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Integrating ICT for Enhanced Maize Market Access: A Business Model for Storage and e-Marketing in Char Land

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This paper puts forth the idea of MaizeConnect—a business model centred on information and communication technology (ICT) to improve a lot of rural maize farmers in Bangladesh when it comes to accessing markets.
Methodology: The research was conducted in the char areas of Jamalpur District, where the Making Markets Work for the Chars (M4C) project is being implemented. The research undertakes a mixed-methods approach of desk reviews, stakeholder consultations, and SWOT analysis to

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understand the model's viability and impact. A situation analysis was conducted in the selected research sites to understand the current marketing practices, identify gaps, and determine the specific needs of marginal farmers.

Results: An innovative e-marketing model has been developed for ensuring better access to smallholders in Bangladesh. This model not only seeks to give farmers direct access to buyers but also aims to tackle the problem of postharvest maize losses. The rural farmers are mostly poor, producing maize on a small scale. They don't have much power to negotiate, which makes their situation look pretty grim. MaizeConnect focuses on transforming the maize sector by providing easy-to-use technology, with three main benefits: price stabilization, market connectivity, and payment system inclusion. The model relies on collaboration between government, NGOs, and the private sector, with continuous support essential for sustained impact.

Conclusion: There is a unique opportunity to transform the rural agricultural landscape in Bangladesh through ICT integration in the maize value chain—specifically in improving market access and storage solutions. The MaizeConnect model can overcome key challenges including post-harvest losses, market inefficiencies, and the integration of smallholder farmers into a more profitable value chain.

Keywords: ICT; maize; market access; storage; business model.

1. INTRODUCTION

Being a short-day crop with a wide range of soil conditions and the capacity to thrive under a wide range of moisture conditions, maize can be grown throughout the year in all parts of the country (Dewan et al., 1998). Maize cultivation is common in rural Bangladesh, but its potential is still untapped. Combining Information and Communication Technology (ICT) with marketing methods can greatly improve market access for small farmers (Nwafor et al., 2020). This conceptual paper aims to explore the transformative power of ICT in enhancing maize market connectivity, storage solutions, and e-marketing strategies.

Promoting and selling products or services online can be an effective way to reach a wide audience. This is especially true for many farmers of Bangladesh who live in rural or remote areas, where remoteness can lead to asymmetric information dissemination. These studies emphasize that farmers in rural and remote areas often face significant challenges in accessing timely and relevant agricultural information, which leads to asymmetric information dissemination. For instance, research highlights the role of smartphones in bridging the information gap for farmers in remote areas. Mobile phone technology has been crucial in providing access to market information, weather forecasts, pest and disease control, and agricultural inputs. However, challenges such as the high costs of smartphones, poor network coverage, and limited technical know-how among farmers can restrict the effectiveness of these technologies (Rahman, 2022). Additionally, the importance of mobile phones in reducing information asymmetry and improving market participation among farmers has been noted. The use of ICTs, particularly mobile phones, can significantly impact farmers' access to market information and other agricultural resources, thereby enhancing their productivity and market engagement (Mwalupaso et al., 2019). ICTs can be used to enable, fortify or replace existing information systems and networks. Its utilization in agriculture can promote and distribute new and existing farming information for bringing social and economic changes (Chowhan and Ghosh, 2020). It acts as a bridge in the communication gaps among development workers, rural organizations, farmers and enables bottom up articulation of needs. Information sharing of local knowledge and strengthening university-research-extension farmer linkage can be quick, easy and hassle-free through modes of different ICT media (Rahman et al., 2023; Bansal et al., 2022; Chowhan and Ghosh, 2020; Crowder, 1998).

Rural farmers find themselves in a market that, to some extent, embodies the characteristics of a nearly perfectly competitive market. When farmers use (or are given the opportunity to use) ICTs, they invariably create a more efficient market. Research suggests that digital marketing and better storage options have an impact on small-scale farmers. Studies indicate that these advancements can result in pricing decreased losses after harvesting and increased bargaining power (Aker, 2011). For example, having access to platforms allows farmers to sell their produce

directly to consumers or larger markets without intermediaries. Enhanced storage solutions also help keep the crops fresh for durations, reducing waste and enabling farmers to sell at the times. These developments contribute to incomes. Improved economic stability for small-scale farmers. Despite the advantages, there are still gaps in research regarding the use of ICT for market access and storage in Bangladesh. This paper aims to fill these gaps by exploring a business model that combines ICT for market access with enhanced storage solutions.

The study was motivated by the need to address the persistent challenges faced by small-scale maize farmers in Bangladesh. Previous research has highlighted the potential for ICT-based solutions to improve smallholder market access and productivity. However, there has been limited work on developing comprehensive business models that integrate ICT, storage, and e-marketing to serve the needs of rural maize producers. To address this shortcoming, this paper proposes a unique framework that synergizes these three components and directs them toward a single outcome: the improved livelihoods of smallholder maize farmers, achieved largely through enhanced access to and engagement with key markets and vital resources.

2. METHODOLOGY

This study employs several stakeholder consultations to explore the integration possibility of ICT for enhanced maize market access through e-marketing and storage solutions in rural Bangladesh. Before simulating the MizeConnect (the proposed simulated model is coined as MaizeConnect) making the intervention, an extensive desk review was performed to gather existing literature and data on ICT applications in agriculture, e-marketing models, and storage solutions. In addition, a situation analysis was conducted in the selected research sites to understand the current marketing practices, identify gaps, and determine the specific needs of marginal farmers.

The research was conducted in the char areas of Jamalpur District, where the Making Markets Work for the Chars (M4C) project is being implemented. To achieve the objective of this study, the research team deployed the following research approach in the study areas.

The nature of this model is MaizeConnect (business between ICT center to Outreach center). The income model for char farmers is the selling of char products (especially maize) and the price which would be paid by customers. Char farmers will go to the nearest rural ICT office where they live and announce the features of their products to the office clerk, such as the type of products, the amount and the price. Farmers will store their maize in the rural warehouse by paying for the storage services (Fig. 1). They also should pay for the connecting service also. The product will be delivered to the industrial customer center as per customer requirements.

In addition, to identify the potential challenges and future prospects of e-marketing, SWOT analysis was carried out. SWOT analysis categorically represents the Strengths, Weaknesses, Opportunities and Threats of existing facilities.

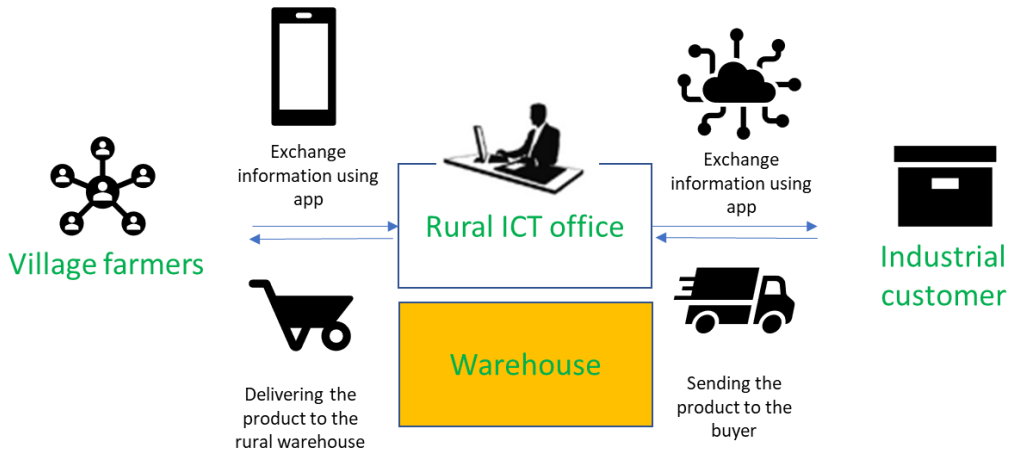

Fig. 1. MaizeConnect – App based marketing

Table 1. Access to the internet in Bangladesh

Particulars	Bangladesh	Source
Internet penetration (Users as percentage of population)	131 million	BTRC, 2023
Mobile internet	118.49 million	BTRC, 2023
Fixed broadband	12.88 million	BTRC, 2023
Mobile connection (% of population)	196.08 million	BTRC, 2024
Electricity access		
Average upload speed – Fixed line connection	47.28	SGI, 2024
Average download speed – Fixed line connection	48.28	SGI, 2024
Average upload speed – Mobile line connection	11.31	SGI, 2024
Average download speed – Mobile line connection	27.08	SGI, 2024

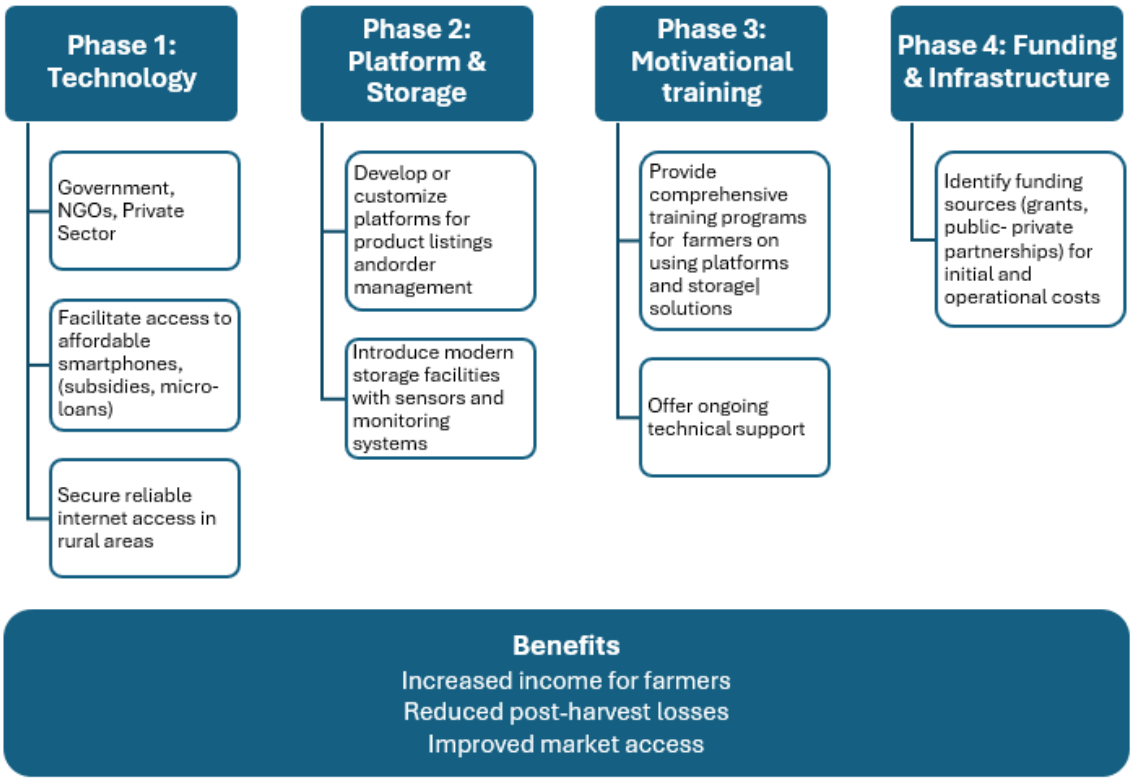

Fig. 2. Requirements of the ICT-based model

2.1 Requirements for the ICT-based Model

For smallholder farmers in particular, digital market access is contingent on robust internet connectivity (Chen, 2020). Reliable internet access—via mobile or fixed broadband—makes possible both e-marketing platforms and ICT-based storage solutions in the kinds of rural areas where these services are most needed. While Bangladesh has achieved a noteworthy landmark in internet connectivity, it still faces several issues concerning internet speed and service quality. The most serious of these seems to be the stability of service in rural areas. The connections are getting better, they are still "erratic" and the situation is "far from satisfactory" (Rahman, 2022). According to Wright (2020) as of 2019, only about 4.8 million people in rural areas were able to access the internet, which is only a small fraction of the roughly 162 million people who live in

Bangladesh. Bangladesh has achieved yet another milestone as the government is set to announce that it has brought 100 per cent of the population under electricity coverage (Table 1). Installed power generation capacity rocketed to 25,514 megawatts from 4,942MW in 2009, while the maximum power production rose to 13,792 MW, up four-fold from 3,268MW13 years ago, data from the power division showed (The daily star, 2022).

We have laid out a proposed framework that comprises four critical phases (Fig. 2). The first phase revolves around technology, with the key movers and shakers of technological adoption being government entities, NGOs, and the private sector. Our main action in this phase is to ensure that affordable smartphones are accessible to all those who might benefit from them. We might do this, for example, by directly subsidizing the purchase of smartphones or by using some kind of micro-loan to help our target population buy the phones themselves. Beyond the phones, we will also make sure that the dependable, high-speed internet access necessary to enable these phone-based interventions is available in rural areas.

In the second phase, the emphasis is on the two key areas of Platform & Storage. The work needed in this phase focuses chiefly on the development or modification of the platforms that make possible the kind of product listing and order management that allows farmers to better interface with contemporary markets. The other main task in this phase is the creation of modern storage facilities that use electronics to reduce postharvest loss.

Motivational training is the focus of Phase 3. This revolves around developing and delivering training for farmers on the two platforms and the storage solutions we introduced in Phases 1 and 2. Farmers will be our primary audience as we train the trainers who will train the prospective farmers. We also will ensure that our present team offers ongoing technical support as an essential part of this endeavor. Without such support, we reason, the endeavor is likely to fail.

In the end, Phase 4 deals with funding and infrastructure. In this phase, we undertake the actions necessary to identify funding sources—concentrating particularly on securing the kinds of funding that come from grants, public-private partnerships, and other avenues that could cover both the up-front costs and the ongoing operational expenses of an initiative. Taken together, these three phases and the structured approach represent work to reduce postharvest and nutrient losses within the agricultural value chain.

2.2 Impact Analysis

It's also crucial to create or adapt e-marketing platforms to the specific needs of smallholder farmers. These platforms need to be user-friendly and to serve the basic functions — like vital roles in product, price, and order management, along with secure payment channels — that any online marketplace would need to serve its customers. A digital platform that links small farmers straight to consumers can provide a multitude of opportunities for these farmers to increase their earnings (Aker and Mbiti, 2010). This setup might also bypass many problems and inefficiencies that small farmers confront in the developing world.

We combine theories of poor people's market access with theories of the poor's limited access to ICT. We also discuss how real-time information, in the hands of small farmers, not only affects the stallholders' access to the e-world but also affects their poor-market access situation. Putting an e-marketing system based on information and communications technology into operation is expected to yield benefits in two main areas. First, it will enhance farmers' access to markets. And second, it will furnish them with real-time information on prices. The e-marketing system is designed not only to provide these two basic services but also to stabilize price levels across the two "seasons" of the agricultural market: the peak season (when produce is fresh) and the off-peak season (when produce is stored) (Jensen, 2007). Enhanced access to more kinds of markets, plus access to more real-time price information, is expected to contribute to this kind of stability (Aker and Mbiti, 2010; Baumüller et al., 2018).

The communication tools of the ICT system help farmers access markets for their products better and more profitably. The storage tools or, rather, the storage solutions of the ICT system enable farmers to keep their products at the right quality and to do so for the right amount of time. When used properly, both tools help reduce post-harvest losses for a given season's worth of product. Moreover, when we deploy tools for digital inventory management, we make it possible to reduce the waste inherent in the

logistics of moving perishable things from place to place. These tech innovations are helping make farming profitable. That profit potential is part of the goals of something called "sustainable intensification," which this article attempts to explain. This pilot program, if proved successful, could go a long way towards not only improving the economic viability of farming as an occupation but also towards food security and sustainability of rural communities (Olabinjo et al., 2023).

3. RESULTS AND DISCUSSION

3.1 Capturing Market Dynamics

In Bangladesh, using information and communication technology in e-marketing and storage for agricultural products is bringing about a change in the way farmers do business with agro-processors and consumers. Direct sales from farmers to consumers are being facilitated by e-marketing platforms that cut out the middleman and make the transaction between the farmer and the consumer so visible and auditable that there's no need for a traditional market (Jensen, 2007). Uncertainty, the bedfellow of inaccessibility and invisibility, is being reduced, too (Aker, 2011). Now, we can turn to consideration of how real-time access to market information is affecting the dynamics of on-farm decision-making.

Collaborative supply chains between farmers and agro-processors, supported by information and communication technology (ICT), can create better and more reliable market structures. When farmers have a direct link to agro-processors through a warehouse, the processors benefit by receiving unfailing supplies of the requisite raw materials, and the farmers secure something approaching a reliable market for their products. When farmers work together with processors to ensure a reliable supply line, they realize better returns and more of these returns can be realized when they operate "beyond the farm gate" (Kolade et al., 2019).

Moving from cash-based to digital transactions improves financial security and protection. With the rise of "fintech," or financial technology, users are afforded an unprecedented level of oversight into their accounts and transaction history. With digital payments, all transactions are logged in, and users can see where they've spent their money and, more importantly, where it's gone since the last time they looked. This oversight gives users a better handle on their finances, which in turn makes them feel better about their financial circumstances. Another way in which "fintech" can guard users against risks is by providing detailed protections in the event that a user does not have direct access to their digital payment method.

Long-standing participants in the world of markets—like middlemen and traders—have long been necessary for connecting buyers and sellers. These actors were needed because, in many places, there was no other way for most people to connect with the market. They served as essential linkages for enabling added-value connectivity and, in some cases, enhanced the efficiency of the market. But classic market actors have also historically been blamed for constituting unfair market environments, in which each market actor tries to make as much money as possible, without really considering the welfare of the ultimate consumer (Baumüller, 2018; Mittal et al., 2010).

3.2 Determining Factors

The confidence farmers have in the technology used in agriculture is essential for its successful adoption. That confidence among the target group can be achieved only if these essential factors are taken care of. Clear and accurate information about market prices, demand trends, and transaction details, when provided to farmers, fosters trust among them. On the other hand, consistent and dependable data instils confidence, while any disruption or delay in transactions can erode trust. These two factors are vital. Another factor is the user experience. If systems are user-friendly and intuitive, we can expect their widespread adoption. Lastly, can we expect widespread adoption if local languages are not used in our platforms and if our platforms are not relevant to the area in which we want to adopt ICT? Hence, we have to consider these factors too, leading to the enormous impact potentially ICT can have on agriculture (Qadri et al., 2023).

Trust and adoption hinge on two critical components: support and training (Jafri et al., 2014). Farmers gain the most from using information and communication technologies (ICTs) when they understand how to harness them. That means comprehensive training—not just in the use of the technologies, but also in understanding the why and how behind them. That leads to effective use, and effective use

leads to adoption and, finally, to empowerment. Some conflicts may be in our back rooms, but at least four reasons give us the confidence to tell our users that our front doors are secure: cause for confidence are we have an assurance mechanism; our system was built with security in mind; we use personal propensity to trust; and we've got databases full of trustworthy users (Kim et al., 2019).

The rate at which farmers adopt new technologies is affected by many complex factors. These factors include technology, education, economics, and the social and institutional environment (Mwangi and Kariuki, 2015). In areas where devices and the internet are readily available, farmers are keener to embrace the digital shift. However, the divide is stark: in India, for instance, nearly 60 per cent of people live in areas without reliable internet access (World Bank, 2024). Even in America, the Federal Communications Commission (2020) reported that despite the nearly 8 out of 10 Americans who access the internet through a fixed broadband connection in their homes, there are nearly 17 million people (4.9%) who do not have access to broadband at all, and 29.9 million live in areas where only slow internet service, of 25 Mbps or less, is available. Hence, if fiscal and policy measures are to be considered effective, they first need to penetrate the most disadvantaged farming communities.

3.3 Implementation Strategies

Establishing ICT hubs in rural Bangladesh takes careful planning and execution to make them viable and sustainable. There are several necessary steps. The most important is to select locations that are convenient and accessible to the communities. These centers should serve localities that are close to agricultural communities. This is a big reason why we have chosen to place the centers not only in district headquarters but also in sub-districts, which are more rural and far removed from urban centers. The next decision is for local leaders and the farming community to make together. They must choose the human resources that will serve in these centers. The next and equally important decision is to make these centers functional. This has been done in part by choosing the right software that meets local needs - here we have to introduce an e-marketing tool and digital storage system software - and in part by creating a relevant and excellent user experience (Aker, 2011; Torero et al., 2014).

These hubs require a straightforward operational framework to run successfully. Employing and training local staff ensures that the hubs have the management needed to run them in an economically, socially, and environmentally sustainable way. Staff need the right technical skills and local understanding to help farmers use the hub's appropriate technology effectively. Clear policies and procedures—usage rules, fee structures, and data management guidelines—make daily operations smoother. Public-private partnerships (PPPs) are crucial to the success of these hubs. With the government providing a mix of funding, policy, and political cover, private firms can invest in and supply the necessary technological backbone for the hub to function. For the vision of the hub to be realized in a functional way, working together with NGOs and community organizers is extremely important (Davis, 1989).

Moreover, the use of ICT in agriculture corresponds with theories and evidence that indicate digital technologies tend to enhance overall market efficiency (Silva and Ratnadiwakara, 2008). The historical reduction in transaction costs when switching to digital formats suggests that ICT systems can do the same for agricultural markets. They may well empower smallholder farmers, too; benefits like those associated with better market access tend to empower that group. In fact, Aker (2011) and Torero (2014) explicitly note and argue these beneficial aspects tied to ICT systems in agriculture. Usable as well as useful, the systems in the arguments above are almost illocutionary. The successful deployment of these systems aligns well with the Technology Acceptance Model (TAM). The model's foundation is built on two constructs: perceived ease of use and perceived usefulness (Davis, 1989). Focusing first on the former, we see that farmers are much more likely to adopt technologies that they find easy to use. The basis for training is laid during the pre-deployment stage. Once the systems are in place, continuous support is necessary. Capacity-building frameworks that include ongoing training and support are essential to extending trust in the systems and ensuring their sustained adoption (Liu et al., 2013).

3.4 Business Model

The business model requires a visual representation in the form of a diagram. We have created one that illustrates the flow of maize from

the storage facility at the ICT office to the sale of the product to agro-processors. The office, operated by an input dealer, stores the maize upon the payment of a fee. Once the maize is stored, the office seeks connections—that is, market connections—using its own e-marketing system. The M4C office facilitates the search for these connections. The system then finds a way to send the product to the agro-processor (Fig. 1). Fig. 2 outlines a proposed business model aimed at improving market access for smallholder maize farmers. It does this by integrating the Information and Communication Technology (ICT) sector in ways that enhance existing communication channels and create new ones. In and among the key stakeholders in this model—farmers, buyers, and the various sorts of human and technological intermediaries that connect each other.

The proposed business model for improving maize market access considers an "Enabling Environment" as a key section. This environment encompasses the external factors and conditions of the system that can be controlled to help the stakeholders be engaged and will enable a long-lasting business model. Among the key elements of this environment are community engagement, which is fundamental if all farmers are to be reached in a 10 km radius; the roadmap for infrastructure development; and the available and accessible access to financial and payment systems. Favourable policies for agriculture implemented by the government promote digitization in the agricultural sector, public-private partnerships, and access to agricultural markets for smallholder farmers (BDLAWS, 2018).

To ensure that farmers and other stakeholders can effectively utilize the MaizeConnect app and its platforms, a dependable ICT infrastructure in rural areas is necessary. Users must also be able to afford the services needed to make the app useful. That makes reasonable and accessible mobile data a rural necessity. Payment is the end goal of the whole business. If for some reason the platform does not ensure payment, then the farmer is going to have a negative experience with the platform and is going to stop using it. Farmers should get the market prices in real-time for their maize, which helps them make more informed decisions about the timing and the location of the sale of their maize. The hub promotes transparency, which helps to address the traditional information imbalance that disadvantages rural smallholder farmers.

The MaizeConnect platform requires several components to function, and these components are the necessary devices of the modern digital world: smartphones, computers, and broadband or wireless internet. For farmers, smartphones have become the access devices of choice. However, the more "connected" world of ICT hubs and agro-processors allows those users to take advantage of the more powerful computers that hub users have access to. The platform's operation depends upon bi-directional flows of information that zoom back and forth between farmers, their hubs, and the agro-processors.

A well-constructed system flows maize from producers to processors. Storage is the first function at the destination, and the warehouses used for this purpose seem to be ordinary structures. However, the systems in place for not only the storage but also the grading of the maize challenge the ordinary. The essential function of assuring the quality of the maize, first at the point of entry to the warehouse and then again before it leaves the warehouse, makes it a kind of "safe" in the way that a seed bank is safe.

The payment framework is connected to the status of procurement, making it visible to all parties involved and thus ensuring accountability. The structure focuses primarily on building relationships in the long term among everyone engaged with and impacted by the commission’s work. The emphasis is on transparency, primarily through the use of virtual tools. Trust, as a component of stakeholder relationship management, is at the heart of all these concerns.

3.5 SWOT Analysis of Maize Market Access

Opportunities and challenges abound for smallholders when it comes to using ICT in agriculture. The good news is that e-marketing can extend the farmer's reach to many potential buyers. This way, the farmer can decrease his or her reliance on middlemen who, in many cases, take an unfair cut of the profits. But access to this e-marketing platform is not yet guaranteed for everyone. This section describes the SWOT of maize market access.

The use of information and communication technology in agriculture offers numerous benefits for small-scale farmers—especially those farming in remote areas—helping them to

overcome the common problems of poor infrastructure and low access to services (Aker, 2011). These problems result in difficult trading conditions both for the farmers themselves and for their potential customers in the urban space. This is how ICT, and specifically the internet and mobile communication, have started to make a difference. By these means, the farmers can access a better market. They can also avoid the problem of post-harvest loss, which is another common issue that small-scale farmers face (Chopra and Meindi, 2013)].

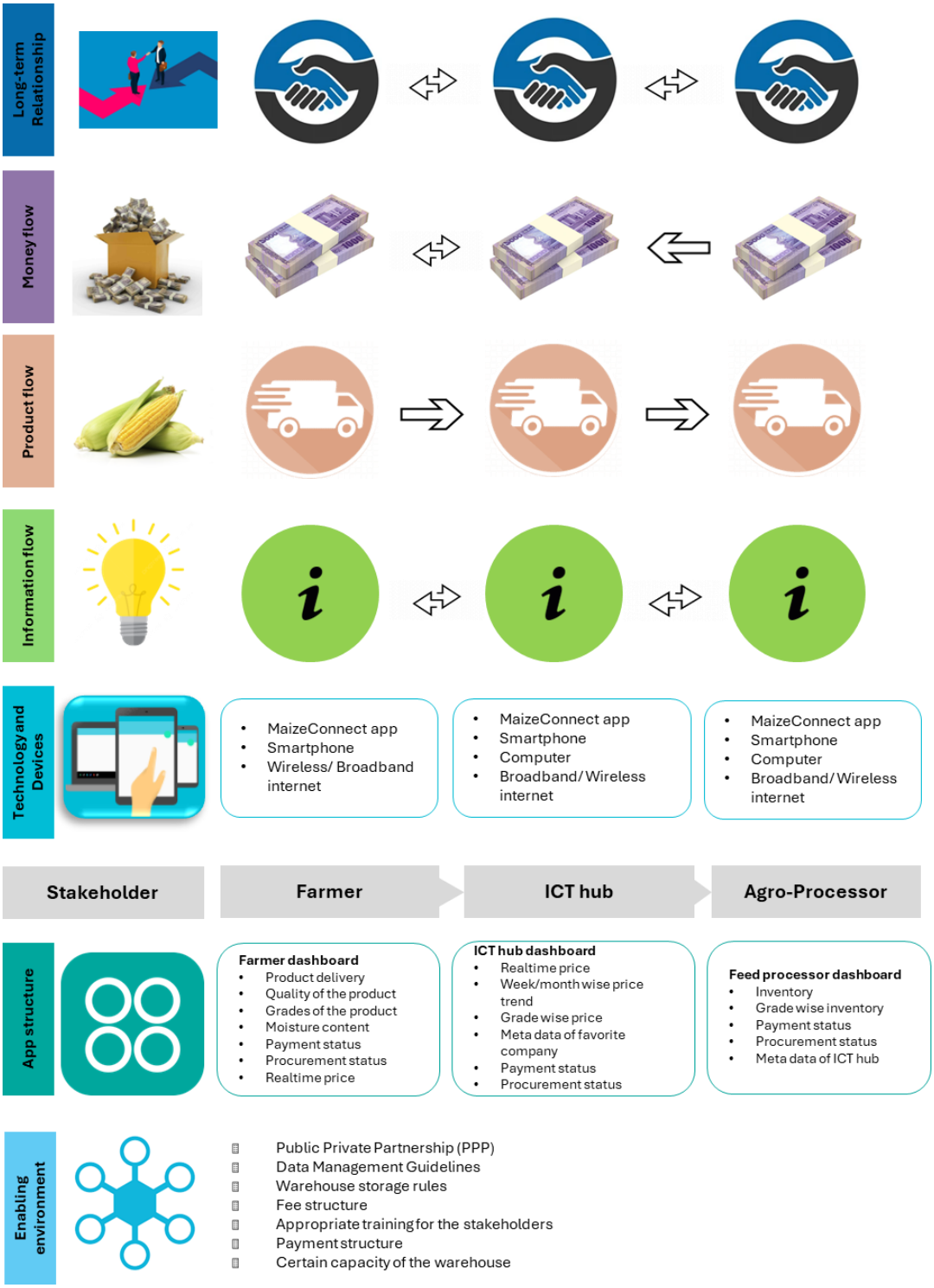

Fig. 3. Business model of MaizeConnect

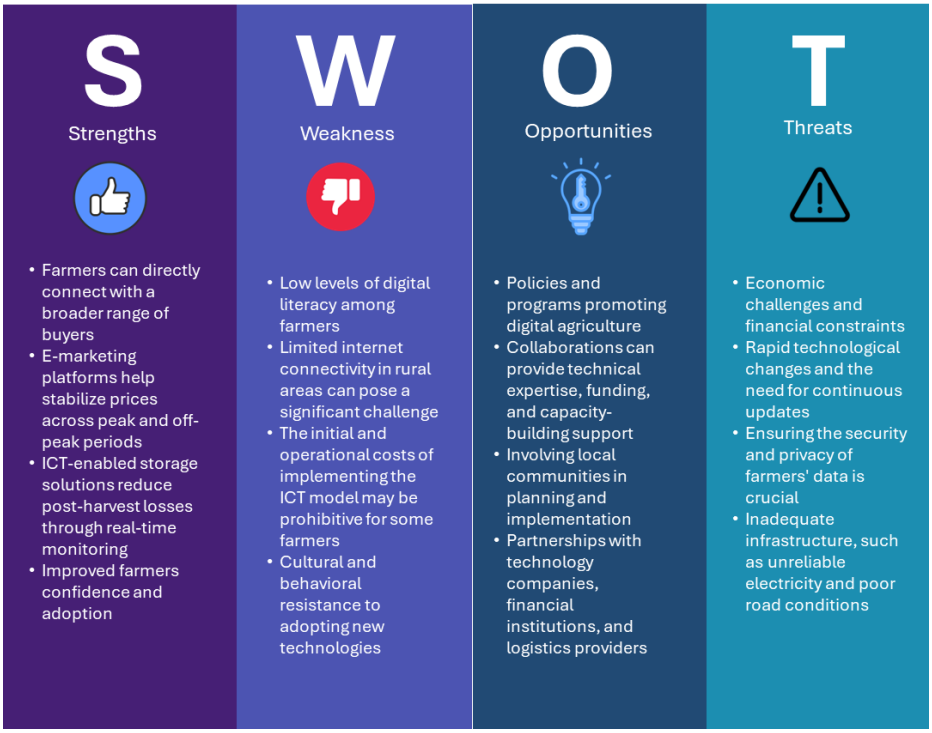

Fig. 4. SWOT analysis of business model

While certain strengths exist in favour of the adoption of ICT in agriculture, the potential of these tools is being limited by several weaknesses. One such weakness that might stand in the way of encouraging farmers to take up these gifts of technology is low digital literacy among them. Alleviating that problem can be accomplished through the sort of tailored training programs that several organizations have already begun to provide for farmers (Mittal and Mehar, 2016). And when ICT tools are overly complicated, they can also be an overburden to the farmers in terms of cost and might be overcome in different ways (Torero et a., 2014). Lastly, resistance to change and cultural obstacles may delay the acceptance of new technology. The best way to counter these moves is to direct well-planned change campaigns that increase awareness and explain the long-term benefits of the technology in question (Rogers et al., 2003).

4. LIMITATIONS OF THE STUDY

Although our study on the implementation of ICT-based e-marketing and storage solutions in rural Bangladesh has produced some promising outcomes, it also has some significant limitations. First, the study was confined to a conceptual framework, only the idea was generated by visiting a few selected char areas of the Jamalpur and Bogura Districts of Bangladesh. These are the isolated, riverine areas of northwestern Bangladesh that have largely been bypassed by national development. The solutions we provided in this paper may have limited generalizability to other, more accessible, and developed areas of Bangladesh. Moreover, data were generated qualitatively; thus, the result cannot be considered wholly representative.

The study concentrated mainly on short-term impacts, which may not give a complete picture of the sustainability and long-term payoffs of these ICT solutions in the agricultural sector. Nevertheless, although the study highlights the potential of ICT to change vertical and horizontal agricultural practices, it notes some "significant technological barriers," such as inconsistent internet connectivity and the "high cost of digital devices," that are likely to preclude many farmers from accessing what could be a game-changing technology. To counter the current limitations, we must urgently do two things. We need to validate the current findings, and we need to augment them. Both must be undertaken to counter the current understanding of the integration of ICT in agriculture, a counter that provides not just a more accurate picture but also a more comprehensive one.

5. POLICY RECOMMENDATION

To ensure the growability and sustainability of ICT-based e-marketing and storage solutions for smallholder farmers, it is essential to develop good support mechanisms. These should be established by the combined efforts of governmental and non-governmental entities. Governments should offer financial support in the form of subsidies for digital devices and infrastructure development. They should also support capacity-building programs to enhance the digital literacy of farmers. Partnerships between the public and private sectors are essential; they ensure the continuous funding and technical support these programs require. It is also necessary to develop a clear legal framework that secures digital transactions and protects data privacy. NGOs, along with community organizations, should help deliver training to farmers and ensure all stakeholders can benefit from the technology. These combined activities create an ecosystem that supports the use of e-solutions by marginal farmers.

6. CONCLUSION

Information and Communication Technology (ICT) holds the promise to enhance smallholder farmers' access to market and rural economic outcomes. Integrating this technology into the maize market system in rural Bangladesh could help resolve the long-standing problems maize producers face in obtaining good prices for their produce and in managing post-harvest storage and storage-related quality problems. The MaizeConnect Business Model proposes to establish three ICT-based solutions that seek to connect the smallholder maize farmer with the larger, more efficient market.

The digital revolution in agricultural marketing is anticipated to decrease the need for middlemen, furnish farmers with up-to-the-minute market information, and allow them to transact directly with consumers and processors. Most promising of all, perhaps, is the digitization of price reporting. That could supply farmers with timely, reliable data about how much their goods should sell for in order to clear the market. All these changes are expected to help push farmers toward a more urban-competitive mindset and improve their chances of achieving a secure rural livelihood.

Still, for this agricultural model to succeed, several substantial local issues must be surmounted: an adequate ICT base must be put in place; a user-friendly platform must be developed; and the model must be widely adopted by farmers. Building this base, developing this platform, and ensuring this adoption will require a public-private partnership—essentially, government support coupled with private-sector investment—along with a capacity-building initiative that will train farmers to use smart agricultural tools effectively.

To sum up, we see a prime opportunity to change the rural agricultural landscape in Bangladesh through the integration of ICT in the maize value chain—specifically in market access and storage. After successfully piloting, if we carry out the MaizeConnect model with adequate strategy and the necessary complementary forces, we believe that within 3 to 5 years it will help overcome the three major obstacles we have identified: postharvest loss (especially in storage), market efficiency, and smallholder farmers' gainful integration into the value chain.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

Details of the AI usage are given below:

ChatGPT 4o used for editing the manuscript

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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