INITIATIVE ON Digital Innovation

WORKING PAPER

Inclusion in Agri-food Systems in Bangladesh: the Digital Innovation and Transformation Initiative

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INFO

Submitted 20 September 2023

Keywords Digital Divide in Agriculture, Gender Equality and Social Inclusion, Digital Innovation in Agri-food Systems, Human-Centered Design, Bangladesh Digital Connectivity

Flagship Inclusion Framework

Work Package Digital Inclusion

ABSTRACT

Agriculture has played a crucial role in supporting smallholder livelihoods in Bangladesh. Despite being actively involved in various stages of production, including seed sowing, harvesting, and post-harvesting, women's contributions are often undervalued. They are often regarded as a cheap labor force and are not given meaningful roles in the supply and value chains. One of the primary challenges they face is the lack of access to and ownership of land, which results in limited and unequal access to resources such as credit, services, markets, and information on modern technologies. These disparities hinder women's participation in market systems and further widen gender gaps and digital divides. Studies have shown that Bangladesh has one of the highest gender gaps in mobile internet usage among low and middle-income countries. This study examines the gender digital divide in Bangladesh, focusing on the reasons behind women's exclusion from digital information highways and their limited access to, use of, and benefits from internet-based agriculture and climate-related services and innovations. In addition to a comprehensive review of secondary data, we conducted a needs-based assessment using both quantitative and qualitative indicators in three divisions. Qualitative data were collected through focus group discussions, in-depth interviews, and key informant interviews. Both the qualitative and quantitative studies shed light on the social, economic, and contextual issues related to the digital ecosystem in the agriculture sector. The assessment also evaluates the effectiveness of public, private, and civil society interventions in the study areas. Our findings reveal that most digital initiatives fail to address the economic gaps and challenges faced by smallholder farmers, poor women, and rural youth. To address these challenges and promote gender equality in agriculture, it is crucial for the government to implement consistent policies across government agencies and develop strategies that prioritize closing digital divides in the agricultural sector.

1. Introduction

1.1. Background

Historically, agriculture has played a vital role in terms of smallholder livelihoods in Bangladesh. However, the sector's contribution to the GDP has been declining in recent years – 15.3% in 2014, nosediving to 11.6% in 2021 (Chowhan et al. 2021). There are several reasons for this decline, and it is recognized that reenergizing the sector will require addressing bottlenecks like the disproportionate rise of input prices, the influence of intermediaries, volatile market prices for outputs and the lack of inclusive improved technology, including e-literacy at the bottom rungs of food value chains. These

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Sarker, F.; Mamun, K. A.; Uddin, J.; Ahmed, S.; Nisha, N. A.; Joshi, D. 2023. *Inclusion in agri-food systems in Bangladesh: the digital innovation and transformation initiative*. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Initiative on Digital Innovation. 11p. https://hdl.handle.net/10568/137368

bottlenecks impact smallholder farmers, especially women and fail to attract private investment or promote market development. Women are engaged in production (from seed sowing, harvesting to post harvesting), yet their roles are undervalued – they remain a cheap labor force and lack any meaningful role in supply and value chains (Rahman et al. 2023). A primary challenge is women's lack of access to, and ownership of land, which leads to decreased and unequal access to related assets, credit, services, markets, and information on modern technologies. These inequities handicap chances for women to engage in market systems, which leads to a further widening of gender gaps and digital divides.

Women are inappropriately engaged in the agricultural value chain with low paid or unpaid work (harvesting and post harvesting). In the context of increasing digitization of agriculture, women have a small digital footprint. Bangladesh has the highest gender gap in mobile internet usage among 10 low and middle-income countries according to the 2022 GSMA Mobile Gender Gap report. It indicates that internet use is 36% for men compared to 19% for women. Various reports mention that women and youth can find it particularly difficult to engage with and benefit from mobile and digital tools, as these are often designed with a stereotype user in mind, which is often an adult man (GSMA 2022; Polar et al. 2017). Marginalized women and young people tend to have a lower access to assets (mobile phone access and ownership) than others.

Bangladesh is moving towards a 4th Industrial Revolution (4IR) in agriculture by increasing levels of privatization, private capital flows and investment in all levels of agriculture value chains. The exclusion of women from innovations in these areas will further the systemic, structural gender divide and impact improved resilience to climate change impacts.

This review of the gender digital divide in Bangladesh, supported by the International Water Management Institute (IWMI) aimed to look at how and why women are excluded from digital information highways and access to, use and benefits from internet-based agriculture- and climate-related services and innovations. Digital inclusion is not just about the internet or technology. It is about using technology as a channel to improve skills, to enhance the quality of life, to drive education and to promote economic well-being across all elements of society. This includes the freedom to access and use technology to contribute to social, political, and economic activities in daily lives by virtue of the choices or capabilities available.

1.2. Objectives

The focus of this review was to identify the Gender Equality and Social Inclusion (GESI) bottlenecks in Bangladesh in relation to the food, land, and water systems (FLW) and climate interventions. This report focuses on three specific issues:

1) GESI and the digital divide: Provide evidence-based data of the digital divide in relation to agricultural innovations and interventions, which includes digital infrastructure, digital ecosystems, and information systems.
2) Social norms, biases, and digital capabilities: Identify key gaps, including gender norms and biases, which impact the design and implementation as well as access to and use of digital innovations and interventions.
3) GESI and digital institutions and innovations: Identify the strengths and limitations of diverse digital stakeholders across agricultural food systems, including the design, development and implementation of digital innovations and interventions.

2. Data and Methods

2.1. Study Area

Our study targeted areas were in urban, rural, and semiurban locations (Figure 1), including three districts and four different divisions to give a representative overview. Dhaka was considered as the urban setting, as it is also the hub of key digital innovations. Adjacent areas included semiurban locations in Barisal District and rural locations in Kurigram District. One subdistrict of greater Mymensingh District was included in this study to analyse communities from the Garo, Hajong, Koch, Dalu, Rajbangshi and Banai ethnic groups.

2.1. Sampling Procedure

For the quantitative component, a multistage random cluster sampling procedure was applied for selecting study areas. In each of these locations, we conducted focus group discussions (FGDs), key informant interviews (KIIs), and in-depth interviews (IDIs) for the qualitative assessment.

2.2. Sample Size

For the quantitative survey we selected a total of 1,161 (434 female and 727 male) households, including at least three respondents (male/female/youth) from each household.

We used the following formula:

$$\text{Unlimited population: } n = \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2}$$

$$\text{Finite population: } n' = \frac{n}{1+\frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}}$$

where z is the z score = 1.96, ε is the margin of error = 5%, N is the population size = 600,000 estimated as farmers/people engaged with FLW and climate systems in one district (50% of people in agriculture), and $\hat{p}$ is the population proportion = 0.5.

In Dhaka city, we interviewed 85 respondents (10 from FGDs, 25 from IDIs and 50 from KIIs) from a wide range of institutions through FGDs, KIIs, IDIs and a knowledge-sharing workshop.

3. Key Findings

3.1. The Gender Equality and Social Inclusion (GESI) and the gender divide

More than 50% of the world's women are offline (ITU 2019). In South Asia, the mobile internet gender gap had narrowed significantly from 67% in 2017 to 36% in 2020, but then expanded to 41% in 2022 (GSMA 2022). More importantly, it is reported that 52% of young women globally have experienced some form of digital harm, and 87% of them believe that the problem is getting worse (Web Foundation 2020). This is important to consider in relation to reducing the gender gap in the digital ecosystem.

Bangladesh has undertaken several policy initiatives in relation to digitization. However, the gender gap in accessing digital technology is still high. Only 12.7% of households among the surveyed population had access to internet connections. Bangladesh also has the highest gender gap in mobile internet usage among 10 LMICs (GSMA 2022). In 2021 just after the COVID crisis, when the rest of the world had gone digital, the gap remained wide in Bangladesh. According to the GSMA Consumer Survey 2021, about 36% of men in the country used mobile internet services compared to 19% of women.

It is interesting to note that the electricity supply has increased significantly across the country. In the areas studied, 97.7% had electricity supply. However, according to the Bangladesh Multiple Indicator Cluster Survey (MICS) 2019, only 5.6% of households in Bangladesh owned a computer and only 37.6% of households had access to the internet in 2019 (BBS and UNICEF 2019).

Figure 1 Map of the study areas in Bangladesh

The BRAC Institute of Governance and Development (BIGD) conducted a nationally representative survey with 6,500 rural households in eight divisions to understand the access to and use of ICTs among rural people (Shadat et al. 2020). The survey revealed a stark digital divide between rural men and women. In the survey, each household identified the most digitally enabled member among all the members; 63% of households identified a man as the most digitally enabled person, twice as many as women.

In terms of mobile phone ownership, Bangladesh has a 29% gender gap in the ownership of the devices which means women are 29% less likely than men to own a mobile phone (GSMA 2020). A persisting gender gap is said to impact Bangladeshi women in multiple ways, including in human (health) capital development (Ahmed et al. 2021). Our survey findings corroborate this data. Overall, 73% of female respondents in our survey had never accessed internet-based information compared to 62% of male farmers. Only 70.05% of women owned a mobile phone, compared to 92% of male respondents. The percentage of mobile phone ownership varied across districts. Furthermore, 9.5% of women had never used mobile phones compared to men (4%).

Among the three districts, Kurigram internet access varied significantly between men (35%) and women (10.5%); while

Barishal reported more equitable access with little differentiation between men (33%) and women (32%). In Mymensingh, where ethnic minorities are a majority, access to internet-based information was lowest at 24% for men; and lowest for women at 9%. This implies that access to internet services is shaped by geographical location (urban, peri urban and rural) and other socioeconomic barriers. While access to information via mobile phones was high (91%), internet access was much lower at 28%. Gender, class, and ethnicity influenced both access to mobile phones and internet connectivity.

Otherwise, 70% of the female respondents and 92% of the male respondents reported owning a mobile phone. There were local variations. However, only 12% of women had access to a smart phone compared to men (33.6%). Also, most women had started to use digital devices about five years ago on average while most of the men had done so 15 to 20 years before on average.

A recent study on gendered digital divides between male and female youth (aged 15–30 years) in Bangladesh noted that on average, 46% of young women had a mobile phone compared to 79% of young men (Raihan et al. 2021). However, this assessment did not include variations across age cohorts, rural –urban divides and distinctions by class and poverty. These divides have wide-ranging impacts. According to an article published in the Business Standard in 2023, only 7% women use mobile banking through their own internet mobile accounts.

There is little training available on the use of e-technologies. Only 12% of female respondents reported using their mobile phones for e-learning, and an even smaller number (2.3%) had had training on using internet-based applications compared to men (15.5%). In Kurigram District, 94.5% of female farmers had never had any form of mobile or computer e-learning or training.

It is thus not surprising that only 9.5% of female respondents reported feeling comfortable in using digital devices against 74% of women who had not used or were unable to use digital devices, especially smart phones.

The 2022 GSMA report on the mobile phone gender gap noted that 29% and 52% of women in Bangladesh were less likely to own a mobile phone and use the internet, respectively, compared to men. According to the joint Time Use Survey report 2021 (published in June 2022) by the Bangladesh Bureau of Statistics and UN Women Bangladesh, only 21% of internet users in Bangladesh were women, while men accounted for 35%.

3.2. Social norms, biases, and digital capacities

The ability of women to engage in, access and benefit from new digital innovations is influenced by deep-rooted power structures and gendered social norms. Firstly, key actors, for example, seed, fertilizer and pesticide suppliers, traders, processors, transporters, wholesalers, retailers along the agriculture supply and value chains are men. Influences of gender and social norms at household and community levels act to prevent women from engaging in these essentially male occupations. Second, as discussed above, internet and digital access has often negatively impacted women, putting them at risk, which shapes social behaviors and attitudes both among women and men.

Our data show that both female (68%) and male (65%) respondents lacked awareness of online privacy. Only 35% of the respondents used passwords to protect their digital devices. Regardless of this lack of privacy, 60% of the male farmers used Facebook, YouTube, WhatsApp, and other common social media apps, whereas 81% of women had never used a mobile phone to upload content on social media apps. This finding echoes other data, that show that the Facebook (Meta) users in Bangladesh in 2022 were predominantly male (68%) compared to females (32%).

The biggest barrier to internet access was the cost associated with it. Most of the respondents of this study lived below the poverty line and hence could not access digital services. Notably, 71% of respondents reported that the cost of digital devices and online resources was unaffordable; 80% of female farmers were unable to afford devices and internet access against 63% of male farmers. A key issue was also the lack of mobile financial services, which facilitate access to digital services. The GSMA study (2020) identified five major barriers to the digital divide represented in Figure 2.

Information is accessed through multiple ways: through radio, television, mobile phones, internet-based websites, neighbors, friends, families, retailers, community groups, agricultural extension officers, NGOs and so on. In the case of women, engagement and information sharing is shaped by factors such as cultural restrictions, domestic care responsibilities or male control on mobility. Nonetheless, women mostly access information through friends, neighbors, and family, even though their access to external actors is lower than that of men. About 22% of women reported access to the internet (through family members). However, youths (15 to 30 years of age) had a much higher access to the internet (51.5%). Here

too, access by young men was higher (62%) than that of young women (34%).

Female farmers (71.5%) lagged behind male farmers (47%) in making purchases online. According to the Bangladesh Bureau of Statistics (BBS) survey, poverty was a key reason behind the low usage of internet, cell phones and smartphones in rural locations in Bangladesh. However, Dhaka had the maximum users of computers, the internet, mobile phones and smartphones. It is interesting to note that more women (89%) than men (83%) wanted to learn about using digital services.

Ethnic divides and geography create additional barriers to digital connectivity. In the Garo community, mobile phone access for women is extremely low at 9% compared to elsewhere. Garo men also lag behind Bengali men in terms of accessing mobile phones. Even though the radio is considered a potentially strong media option in Bangladesh, the findings showed a decline in radio use of 42% in 1998 which dipped to 24% in 2002 (Associates for Company and Population Research 2002). In this study 28% of respondents reported accessing the radio for information and a much higher percentage (74%) reported information access from television. The survey showed that women also had lower access to information through the radio (17%) as well as the internet (22%).

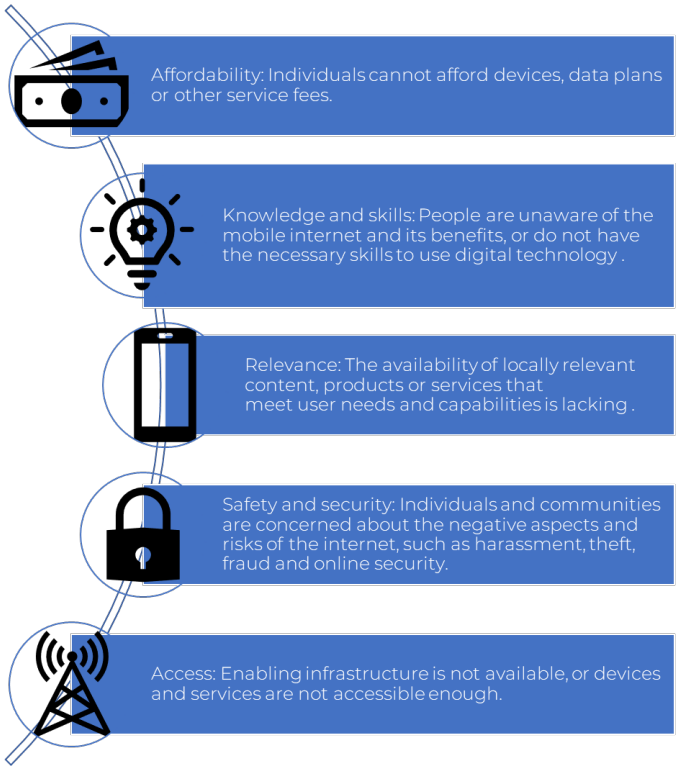

Figure 2 Five major barriers to the digital divide (Source: GSMA, 2020)

3.3. GESI and digital institutions and innovations

Historically agriculture has sustained livelihoods in Bangladesh. However, the agriculture sector is seeing a declining contribution to the GDP – 15% in 2014 that nosedived to 11.6% in 2021. The biggest bottlenecks are the rise of input prices, more intermediaries, volatile market prices, the lack of literacy, especially e-literacy at the bottom of the pyramid for receiving the benefits of mobile-based apps and services. Women are sub optimally engaged in the agriculture value chain with low paid or unpaid work (harvesting and post harvesting) and fail to gain meaningfully from agriculture value chains. According to the GSMA 2020 study, the gender digital divides are key to establishing a gender divide in agriculture.

The potential impact of ICT on agriculture is enormous. In Bangladesh, agriculture provides 40% of employment and provides food security and nutrition for 170 million people, while 63% of agricultural labor is women with 27% participation in the crop production cycle.

The 2009 launch of the Digital Bangladesh program focused on transforming the country into a digital economy by 2021. The National Information and Communications Technology Policy (NIP) is a key legal framework for Bangladesh's 'Vision 2021' and 'Digital Bangladesh' and is based on three distinct criteria: ICT access, use and skills. However, the policy is techno-centric and does not comprehensively address the structural issues associated with digital inclusivity and the gender digital gap (Aziz 2020).

Aligned to this vision, several digital innovations were developed in the agriculture sector in Bangladesh. These included: iFarmer, 7676, e-Farmers' Hub, Parmeeda, KhaasFood, Fish Bangla, Chaldal, Krisaker Janala, Fosholi, Kisan Diary and so forth. Digital innovations can inspire more youth to develop their careers in the agriculture sector (Ng et al. 2021) including programs by NGOs, the private sector and local government. Some examples of digital innovations in Bangladesh include the Gonokendras of BRAC, D.NET-Pallitathaya Kendra, GP-Communication Information Center, RDA (Bogra), Dam (Gonokendra), Ghat-Rural ICT Center, YCMC, (Youth Community Multimedia Center), RTC of Practical, Action, Amader Gram of BEFS , BNNRC, Bangladesh, Computer Council, AIS of the Ministry of Agriculture, Hridoye Mati o Manush by Channel–I and Coast,

Support to ICT, task force program launched by the Ministry of Agriculture (MOA).

The Government of Bangladesh has developed the e-Krishi Vision 2025, National Agricultural Policy 2018 and 8th Five-Year Plan (2021-2026) for successful implementation of digital systems in the agriculture sector. However, gender inequalities persist in the agricultural food system and digital innovations have not been inclusive for everyone.

The ICT wing of the Department of Agriculture Extension (DoAE) has detected that various problems arise when banks disburse incentives among eligible farmers. Given this constraint, the government plans to start a project to introduce 'smart agriculture' cards for farmers. They will serve as farmers' digital identity or their individual digital profiles. The smart cards will ensure area- and demand-based agricultural services for each farmer. By digitally checking on farmers' personal details vis-à-vis those related to their farming needs, people at the concerned department could generate the information of farmers' requirements and could take immediate action. At the initial stage, the digital profiles will cover 16.2 million farmers out of 50 million farmers. Smart agriculture cards will be first issued in 14 agricultural regions. The cards will be based on a district's geographical profile. The plan is that this will allow the DoAE to communicate more effectively digitally wise with these 16.2 million farmers.

Farmers across Bangladesh rely on intermediaries for selling agricultural products. For almost every agricultural product, from fish to livestock to vegetables, there are some five to seven layers of intermediaries between farmers and consumers. While the intermediary-driven supply chain increases the price for consumers, farmers do not benefit from these benefits. Limited access to information and finance often leads the intermediary to form a monopoly that deprives farmers from getting a fair market price for their produce. This is one reason that influences male outmigration from agriculture. The Ministry of Agriculture, through its Department of Agricultural Extension (DAE) employs 15,000 extension workers; there are around 2,400 field officers for the Department of Livestock. The task of these staff should be to make agricultural information more accessible to producers, but these actors do not all have access to modern communication devices, and there is no plan to equip them as such. A selection of relevant e-interventions in Bangladesh are discussed in Appendix A.

4. Conclusion

The study findings indicate that the systemic and structural biases that affect agricultural food systems are also present in digital innovations in Bangladesh. Firstly, there is a significant digital divide. Poverty and the lack of digital infrastructure in certain areas affect smallholder farmers and marginalized groups, especially ethnic minorities. While Bangladesh achieved a significant milestone in 2022 with 100% electricity connectivity and high mobile phone connectivity, access to the internet remains much lower (e.g., 38.9% at the beginning of 2023). Similarly, there is limited access to smartphones among smallholder farmers, particularly women and marginalized rural populations. Marginalized women, youth, and ethnic minorities face challenges in bridging the digital divide. For women, access barriers are further shaped by social norms and the unfortunate reality of cyber violence and exploitation. In other words, the gender and social exclusion significantly contribute to the digital divide.

The GSMA 2022 report reveals that women in South Asia are less likely to use mobile internet compared to other Low- and Middle-Income Countries. Surprisingly, while mobile data use increased globally during the COVID crisis, the gender digital gap in the region, including Bangladesh, widened instead of narrowing. It is crucial to acknowledge that systemic and structural gender biases are the reasons why positive factors such as access to electricity and lower costs of mobile devices have not led to increased digital connectivity for women. In Bangladesh, patriarchy acts as a significant barrier to women's mobile access and use, as social norms require male approval and monitoring, especially for mobile data usage. The reality of cyber violence has further exacerbated this structural barrier. It is not surprising that the majority of women respondents in our study still rely on social connections and networks, such as family members, friends, and neighbors, to access information. Unfortunately, none of the women respondents reported using mobile devices and digital data for agriculture-related purposes.

We highlight the issue of deep-rooted social norms and barriers because we also observe a lack of user-centered, human-centric design approach in digital innovations related to food systems in Bangladesh. In conclusion, digital innovations are not solely about infrastructure and technology; they should also prioritize human well-being and development. This means technology design that recognizes and accommodates social heterogeneity and diversity, as well as design that empowers individuals and enhances their decision-making power and digital literacy, especially for

those who are "still left behind."

One key finding from this study is the absence of a human-centered design approach in digital innovations and interventions in Bangladesh, as well as a disconnect between the digitization process in the country and its adoption and integration in key sectors, including agriculture. Our findings indicate a systemic gap between the traditionally led and subsidy-driven food-water sectors and the digital innovations, which in Bangladesh, involve significant private sector engagement and leadership. Balancing these approaches is a complex task, but the lack of complementarity will continue to impact the progress of digital innovations in relation to food systems and food security.

Acknowledgement

The authors would like to thank all the respondents from the different research locations for their contribution to this research endeavor. The team would also like to thank the Department of Agricultural Extension (DAE), Ministry of Agriculture (MoA), Ministry of Water Resources (MoWR), Ministry of Land (MoL), Access to Information (a2i), Bangladesh Institute of ICT in Development (BIID), Syngenta Foundation, Light Castle Partner (LCP), Cordaid and Bangladesh Agriculture University (BAU) for valuable suggestions and inputs during the process of research and during the stakeholder workshop. The team is grateful to digital ecosystem stakeholders of agrifood systems in Bangladesh for participating in the workshop organized by the team and for their valuable feedback. The information and data provided in this report are based on secondary and primary research conducted by the team, who remain solely responsible for any technical or other errors in this report.

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Appendix A. An overview of the FAW-relevant e-interventions in Bangladesh

Bangladesh e-Krishi Vision 2025, National Agricultural Policy 2018 and 8th Five-year Plan (2021–2026)

The impact of ICT on agriculture including increase in internet connections coincided with increased yields to 41 million tons in 2018 from 27.28 million tons in 2006. This was a key driver for the Government of Bangladesh to work towards these strategies for successful implementation of a digital system in the agriculture sector. However, localized challenges including gender biases are not coherently considered in these strategies.

Bangladesh Agro-Meteorological Information (BAMIS) Portal

The BAMIS Portal is a dynamic web portal developed under the Agro-Meteorological Information Systems Development Project (Component C: BWCSRP), DAE for disseminating agrometeorological services and other related information to different users especially to farmers in Bangladesh.

Public–Private Partnership (PPP) model

The government has initiated the PPP model to expedite ICT infrastructure and public services development, and consequently the shares of ICT investment have been increased from around 2% to 6% of the country's GDP (GSMA 2020). The National ICT Policy (NIP) has become a flagship regulatory framework for the digital agenda in Bangladesh. As a policy promise, there is an extensive network of 4,500 Union Digital Centers (UDC) across the country designed to ensure rural empowerment and inclusion (ITU 2018). Developing women friendly digital centers is an issue.

Digital Village Initiative by FAO

There are 60 digital villages across Barishal, Rangpur and Cox's Bazar. The centers also serve as information exchange hubs for farmers. They are operated by producer organizations which run 57 virtual call centers to aggregate produce for collective marketing and facilitation of bulk procurement of agricultural inputs. Digital agricultural schemes have gained international awards and left a positive impact on local farming communities and farmers. This has made the farmers' lives much easier. But these types of virtual services are not sustainable eventually as they lack trained operators and funding to continue the services.

Digital Land Management

The Bangladesh Government has fully digitized the land management system of the country. Digital technology is being used in all areas of land service including online Khatian (record of rights over the land) collection, inheritance calculators and online databases. The Ministry of Land (MoL) has developed a helpline with a call center, a land service portal, and a union information center for e-namjari, e-mutation and e-Porcha/Kathian. The target is to achieve 60% of citizens working by themselves from home online by 2026. This is now at the pilot stage in 17 districts and will take time to cover all districts. A minimum level of education, access to the internet and a smart phone are needed to access the services.

Climate Resilience

The Department of Agriculture Extension, Ministry of Defense and Ministry of Water Resources are working together on a project to provide timely information about climatic conditions, water, and flood events. The department plans to identify and train farmers' group leaders from every district, with a focus on 25% of these leaders being women. Last year, the department's Flood Forecasting and Warning Center (FFWC) under the Ministry of Water Resources sent more than 10 million messages to people electronically. But access to smart phones with internet connections is required to avail the services.

i-Farmer

i-Farmer is a one-step solution for local farmers to get access to microcredit from institutional financial services (Figure A1). This service is intended to catalyze the linkage between farmers and financial institutions. Training is also arranged for farmers through government and private sector support. As farmers receive credit through this platform, the access to and use of inputs is ensured that leads to greater production. i-Farmer is also developing new agricultural insurance products,

Figure A1 iFarmer business model

Figure A2 E-Farmer business model

Figure A3 Deshi farmer business model

satellite and sensor-based advisory services and farm mechanization services. Services are provided for farmers, input dealers and others across the food supply chain. More than 90,000 farmers have been registered on the network. All services are designed to make farming profitable. To digitalize the agriculture sector and the total supply chain, two apps Sofol and KRI-shop have been launched which can be operated both online and offline. To attract women farmers to sell their produce in the market, i-Farmer has launched doorstep market services – the i-Farmer agent buys their products from their doorsteps and sells them to the market.

E-farmer

E-farmer provides banking services at home to farmers. Besides IoT-based farm management, crop assessment, intelligent goods and settlement services, connection to input and output marketplaces and agricultural fintech services are also under planning in e-farmer services (Figure A2). E-farmer has mainly targeted the women of households for providing loans. The experiment shows that women are more trustworthy and responsible in returning installments than men. A substantial portion of women farmers is directly linked with postharvest operation in Bangladesh. E-farmer is trying to engage this majority with markets and to provide them with necessary financial support through banks.

Integrated Precision Agriculture and Engineering (iPAGE)

iPAGE Ltd is one of the Agritech startups working to address information imparity and deliver value-added data to the farmers and relevant stakeholders in the agricultural industry in Bangladesh. iPAGE provides site-specific crop management support to farmers through precision agriculture.

Deshi farmer

Deshi farmer sources agricultural products directly from farmers and gives doorstep delivery to businesses through the data- and technology-backed supply chain (Figure A3). The entire process takes 12 to 16 hours. It is an easy-to-use online agricultural marketplace that gathers farming communities in one place to offer buy/sell services whenever and wherever. It connects farmers, lead farmers, traders, suppliers' institutions for boosting agricultural trading, waste is reduced, and transparency is introduced to the value chain. Deshi farmer already has 21,000 registered farmers under its service. At the field level, participation of women is extremely low. The program plans to pilot initiatives to connect women at the market level.

Agroshift

Agroshift has designed a farm-to-table model through its controlled supply chain by removing intermediaries. Agroshift helps farmers sell their produce to businesses and consumers by providing a technology enabled supply chain merging the physical and digital worlds for a 'phy-gital' business model which takes care of demand aggregation, sourcing, and delivery (Figure A4). The target customers are garments workers, 61% of whom are women. Agroshift has its own software system, where all of the selling and buying procedures are done online. It has agents at every selling point to operate. There is no gender-specific criterion. There is no fixed ratio for men, women, and youth. Anybody can buy and sell through the platform.

WEGRO

WEGRO is a technology-based agricultural startup that is working towards revolutionizing the archaic agriculture industry by integrating the latest technology in all aspects of the agricultural supply chain (Figure A5). Through the integration of technology, WEGRO is ensuring that farmers have access to the required finance and end market and incorporates quality consumable inputs and modern agriculture knowledge in their farming practices. By equipping the farmers, agriculture facilitators and partner traders with technologically advanced resources, WEGRO brings an innovative flair to an otherwise archaic agriculture supply chain and hence, is improving the efficiency and

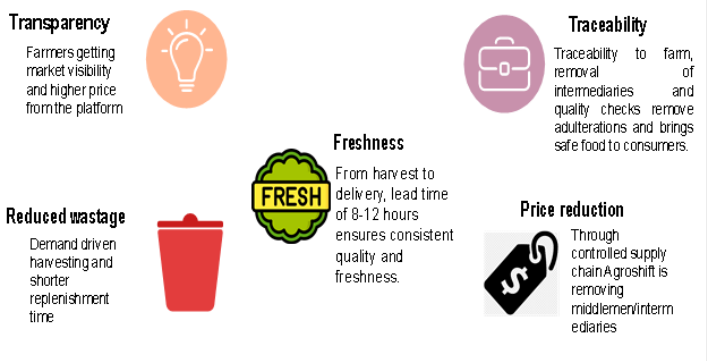

Figure A4 Agroshift business goals

Figure A5 WEGRO business model

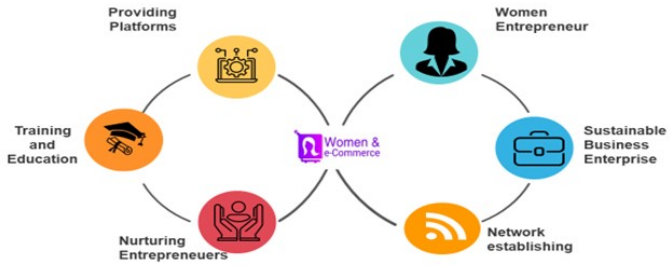

Figure A6 The WE model

Figure A7 The Krishoker Janala application

effectiveness of all the activities in this value chain. Approximately 1,000 farmers are using WEGRO of whom 60% of are female. WEGRO draws investor attention to investing in farm business and helps farmers to produce the best quality products under its advisory services.

Women & E-commerce Forum (WE)

This is specifically designed to address the needs of female entrepreneurs (Figure A6). WE's goal is to help female e-commerce entrepreneurs to sustain their businesses and empower them. The forum provides a platform for women for discussion and exchange of ideas. WE gives training and education to women entrepreneurs to overcome challenges through professional development workshops. Currently 400,000 women entrepreneurs are connecting with WE.

Krishoker Janala

Krishoker Janala (farmer's avenue) is a smartphone application and directly an outcome of the Digital Bangladesh vision (Figure A7). By uploading photos in the app related to crop diseases or attacks of insects or fertilizer-related problems, one can get instant solutions from the app. The app can run on a mobile, laptop or desktop computer. Any kind of farm-related problem can be found on this app. It also addresses farmers' challenges in accessing agricultural extension offices.

Fosholi

Fosholi provides digital platform advisory services for farmers in both static and dynamic form (Figure 10). The platform is designed to enable farmers to become smart farmers. Its services are broadly classified into the areas of Pre-Cultivation, Cultivation, Post-Cultivation, Weather Forecast, My Crop, Knowledge Bank, Farmers Toolbox, Reach to Extension etc. Over 105,000 farmers are regularly getting relevant information and advisory services of their own area via the app on agriculture.