzzaman and Emad Mustafa, "Women Participation in Agricultural Extension Services in Bangladesh: Current Status, Prospects and Challenges," *Bangladesh Journal of Extension Education*, Volume 29, 2017, pp.93-107.

IMPLEMENTERS (NGOS)

As users: Many NGOs use digital survey tools to measure indicators among their beneficiary groups, in accordance with project monitoring and evaluation plans. Beneficiary use of digital tools can also generate additional data for implementers.

As developers: Implementers generally operate on fixed periods of donor-funded projects, though some have maintained ongoing digital platforms outside of project periods. NGOs generally look for a public or private entity to take over tools they develop as the long-term owner.

As funders: Some implementers act as funders by supporting other organizations to develop tools, generally as a sub-award under their larger project with a donor.

DONORS

As funders: Donors fund NGOs, agribusinesses, tech companies, and government in the development of agtech tools. The government's Startup Bangladesh initiative in the ICT division has served as a donor over the past three years by granting seed funding to start-ups of up to \$12,000 – with tranche disbursement tied to performance milestones. Donors vary in their restrictions of what they will fund and require grantees to report. Some developers choose not to pursue funds from more restrictive donors.

INVESTORS

As funders: Unlike most donors, investors generally require a robust commercial plan. Venture capital firms are emerging in Bangladesh, and some provide mentorship and networking support in addition to finance, but the sector is still nascent and has little engagement with agtech to date. Several agtech developers have secured venture capital from foreign venture capital firms. MNOs have also support and invest in start-ups, such as Robi's r-ventures 2.0. Bangladeshi angel investors offer another source of capital; some participate under the Bangladesh Angels platform, while others operate independently. At the time of writing, Startup Bangladesh is preparing to start making equity investments in start-ups, complementing its seed grants and non-financial incubation support.

Women and Agtech

A compilation of research found that the most common roles for women in agriculture in Bangladesh include:

- In **crop agriculture:** Nursery raising and seed sowing, weeding. All aspects of vegetable production. Harvesting and processing (threshing, husking, winnowing, parboiling, driving).
- In **livestock:** For cattle: Cleaning shades, feed collection and preservation, feeding, dung collection, grazing. For poultry: Collection of breeds, cleaning of shades, feed collection and preparation, treatment, feeding, egg collection and preservation, selling birds and eggs.

- In **fisheries**: Preparation and application of feed, fish catching, guarding from predators.³²

Across sectors, women tend to have limited roles in transactions — from purchase of inputs to sale of the harvest. Not only do women tend to be less mobile than men, but social norms discourage women from interacting with men outside of their family, and only a small minority of extension agents and agribusiness field workers are female. While digital technology could presumably bridge some of these mobility and social barriers and allow women to participate in more areas, experience shows limited impact to women’s agency when access to resources is addressed in a vacuum.³³ For example, an Oxfam’s PROTIC project found that giving Bangladeshi women smartphones and data packs was inadequate to ensure their access to the digital tools, as a number of their husbands took over as the household’s primary user of the device. In many countries, men tend to take the primary role in using agricultural technology. This report’s Enabling Technology section showed that women have reduced rates of ownership of all types of mobile phones and significantly less use of mobile internet compared to men. A multitude of factors influence whether women farmers will use agtech.

Among the surveyed tool developers and owners, most did not know the proportion of their users that are female; generally, they estimated that they comprise a very low proportion (e.g., less than 20%). For agribusinesses, the proportion depends on the gender ratio of employees. An estimated 7% of extension workers are female. The one area where women are estimated to form a majority of users was the consumer group; specifically, individuals ordering food for household consumption. This is unsurprising, given women are often expected to lead domestic responsibilities like meal preparation. Use of e-commerce may have an empowering role for these women as it reduces time spent in often high household workloads. However, for the time being, this e-consumer demographic is a middle-upper class urban population, outside the demographic of intended Feed the Future beneficiaries.

iii. Hardware

Digital tools can use a variety of hardware or form factors to collect data and reach clients. The database (Annex 1) shows the types of hardware each agtech tool requires or intends for its customers to use their service and sometimes to generate the information that it provides. These hardware can be as simple as a basic mobile phone or as complex as a satellite orbiting around the Earth. Some solutions use multiple types of hardware in order to reach different users with information. Agtech tools in the database use hardware across five categories:

1. **Basic/Feature Mobile Phone** (10 tools): The basic or feature mobile phone support USSD codes and calls; they are often used to deliver information services via SMS or IVR, and are the most typical digital gateway for smallholder farmers in Bangladesh. Tools that use basic/feature mobile phones can also be operated on smartphones.

³² M. Mamun-ur-Rashid, M. Kamruzzaman and Emad Mustafa, “Women Participation in Agricultural Extension Services in Bangladesh: Current Status, Prospects and Challenges,” *Bangladesh Journal of Extension Education*, Volume 29, 2017, pp.93-107.

³³ Wei Chang, Lucía Díaz-Martin, Akshara Gopalan, Eleonora Guarnieri, Seema Jayachandran, Claire Walsh, “What works to enhance women’s agency: Cross-cutting lessons from experimental and quasi-experimental studies,” J-PAL Working Paper, March 2020.

2. **Smartphones / Tablets** (30 tools): Many applications (“apps”) are designed for smartphones and tablets. Because access to these devices and high-speed networks is still limited for much of Bangladesh’s smallholder farmer population, findings that show that the majority of tools require smartphones or tablets may lead observers to question how well tools are designed for users. However, if smartphone usage increases in rural Bangladesh as rapidly as some expect, users will have a wide array of apps to choose from.
3. **Computer** (12 tools): Laptop and desktop computers can provide additional functionality beyond smartphones. This type of hardware is almost exclusively used in office settings (i.e., among companies, government, NGOs, researchers), enabling easier access and viewing of dashboards and platform management. (Tablets can serve as an alternative for computers.)
4. **Sensors** (5 tools): This category includes devices like weather stations (2), livestock tags (2), and vehicle tracking devices (1) that enable relevant data to be fed into an agtech tool in order for it to provide improved information and services to its clients. We did not find any uses of soil sensors. Overall, the prevalence of sensors among Bangladeshi agtech was lower than expected.
5. **Satellite** (2 tools): This category does not mean the agtech tool has its own satellites orbiting Earth, but indicates it is using images or remote sensing data from satellites to deliver relevant information that helps the agtech tool provide its service. While most of the tools that provide weather information get the data from other services that analyze satellite and radar data, two tools use satellite imagery themselves.

We did not come across any tools that use drones. This may change in the near future, as drones offer a unique opportunity to provide remote, up-close imagery at the individual field level and capture multispectral images. This technology is being leveraged for agriculture in a number of other countries, and Bangladesh’s legislation around drone use would not pose an obvious barrier.

iv. Product Lifecycle Phase

A tool’s phase in its life cycle provides important context for interpreting a number of factors, including its number of users, results achieved to date, finances, and outlook for growth. While products do not follow identical lifecycle trajectories, there are sufficient patterns that have given rise to a number of product life cycle models. For this exercise, SIA adapted common lifecycle phases, written below. Tools were assigned a current phase by SIA based on interviews.

Development (5 tools): The core product is under development, which may include prototype testing among intended users.

Introduction (14 tools): The core product is complete, likely in a minimum viable product stage, and is being rolled out to some users. Some changes to the product may be made based on user feedback.

Growth (8 tools): After demonstrating proof of concept (PoC) during introduction, the product is achieving or is poised for significant growth.

Maturity / Stagnation (5 tools): The product has likely reached the highest number of users it will see. (This may or may not be the total addressable market.)

Decline (5 tools): The product's user numbers are decreasing, or expenses that had been relied on for use of the tool are no longer being paid.

PoC Fail (1 tool): A failed PoC generally is realized during the introduction phase, when the tool does not see the level of uptake expected, and thus moves to inactivity (though some users may continue short-term use as the infrastructure remains active) instead of growth.

The numbers by phase indicate a significant pipeline of tools that are not yet at large scale but may be in the coming years. However, some tools in development and introductory phases may not achieve PoC.

Some tools currently in decline will likely be inactive in future years – just as some tools previously developed are no longer active at the time of this assessment. Decline is a standard part of product lifecycles. Some decline happens as users switch to tools that no longer meet their needs. Tools that depend heavily on promotion to keep users involved are more susceptible to decline, generally realized when budgets drop. Some private sector owners discontinue tools if they produce lower profit margins than expected. Several owners said their tools were intended primarily for research purposes without an intention to be sustained.

v. Geography and Scale

Many but not all tools target the entire country. Some start up in a particular area while others are launched for nationwide use. Some have intentionally limited geography, due to crop cultivation areas or the mandate of a specific initiative. Five tools originate from outside of Bangladesh,³⁴ and some Bangladesh-grown tools seek to expand internationally. The divisions in Feed the Future's zone of influence (Khulna, Dhaka, and Barishal) have the highest concentration of agtech tools with active users identified by this assessment. However, recognizing that the assessment unlikely identified all active agtech tools in Bangladesh, these results may be skewed by the assessment's emphasis on interviewing Feed the Future implementers.

TABLE 4: Tools by Division

DIVISION	Khulna	Dhaka	Barishal	Rangpur	Rajshahi	Chittagong	Mymensingh	Sylhet
# OF ACTIVE AGTECH TOOLS	27	24	23	20	19	16	15	14



















vi. Results

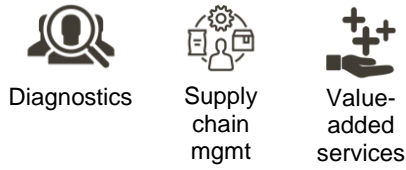
The Results column in the database reflects interviewees' responses when asked about the results or successes the tool has achieved. Most of the interviewees gave non-quantified summaries of results. They ranged from the frequent, vague statement, "Our customers tell us they are happy with the tool" (and similar variations) to specific changes, such as, "Those with no

³⁴ In addition, many agribusinesses use globally available tools for internal systems; these are not included in the database.

credit history can now access bank loans.” Absent quantities, the use of result statements is limited, but nonetheless they offer valuable insights into the types of changes that digital tools are making — and what types of changes matter to the tool owner. Other non-quantitative results by tool purpose are shown in Table 5.

TABLE 5: Non-quantitative results

SOLUTION CATEGORIES		RESULT		
 Diagnostics	 Value-added services	It has led to improvements in cattle health and production		
 Market linkages	 Supply chain mgmt	The user (company) finds it much easier to monitor their field team , and learn about and resolve issues more quickly		
 Market linkages	 Supply chain mgmt	A high volume of harvested crops has been transported using the system		
 Diagnostics	 Market linkages	 Supply chain mgmt	 Data collection	Field data collection has provided valuable insight into current market conditions
 General ag advisory	 Shifting conditions	 Market linkages	 Data collection	It has improved the profile of digital agriculture among policymakers
 General ag advisory	 Shifting conditions	 Market linkages	 Data collection	It informs other work , such as in rural entrepreneurship



It improves the knowledge, efficiency, and business of livestock service providers









Farmers are now cultivating new crops

Ten tools reported quantitative evidence of results. Among those, five shared operational results, including: number of new customers, increased use of mobile data, amount of funds lent, value of orders received, and amount of data for commercial use.








Three tools assessed behavior change among farmer users as a result of information they had learned from the tool. Those tools are focused on getting agricultural information to farmers; either general agricultural advisory, information on shifting conditions, or user-specific diagnostics.

TABLE 6: Quantitative impact results

SOLUTION CATEGORIES	BEHAVIOR CHANGE
 General ag advisory  Shifting conditions	37% of respondents reported that they had adopted recommendations
 General ag advisory  Diagnostics	65% of regular users report making at least one on-farm change
 General ag advisory  Shifting conditions	Among the initial farmers using the tool, 70% had a change in behavior

Four tools have quantitative evidence at the level of impact, as shown in Table 7.

TABLE 7: Quantitative impact results

SOLUTION CATEGORIES		IMPACT RESULT(S)
 Market linkages	 Financial services	Rice yields increased by 0.92 kg / decimal following product introduction. Participating retailers saw their sales margin increase 20-25%.
 Shifting conditions		Farmers using the tool experience an average yield increase of 15%. On average, the financial benefit to a farmer for using the tool is €200.
 General ag advisory	 Shifting conditions	The total estimated revenue that farmers would have lost without the forecast is higher than the amount invested in the tool to date.
 Diagnostics	 Value-added services	Use of the tool increases the rate of successful pregnancy in cattle from 50% to 78%.

Quantitative impact results like these are extremely useful in understanding the value of a tool. Unfortunately, their scant presence in the agtech landscape limits the conclusions and comparisons we can make about the potential impacts of individual tools.

vii. Challenges

Specific challenges for individual tools are included in the database. Challenges that arose multiple times among institutions included:

- **Limited digital skills of users.** Multiple interviewees cited very limited smartphone abilities among farmers, including in tasks like taking a clear photo. Some agribusinesses also found that staff skills were lower than expected, necessitating more training than planned.
- **Limited 3G/4G network coverage.** While most smartphone tools have some offline functionalities, the inability to use the entire tool in remote areas, where much of the work in question takes place, is a challenge for some tools. (Other 3G/4G users reported no challenge.)
- **Hesitance around digital adoption.** “Cultural change,” “procrastination,” and “fear of the unknown” were some of the specific barriers cited to digital uptake among agribusinesses — whether at the head of the company or among the staff.
- **Changing behaviors and relationships.** This was cited as a challenge within companies and among independent actors as, for example, field staff with low levels of digital literacy

are asked to use agtech tools, or farmers are encouraged to work with new intermediaries with whom they do not have a trust-based relationship.

- **Limited willingness to pay.** Beyond the general consensus that farmers are generally not willing to pay for agtech services beyond airtime, some developers were disappointed that they could not get agribusinesses or the government interested in subscribing to their service.
- **Limitations around donor funding.** Some private firms expressed frustrations with restrictions on the funding they received through donors like USAID. Inadequate time, bans on any investments that could be considered “commercial,” and intolerance of failure were cited as constraints that limited growth of commercial pathways.

The first two challenges were cited by a number of actors seeking to reach farmers as a reason for staying away from smartphone-based tools for now.

Interviewed users tended to mention few challenges, though our sample likely skews toward the more successful users. One tool has a misalignment between the owner and users around ideal use, with some implications for design.

C. Evaluating Tools

SIA selected five areas — accessibility, data & security, user experience, finances, and growth outlook — as key indicators for estimating the quality, scalability, and sustainability of digital tools. The sections below summarize the factors that go into each of the five areas and present summary findings from the assessment.

i. Accessibility

Explanation of Criteria

Accessibility to intended users is an important factor in a tool’s success. One aspect is financial and network access to the requisite technology; for example, apps require users to have a smartphone, 3G/4G network, and data. Bangladeshis vary in their access to these, especially by location and income level. Accessibility can also be evaluated relative to a user’s knowledge and skill level. If users do not have baseline skills that support quick uptake of the tool, training is a possible solution, but only if users and the providers are willing to invest the amount of time necessary. A significant accessibility gap also raises questions about the quality of the tool design process, per the Digital Development Principle to design with the user.

Summary Findings

Smartphones are significantly less accessible to smallholder farmers than basic or feature phones. Even if farmers are provided with a smartphone and data package, or they are connected with an “infomediary” (e.g., farmer ICT champion, retailer) with the hardware and digital skills, packages expire and infomediaries’ willingness to help may change. Access to 3G/4G coverage also remains a challenge — for farmers and for more advanced user categories. However, there is still value in quickening the expansion of smartphone use among farmers. Depending on the pace of change, apps may be significantly more accessible to farmers in the coming years.

Technological skill limitations were periodically cited as a challenge across tools — from those targeting farmers to agribusiness employees. Because even basic literacy can be a limitation

among marginalized populations like smallholder farmers,³⁵ tools with high audio functionality can be considered the most accessible.

The top tools in this category present very minimal potential barriers to access. For farmers, these are tools that use radio or require only basic mobile phones with audio options. Given the challenges of 3G/4G network accessibility in rural Bangladesh, smartphone apps are most accessible if their primary function does not rely on network connection. Websites are accessible if all their intended users are in office settings or are urban consumers.

ii. Data Protection & Security

Explanation of Criteria

Safeguarding of data and users' privacy is an important factor in evaluating the quality and responsibility of a digital tool, as recognized in the Principles for Digital Development. Tools that collect personally identifiable information (PII), such as a phone number or ID number that is linked to a name, should have clear protocols on how the data is collected and stored, what it is used for, security protocols (often with multiple levels), user management, and password security. Registration should occur on a closed database with user login requirements versus an open file format such as Excel or Google Sheets. Other benchmarks included whether the tool providers could discuss certain elements of security protocols, user management, and password security during the conversation. We also examined how data was being used, and whether there was informed consent on the part of the user.

Findings

A few self-reported answers from tool owners provide much less detail than could be collected from a data or security audit, but still allows us to draw some conclusions. We did not encounter any tools using customer data beyond what levels of consent have been provided, though this could still be occurring. For most of the B2B solutions, the data is owned by the client (i.e., agribusiness) using the solution, meaning the tool is merely providing a channel for the client to create and use data in a more organized way. Most tools that were collecting PII had some level of user login database; we did not learn of any using an open file format. Several tool owners told us they are compliant with the EU's General Data Protection Regulation (GDPR) standards.

A number of tools use well-known and highly secure cloud computing services such as Azure or Amazon Web Services (AWS), which build an additional level of confidence on security. Some tools were meant to create data that is shared with third party partners, such as financial institutions. For the most part, there was very little information provided on what data sharing agreements were in place; while these data sharing partnerships were planned, they had yet to be fully implemented. One tool shares financial record keeping data with lenders uses Salesforce data sharing protocols, which enables the service to assign access to data at a very detailed level.

A few interviewee responses around data and security were concerning. One product manager was unable to describe any details around the product's user security, while another told us that security concerns were not relevant for a product where it should indeed be a consideration.

³⁵ Bangladesh's adult literacy rate is approximately 74%. UNESCO, 2018.

iii. User Experience

Explanation of Criteria

A number of factors go into this category. User reviews on Google Play or similar sites are relevant where they exist. We considered the reported experience of users we could interview for five tools, including how they describe the tool's ease of use, value to their livelihoods, and if they are aware of a resource they can contact if they need help. Some tools have quantitative user feedback or results. We asked all tool owners about the availability of services to help clients (e.g., a customer help line), though they would be redundant for call center services. Reliability of the service is a relevant factor; if it gets shut off during challenging times, the user experience is hurt. Also, declining user numbers can reflect poorly on user experience; for example, if user numbers significantly drop because promotion campaigns have tapered off, the user experience may not be so strong. To a limited extent, we also used reported results to draw some inferences around user value and experience.

Findings

Six tools have user ratings on Google Play and other sites where apps can be downloaded and reviewed; ratings of tools on our database ranged from 4.3 to 4.7 stars out of 5. The 16 farmers,³⁶ livestock service providers, and extension officer users with whom we spoke were positive around the value that the tools offer.³⁷ Across the board, users reported that all five tools, which included smartphone apps, were easy to learn how to use. One tool has a misalignment between the owner and users around ideal use, with some implications for design.

Other tools have some level of quantitative user feedback or results indicate positive user experience. Eight of the tools have customer help lines, indicating ongoing commitment to customer experience.

Two tools had concerning suspensions of service during challenging times. One weather service discontinued messages before a cyclone, because the necessary audio content to inform users of the event did not exist — an action that may have impacted safety and agricultural production if users relied on it for exclusive access to weather information. An e-commerce tool that discontinued use during the pandemic, as its drivers were scared to go out. This may have caused disappointment among its users on both sides of the transaction during a time when demand for e-commerce was skyrocketing.

iv. Finances

Explanation of Criteria

Financial viability has major implications for a tool's sustainability. Almost every tool has ongoing costs;³⁸ following tool development, ongoing costs often include salaries of call agents and/or others responsible for sourcing content, web hosting, and maintenance, as well as expenses for promotion and customer acquisition. Benchmarks to evaluate finances would ideally be relatively straightforward, such as annual revenues for the past two years, average revenue per user, average customer acquisition costs, and net margins; however, this information is considered

³⁶ Some of the farmers are in "ICT Champion" roles, in which they are expected to support digital use among those in their community.

³⁷ The contacts the tool owners would have and share are likely to skew in this direction, compared to the general population of users.

³⁸ The one exception we came across was a Facebook group page.

sensitive and may not be shared. Moreover, a number of tools are not pursuing revenue generation models and seek to cover costs through donor funding.

For tools not earning sufficient revenue to cover their costs, we consider whether a reasonable plan exists to get there. If the developer is currently reliant on outside funding, is there a fundraising history that indicates acumen and ability to achieve buy-in on the tool's value? A portfolio of investment that includes private money (i.e., venture capital or angel investors) is a reasonable indicator for higher commercial potential, as these types of funding sources often conduct sound due diligence on the financial projections of a product. Donor funding can be an effective way for tools to stay active, though limited project funding periods and shifting donor priorities can leave tools vulnerable over the long term.

Findings

Interviewees were willing to discuss their financials to varying degrees of specificity. Some tools are bundled into organizational approaches, such as consultancy services or insurance products, and do not have independent revenue streams that can be evaluated in these terms. Of the 25 tools that are intended to earn their own revenue to cover their costs or make a profit, about half are currently earning revenue. Only two report a profit.

Among those without self-sustaining revenue, stated dependency on unsecured donor funding is a vulnerability. While donor funding can positively contribute to a tool's development — providing investment in riskier approaches or subsidizing vulnerable populations — reliance on donor funding raises concerns around over-dependency, especially when donor funding is needed to continue operation after the tool has been rolled out for multiple years.

One of our respondents had received funds from private investors in Bangladesh and Singapore, indicating a high degree of confidence in commercial viability.

Government tools are evaluated differently. Some tools get donor funding for development, with the government as long-term sponsor. Thus, their sustainability depends on government budgets and management decisions that extend beyond project funding periods. The government has maintained multiple agtech services for years beyond project funding, such as those run by the Agricultural Information Service. However, government requirements to keep their services completely separate from privately funded activities may miss some opportunities for economic efficiency.

v. Growth Outlook

Explanation of Criteria

As minimum benchmarks for growth potential, a tool should be able to handle growth in the number of users (i.e., in terms of bandwidth, finances) and should not be seeing user decline. We expect that growth will be highest among tool owners who have a plan for growth, with priority focus areas (e.g., geography, value chains, target customers) selected with some evidence-based rationale behind them. Ideally, tool owners will have a clear understanding of the total addressable market that they can and aim to reach, as well as competing tools and services also targeting that market. Secured partnerships and funding streams for growth are also a plus.

Findings

Some tools report negative growth in user numbers, indicating they are in decline. Often, reduced investment in the tool was attributed as a reason. A tool uninterested in growth — the owner

reported that too many users became too expensive — also does unwell in this category.

Most of the tool owners expressed an intention to grow, though many of these had surprisingly few details on their growth plans. Many could not clearly define their total addressable market. Because many talked about growth hand-in-hand with donor funding, it is possible that they intend to let donor priorities drive their growth strategies; still, more proactive landscaping and prioritizing could be useful for them and lead to more opportunities for growth.

Some tool owners did talk knowledgeably about their total addressable market, and a few were able to name specific segments and geographies that they plan to target for growth, based on indicators identified through their research. These institutions not only had clearly defined their potential customer base, but had also developed plans for how they were going to price and capture market share through the deployment of differing business models. One example was a plan to transition from customizable tech platforms, with limited scale potential, to off-the-shelf Software as a Service (SaaS) models.

Some tools are seeing high increases in use during the pandemic, while others are not. It is not yet clear how growth during this period will impact long-term growth.

D. Agtech During the First Months of the COVID-19 Pandemic

The COVID-19 pandemic is significantly impacting mobility and markets during the time of this assessment. Digital technology has received attention around the globe for its potential to allow economic activity and transactions to continue remotely, mitigating the impact of the 'shock.' While the KIIs did not focus on pandemic impact, SIA asked interviewees to describe the main impact and/or response of their business or digital tool. Through the compiled responses, we can get a glimpse into whether and how agtech might be improving the resilience of the agriculture industry, including farmers, during the crisis. It is also worth examining how resilient the agtech tools themselves are amid crisis and uncertainty. Most of the interviews were conducted within one to seven weeks of the start of Bangladesh's shutdown on March 22.

Unsurprisingly, some tools that allow consumers to make digital purchases online have seen a rapid uptick in use. Most of these are platforms that allow urban consumers to order food products digitally (demand is up to 4x pre-pandemic levels) but also includes an app for farmers to order inputs. However, there was no uniform response on farmer usage change for accessing information. One respondent reported significant increases in usage, attributed in part to city dwellers relocating to rural land they own during the pandemic and taking up farming. Another respondent reported a slight uptick in use, while yet another reported a decrease in use (calls). The latter has also scaled down service offerings, with fewer agent hours than normal.

Logistics and transportation is a key area affecting the agricultural market system and the effectiveness of digital tools specifically. As traditional in-person trading breaks down, an increased amount of harvested crop is not getting to market, as agricultural areas are saturated with unsold produce. This is another area with diverse responses — even among companies with internally-managed transportation networks. One respondent noted that they are essential business and have worked with the government to ensure proper permissions for their vehicles; another took a very different path and suspended services because the drivers were scared and the owner did not want to force them to work.

One respondent noted the value of their data collection tool to provide insight into conditions in hard-to-reach areas during this time.

A common impact of the pandemic on tool developers has been delayed activities in testing and rolling out new tools. One respondent noted a hold on in-person activities to promote their tools, such as fairs. Additionally, those reliant on private funds (such as user subscriptions or investments) have seen their financial pipelines freeze.

As of May 2020, the situation continues to evolve. SIA expects the future will bring further impacts and new responses and adaptations. For now, we can conclude that some tools are mitigating the impact of the COVID crisis and increasing resilience for some in the agricultural market system. We can also conclude diverse levels of resilience of the tools to continue operating during the crisis, which appear tied largely to the decision making of the people in charge of them.

There is optimism among some respondents that the results of the pandemic shutdown will lead to increased interest and trust among Bangladeshis in using digital services in the future.

IV. Conclusions and Recommendations

The sections below offer overarching conclusions and recommendations applicable to general stakeholders³⁹ by topic.

TOPIC: ENABLING TECHNOLOGY

Conclusions:

- Lack of understanding of how to use a mobile phone is the largest barrier to women's mobile use. Literacy challenges are also a key barrier for both men and women.
- The last couple of years have seen a dramatic decline in the number of Bangladeshis who think mobile phones and mobile internet are not relevant to their lives. Other barriers have also decreased. Combined with increasing affordability of smartphone handsets and expanding high-speed network coverage, potential to drive knowledge and behavior changes through mobile internet is growing.
- Multiple platforms enable mobile money, with bKash dominating the market. Mobile money solutions for B2B transactions are still emerging.

Recommendations:

- In order to accelerate mobile uptake in underserved areas, especially among women, consider building basic and digital literacy.

TOPIC: AGTECH STAKEHOLDERS

Conclusions:

- Tool owners report that many agribusinesses have limited willingness to pay for digital tools. On the other hand, the agriculture companies we spoke with had very limited knowledge of digital tools in Bangladesh and said they had not been marketed any Bangladeshi tools.
- Digital technology may have some potential to empower women in agriculture, as it can bridge some mobility and social norms challenges. However, differentiated roles (e.g., agricultural transactions are largely a male domain) and other inequalities (e.g., access to technology, authority over resources) will likely limit the degree women will benefit from

³⁹ Recommendations made specifically to USAID have been removed from the public version of this report.

agtech without other changes to their broader empowerment and agency. Women are rarely targeted users by commercial tech developers as they are underrepresented in roles for which the solutions are designed.

Recommendations:

- Maximizing women's use of and value from agtech requires significant effort to boost women's agency and empowerment, which should be pursued. In order to increase the use and value of agtech to women in their current roles and agency levels: 1) Reduce barriers to women's use of mobile technology, such as improving their confidence to use mobile devices, 2) Design tools for women in the areas of agriculture where they tend to be more active, such as seedling raising and sowing, processing, or feeding for livestock or fish, and 3) Engage women in the design and promotion of agtech wherever possible. For example, in tool design, incorporate women as farmers or use women's voices for audio at rates at least equal to men. In promotion, engage women in intermediary roles, prioritize participation of women in trainings, and hold discussions on the value of a woman using agtech in addition to her husband.

TOPIC: TYPES OF AGTECH

Conclusions:

- Among our surveyed tools, the most common solution categories are those providing information to farmers around cultivation – whether general or customized.
- Within the supply chain management category, the farmer management information system and traceability solution types are only just starting to emerge.
- The agtech landscape has a relatively low use of sensors, and no use of drones that we found.

Recommendations:

- Use of sensors and drones should be increased to keep Bangladesh's agtech sector apace with key capacities and innovations.

TOPIC: RESULTS

Conclusions:

- Some solutions have quantitative results; they range from the operational, behavioral, and impact levels. Four have impact-level results, which are around increased yields and incomes.
- Limited quantitative results available on the impact of individual digital tools presents a challenge to comparing their potential results.

Recommendations:

- Driving more quantitative measures around digital tools' outcomes and results – especially by third-party measurement – would contribute to a quality agtech environment in Bangladesh.

TOPIC: CHALLENGES

Conclusions:

- Frequent challenges cited by tool proponents include: limited digital skills of users, limited high-speed network coverage, hesitance around digital adoption, changing behaviors and relationships, limited willingness of intended users to pay for services, and donor restrictions. Any of these challenges can reduce the success of a tool, especially if they are inadequately considered in planning.

Recommendations:

- Consider and plan for the frequent challenges in agtech development. Emphasize designing with the users – even when designing for an anticipated future state with increased digital access and skills.

TOPIC: IMPLICATIONS OF TOOLS ENDING

Conclusions:

- Many agtech tools intend to alter users' sources of knowledge, individual behavior choices, and relationships with others in the market system. Thus, shutting down some tools could cause major disruptions to users' livelihoods and lead to loss of income. While failed proof of concept or decline may be natural parts of a product lifecycle, we came across several concerning cases where tools were shut down for other reasons.
- In addition to the damage these cancellations can do to users' livelihoods, the experience may damage interest and adoption of future digital products if they are expected to be short-lived.

Recommendations:

- Proponents of digital tools should prepare a plan – part of or separate from a sustainability plan – to reduce the risk of service interruptions amid unexpected events, and minimize negative impacts to livelihoods in case the tool is not sustained.
- Users engaged under short-term agtech research initiatives should be made aware upfront of the short timeline. Ideally, a sustainability plan would enable tools with a successful proof of concept to continue.

TOPIC: FINANCIAL SUSTAINABILITY

Conclusions:

- Most tool proponents want their successful solutions to continue long-term. However, we found a number of tools operating at scale with very uncertain futures without a pipeline or even concrete plan for future funding.
- Among tools intended to generate revenue, currently about half are actively earning revenue. Four of those are earning sufficient revenue to cover their costs; only two report profits. A number of tool owners reported that donor funding is important for covering costs until the tool reaches commercial sustainability.
- Dissonance exists between funders and some private firms that receive funding to develop tools. Private developers argue that producing an effective tool is not a linear process, but rather must allow for trial and error over time; this mindset can conflict with donors who are accountable for achieving targeted results in a fixed timeline. Moreover, private firms and donors (or their implementers) may conflict on what types of investments are appropriate for building a sustainable tool.

Recommendations:

- Agtech development projects should have a sustainability plan, which includes financial projections that highlight specific assumptions on how much of the total addressable market will be captured, expected fixed and variable costs of operating the tool, and revenues from the projected client base. Projections can change as the tool evolves and more specifics emerge, but there should be regular analysis of demand (i.e. target users' willingness to pay) for the final tool throughout the project period, to avoid development of a mature product with no sustainable market.

TOPIC: DUPLICATION

Conclusions:

- Some tools have very similar purposes and set-ups. Duplication is not necessarily a problem in itself, as multiple factors will determine which tools fail or succeed, and some competition can both increase quality and ensure other options exist if one fails. However, the landscape could get over-saturated with similar, unsustainable tools if non market-

driven incentives (e.g., donor funding, non-profit organizations' desire to be seen as cutting-edge) play too high of a role. We spoke with NGOs that noted an oversaturated market while talking about plans to create new tools themselves.

- Donor funding carries a risk of propping up tools that have lower quality and commercial prospects for success – crowding out the unsubsidized tool in the short-term and possibly leaving no long-term solution.

Recommendations:

- Before developing new tools, developers should identify the closest two tools that exist in the market and justify why developing a new tool is the best option. While replication is not necessarily negative, a successful tool developer will have a strong understanding of what else is active in the landscape.

Annex 1: Database

The public database of digital agriculture tools can be accessed at this [link](#). It includes a Definitions tab as well as the Tool tab.

Annex 2: Survey and Interview List

INSTITUTIONS

#	Date ⁴⁰	Organization / Company	Survey / Interview Participant(s)
Online survey respondents			
1	March 14	ACDI/VOCA - FtF Livestock Production for Improved Nutrition	Muhammad Nurul Amin Siddiquee, Chief of Party
2	March 15	WorldFish - FtF Aquaculture and Nutrition Activity	Jon Thiele, Chief of Party
3	March 19	International Maize and Wheat Improvement Center (CIMMYT)	Timothy Krupnik, Senior Scientist
4	March 19	Syngenta Foundation for Sustainable Agriculture	Md. Farhad Zamil, Country Director
5	April 30	Solidaridad Network	Mohammad Moziball Hoque, Sr. Manager of Supply Chain & Business Development
Remote verbal interview			
1	March 30	Grameenphone	Imtiaz Mahboob, Smart Agri Product Manager
2	March 31	Bangladesh Institute of ICT in Development (BIID)	Shahid Akbar, CEO
3	March 31	Bank Asia	Ahsan Alam, Senior Vice President and Head of Agent Banking
4	April 1	ACDI/VOCA - FtF Rice & Diversified Crops Activity	Cuan Opperman, Chief of Party
5	April 1	BRAC Bank (bKash)	Mehmud Ashique Iqbal, Deputy General Manager, Business Sales
6	April 1	Ispahani Agro Ltd	Fawzia Yesmeen, General Manager
7	April 2	ACI Ltd	Shamim Murad, General Manager, Digital Services Faiyeed Ahmedhul Hye, Sr. Manager, Digital Platforms
8	April 2	WorldFish - FtF Aquaculture and Nutrition Activity	Jon Thiele, Chief of Party
9	April 6	CARE	Tania Sharmin, Senior. Team Leader
10	April 6	ACDI/VOCA - FtF Livestock Production for Improved Nutrition Activity	Muhammad Nurul Amin Siddiquee, Chief of Party
11	April 7	Oxfam	Enamul Mazid Khan Siddique, Head of Climate Justice Fatema Janet, Senior Program Officer Tapas Chakraborty, Financing Coordinator

⁴⁰ For interviews that took place in two days due to time zones, the date in Bangladesh is provided.

12	April 7	Robi	Ahmed Armaan Siddiqui, New Business & M-Money Products
13	April 8	Syngenta Foundation for Sustainable Agriculture	Md. Farhad Zamil, Country Director
14	April 9	mPower	Mridul Chowdhury, Founder & CEO Shah Mohammad Mushfiqur Rahman, head of e-Ag
15	April 10	International Maize and Wheat Improvement Center (CIMMYT)	Timothy Krupnik, Senior Scientist
16	April 13	Win Miaki	Dr. Kashfia Ahmed, Chairman
17	April 14	Digital Green	Sadman Sadek, Country Engagement Coordinator
18	April 15	Field Buzz	Habib Ullah Bahar, Co-founder Alexis Rawlinson, Co-founder
19	April 16	Fish Bangla	Mohammad Ashrafuzzaman, Owner
20	April 16	iDE	Jeremy Davis, Programs Director - Agriculture and Food Security
21	April 21	Bangladesh SME Corporation Ltd (BSCL)	Azad Chowdhury, Head of Business Development
22	April 22	Parmeeda	Abu Darda, Founder
23	April 23	LightCastle Partners	Bijon Islam, CEO
24	April 26	Dept. of Livestock Services	Md. Shamim Hossain, Upazila Livestock Officer - ICT Section
25	April 27	AgroMars	Mahmud Hasan, Founder and CEO
26	April 28	Green Delta Insurance	Shubasish Barua, Head of Impact Business & Executive Vice President Ali Tareque Parvez, Head of Agriculture Insurance
27	April 28	Aspen Capital	Razi Amin, Founder and Managing Partner
28	April 29	Direct Fresh	Tanvir Sifat, Head of Strategy
29	April 30	iFarmer	Fahad Ifaz, Co-Founder and CEO
30	May 5	Agriculture Information Service	Mohammad Moziball Hoque, Sr. Manager: Supply Chain & Business Development
31	May 7	Startup Bangladesh	Tina Jabeen, Investment Advisor
Written correspondence only			

32	May 3	Bangladesh Venture Capital	Md. Mahfijur Rahman, Business Analyst
33	May 10	SEBA Limited	Iqbal M. Tanvir Ahsan, Senior Business Consultant
34	May 11	Metal	Amitave Paul, Assistant Manager of Business Development
35	May 19	Banglalink	Ankit Sureka, Head of Corporate Communications and Sustainability
36	May 20	Plantix / PEAT	Bianca Kummer,

INDIVIDUAL USERS

#	Date	Occupation / Role	Gender	Tool
Remote verbal interview				
1	April 20	Livestock service provider	Male	Sudhokko
2	April 23	Livestock service provider	Female	Sudhokko
3	April 23	Farmer, housewife ⁴¹	Female	Sudhokko
4	April 25	Livestock service provider	Male	Sudhokko
5	April 25	Livestock service provider	Male	Sudhokko
6	April 27	Farmer, ICT champion	Male	Shufola
7	April 27	Farmer, ICT champion	Male	Shufola
8	April 27	Farmer, ICT champion	Male	Farmer Query System
9	April 27	Livestock service provider	Male	Shurokkha
10	April 27	Livestock service provider	Male	Shurokkha
11	May 19	Farmer	Male	Fosholi
12	May 19	Sub Assistant Agricultural Officer	Female	Fosholi
13	May 19	Farmer	Male	Fosholi
14	May 19	Farmer	Male	Fosholi
15	May 19	Farmer	Male	Fosholi
16	May 20	Farmer	Male	Fosholi

⁴¹ Not a direct user of the tool, but is familiar with the tool and its impacts.

Annex 3: Standard Interview Questions

This is the standard list of questions asked in interviews. It was rarely followed exactly, given limitations around time and varying applicability to different types of tool interviewees.

1. What was the rationale for the tool's creation?
2. Who are the target users in Bangladesh, and how did you design for them?
3. Is it geared toward plant crops, livestock, fish farming, or all?
4. What institutions funded or invested in tool development? What is their current role?
5. Does the product integrate with other platforms in Bangladesh? (e.g., WhatsApp, mobile money)
6. Please tell us about user and data security.
7. Who owns the data that is collected in Bangladesh?
8. Are there any customer support services in Bangladesh? (e.g., a phone number to call with tech difficulties?)
9. How is the tool rolled out to users in Bangladesh? If training is a part of roll-out, what is the estimated training time? Do you supply any hardware to users?
10. How many active users does the tool currently have in Bangladesh?
 - a. Do you know how many of the users are female?
 - b. In what divisions of the country are there active users?
11. What notable successes / results has the tool realized in Bangladesh?
12. What challenges have you experienced in Bangladesh?
13. What funding / revenue are you receiving in Bangladesh? (Even if unwilling to provide amount, can sources and timelines be shared?)
14. What costs do you have in rolling out, growing, and maintaining the tool in Bangladesh?
15. Have you reached the point of positive margins in Bangladesh? If not, what needs to happen to get there?
16. What has your growth in Bangladesh looked like for the past few years, and what do you anticipate for it in the coming years?
17. How would you describe your total addressable market in Bangladesh?
18. What competitor digital tools are you aware of? How is your product differentiated?
19. How has the COVID-19 pandemic and accompanying restricted impacted use of your tool in Bangladesh?
20. Is there anything else you would like to tell us? Advice to USAID?