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Digital Tool Integration, Biodiversity, and the Potato Value Chain in Kenya

Results from a Baseline Survey

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Executive Summary

Potato farmers in Kenya grapple with various challenges along the value chain, including limited access to quality planting materials such as seeds and fertilizers, insufficient storage and postharvest handling facilities, fluctuating market prices, and unreliable market information systems. For women and youth, these challenges are further exacerbated by persistent social gaps in the agriculture sector. Digital tools can play a vital role in addressing these challenges by providing access to valuable agricultural information, weather forecasts, and best practices that help farmers make informed decisions and improve crop management. However, challenges persist in digital tool adoption within agricultural value chains in sub-Saharan Africa. This study assesses the impact of digital tool adoption and support on socioeconomic and agriculture-related outcomes in Kenya's potato value chain. It piggybacks on an ongoing digital tool integration program, Business Development and Coaching (BDEC), conducted by the Farm to Market Alliance (FtMA), which targets agripreneurs in Farmer Service Centers (FSCs). By comparing a treatment group that receives this training with a control group continuing business as usual, the study evaluates the effects of agripreneurs' adoption and expanded use of digital tools on farmers' agriculture - based livelihoods, income generation, and job creation metrics, with a focus on youth employment and gender disparities.

Introduction

Potato farmers in Kenya grapple with various challenges along the value chain, including limited access to quality planting materials such as seeds and fertilizers, poor storage and postharvest facilities, inadequate transport infrastructure, and pest infestations. These issues lead to low yields, high losses, and market vulnerability as a result of fluctuating prices and unreliable market information (KIPPRA 2025; Kaguongo et al. 2014). For women and youth, these challenges are further exacerbated by persistent social gaps in the agriculture sector, including limited access to finance (Adegbite and Machethe 2020), technology transfer, asset control, and productive resources (especially land), and by inequitable participation in decision-making (Huyer 2016). Digital tools and platforms can play a vital role in addressing these challenges. They can provide access to valuable agriculture-related information—such as improved methods for land preparation, input use, production, harvesting, postharvest handling, and marketing management—as well as weather forecasts, thereby helping farmers make informed decisions and improve crop management. Mobile apps and platforms can facilitate market access by connecting farmers directly with buyers, thus reducing the negative impact of price fluctuations and ensuring fair returns for their produce through more information-based decisions and strategies. Digital tools can also play a crucial role in addressing postharvest losses by providing real-time monitoring and management of storage conditions that help farmers optimize storage facilities to reduce spoilage and waste. Additionally, digital platforms can provide information on proper postharvest handling techniques, including sorting, grading, and packaging, ensuring that potatoes are prepared for the market with minimal losses.

Research Questions and Methodology

The main research questions this study aims to answer are:

1. How does the intensity of digital tools training impact the adoption of digital tools and literacy among FSCs, and what changes result in their capacity to support farmers effectively?

2. What are the measurable effects of digitally empowered Farm Service Centers (FSCs) on serviced farmers' postharvest management, crop yields, product quality, biodiversity, and access to information and services for farmers—including women and youth—and, ultimately, on socioeconomic outcomes such as increased income, job creation, and enhanced livelihoods within agricultural communities?

The Business Development and Coaching (BDEC) program's theory of change outlines how increases in farmer outcomes are anticipated as a result of BDEC participation. To enhance service delivery in areas such as input access, postharvest management, and advisory support, FSCs first develop their digital literacy and familiarity with digital tools/apps like Agribytes. Over time, this expanded capacity is expected to translate into better yields, reduced losses, stronger market engagement, and more equitable access to information for women and young farmers.

The BDEC Leadership Academy, designed for agripreneurs and FSCs, is self-paced, but participation is logged: All topics must be completed before participants can start the activities. In addition, FSC participants are required to take the quizzes and assessments to receive a course completion certificate. Uptake is boosted by three elements: (1) offline content that avoids data-bundle costs, (2) continuous support from dedicated Kuza coaches, and (3) peer-to-peer WhatsApp groups that help sustain motivation. Hindrances include the limited time available for high-performing FSCs. Effective transfer of knowledge

from FSCs to farmers depends on business type (input dealer, aggregator, or service provider); engagement with Agribytes video modules, which some FSCs use in farmer training; and access to tools for field demonstrations.

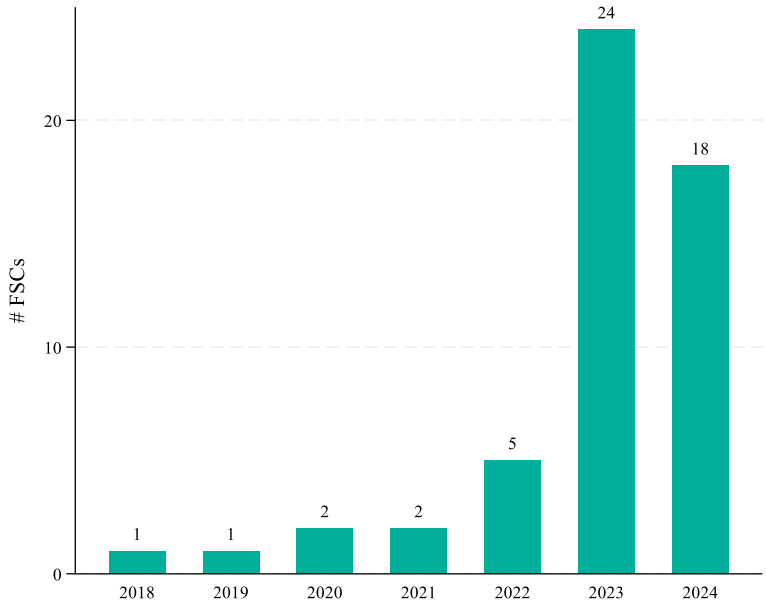
Box 1. Business Development and Coaching (BDEC) hybrid program

The BDEC program, facilitated by the Kuza Leadership Academy, is a pioneering digital platform offering 16 guided self-learning sessions for rural agripreneurs/FSCs. FSCs can also access more than 400 mentorship videos in English and Swahili, peer-to-peer learning, and optional Agribytes app modules on good agricultural practices for potato, maize, sorghum, and soybeans, fostering skills development and business growth.

Key Findings: Farmer Service Centers

Among a total of 140 FSCs, 53 reported having already completed the BDEC training program. As shown in Figure 1, the timeline of participation for these 53 FSCs indicates a gradual increase in the number trained each year, starting with small numbers in earlier years (6 from 2018 to 2021) and a slight increase in 2022 (5). A significant expansion occurred in recent years, with 24 FSCs trained in 2023 and 18 in 2024. This growth reflects the program's scaling efforts and its increasing reach among FSCs.

Figure 1. Number of BDEC-trained FSCs in Nakuru and Nyandarua counties



Source: Authors' elaboration based on the 2024 baseline data.

Note: FSCs = Farmer Service Centers; BDEC = Business Development and Coaching.

Table 1 is limited to the 35 FSCs that participated in the BDEC training between 2018 and 2023, as the latest cohort of FSCs trained in 2024 had only recently completed the program (October 2024) when the baseline data was collected (December 2024). Among the 35 FSCs trained prior to 2024, 100 percent reported increases in digital tool adoption and use, digital literacy, and access to agricultural information,

highlighting the program's effectiveness in equipping FSCs with critical digital skills and resources. Additionally, 91 percent experienced an increase in the number of services they provide to farmers, suggesting that the training had a positive impact on service delivery capacity. In the use of mentorship and Agribytes videos, 74 percent of FSCs reported having used the mentorship videos, of which 58 percent did so regularly and 39 percent did so sometimes, indicating high engagement with this resource. Similarly, 74 percent used the Agribytes videos, with particularly high usage for the potato value chain (81 percent), reflecting the crop's relevance in the region. Additionally, 81 percent shared Agribytes videos with farmers, showcasing the program's potential to disseminate knowledge and best practices throughout their communities, as hypothesized in our study design.

Table 1. Perceptions of BDEC training by FSCs in Nakuru and Nyandarua counties (2018–2023)

	(1)	(2)	(3)
	Mean		
Indicator	Overall	Nakuru	Nyanda-rua
Since BDEC training (%)			
Adoption/use of digital tools has increased	**100**	100	100
Digital literacy has increased	**100**	100	100
Access to agricultural info has increased	**100**	100	100
# of services provided to farmers has increased	**91**	94	88
Use of mentorship and Agribytes videos (%)			
Has used the mentorship videos (%)	**74**	78	71
Rarely (%)	**4**	7	0
Sometimes (%)	**39**	43	33
Regularly (%)	**58**	50	67
Has used the Agribytes videos (%)	**74**	72	77
For potato (%)	**81**	77	85
For maize (%)	**69**	69	69
Has shared the Agribytes videos with farmers (%)	**81**	92	69
# of observations	**35**	**18**	**17**

Source: 2024 baseline survey (simplified).

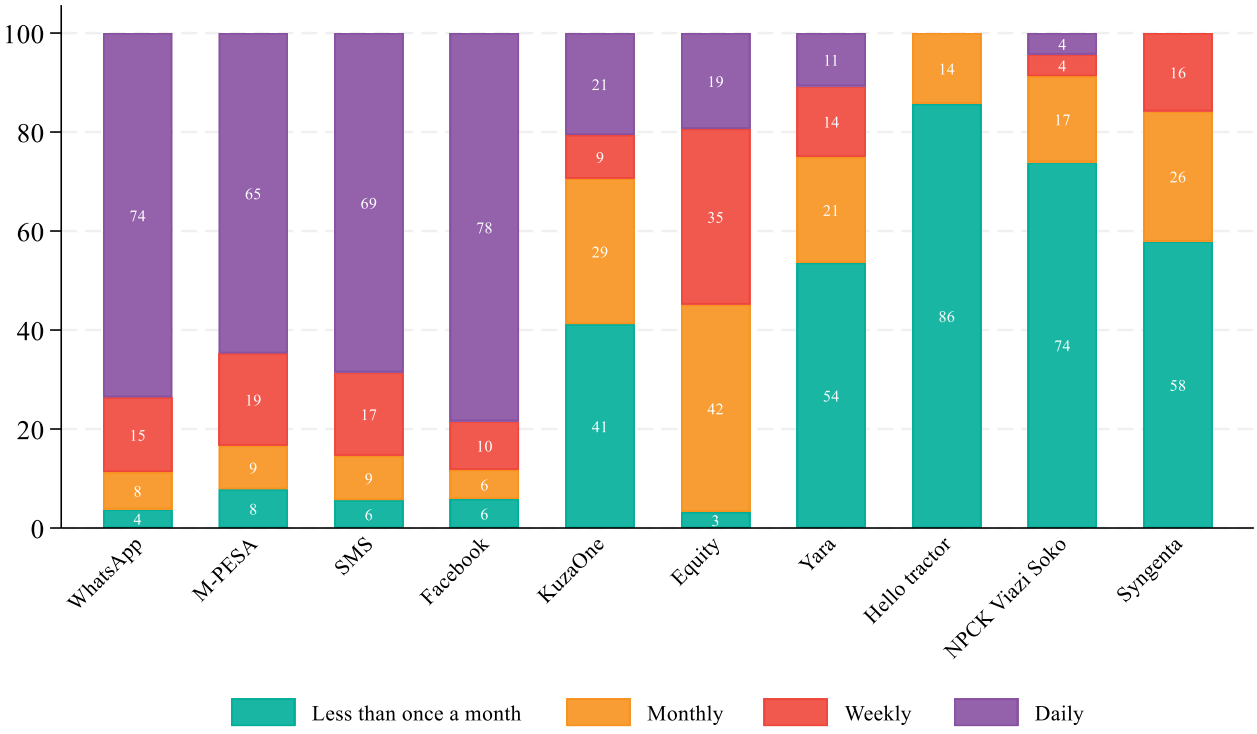
Figure 2 illustrates the frequency of use—among app users only—of the top 10 apps used by all FSCs for their business operations. WhatsApp emerged as the most frequently used app (with 74 percent reporting daily usage), highlighting its central role in communication and coordination with farmers and other stakeholders. Similarly, M-PESA, a critical app for financial transactions, shows 65 percent daily usage, signaling its importance among FSCs.

In contrast, more specialized apps such as KuzaOne, aligned closely with BDEC training objectives, show lower daily usage (21 percent), despite exhibiting notable engagement levels at weekly and monthly frequencies. This result indicates that while these apps are valuable for specific purposes, such as agricultural advice and capacity building, their use is not as common in daily operations compared with communication or financial apps. Apps such as Equity, Hello Tractor, and Viazi Soko show significant variability in usage patterns. Most Hello Tractor users engage with it less than once a month (86 percent),

which may reflect its niche functionality related to mechanization and tractor services. Similarly, Yara and Syngenta, both primarily associated with input provision and advisory services, show limited daily use but higher engagement on a monthly or less frequent basis, indicating their supplementary rather than core role in FSC operations.

The variation in app usage frequency underscores the diversity of tools employed by FSCs: communication and financial apps are integral to daily activities, while agricultural advisory and input-related apps are used as needed.

Figure 2. Frequency of app use among FSCs, share of total (%)



Source: Authors' elaboration based on the 2024 baseline data.

Note: FSCs = Farmer Service Centers.

Key Findings: Households

Table 2 provides important sociodemographic and living standard characteristics of the surveyed households. It confirms that farmers linked to the future BDEC trainees (G1) and those linked to the control FSCs (G2) are statistically comparable across most baseline attributes. Similarly, there is little variation in socioeconomic indicators between previously trained (G3) and the non-BDEC-trained FSCs (G1 and G2).

County comparisons show that households in Nakuru have higher incomes than their Nyandarua counterparts, reflecting broader regional economic disparities. Overall, the lack of systematic baseline differences between the treatment group (G1) and the control group (G2) supports the internal validity of the evaluation design and the future impact analysis.

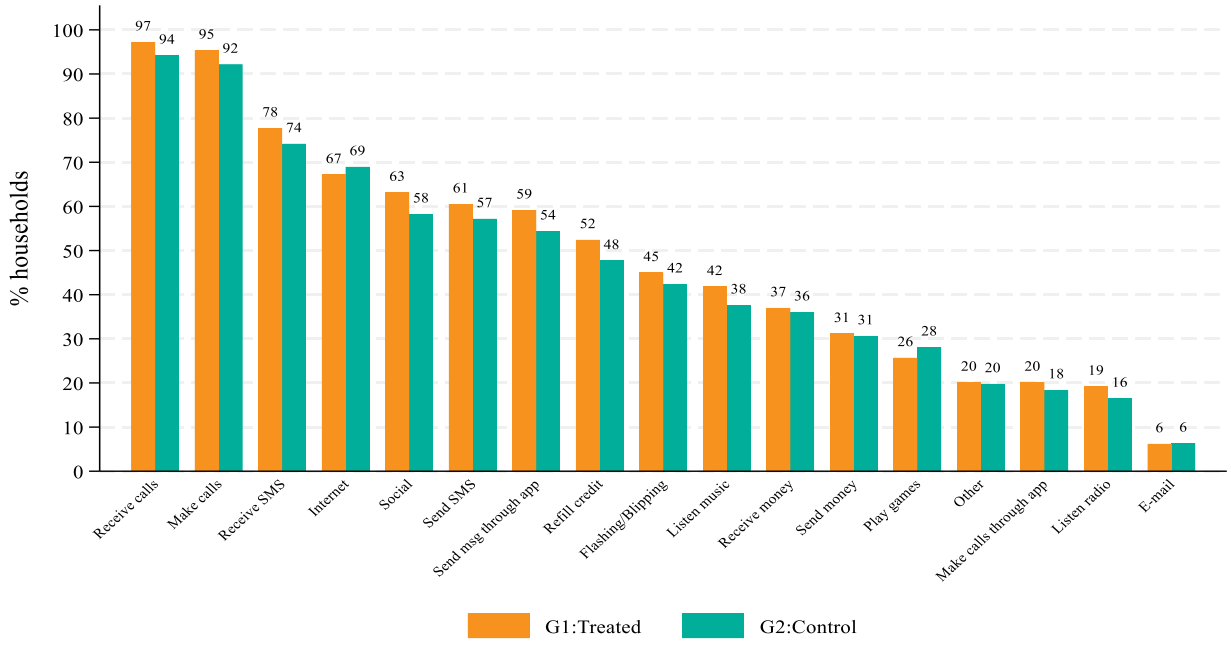
Table 2. Household characteristics

Indicator	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean				Mean		Mean	
	Overall	G1: Treated	G2: Control	Diff. (2)–(3)	G3: Previously trained	Diff. (5)– [(2) & (3)]	Nakuru	Nyandarua
Sociodemographic variables								
HH size	**4.6**	4.8	4.5	0.3**	4.6	−0.03	5.2	4.3
Female-headed HH (%)	**20.4**	17	21.1	−4	22.6	3.5	16.6	22.8
Age of HH head	**53**	53	52.7	0.3	53.1	0.2	49.9	54.8
Ratio of children to adults in the HH	**0.53**	0.5	0.51	−0.01	0.57	0.07**	0.62	0.48
Education of HH (%)								
Never been in school	**3.1**	3.9	2.6	1.3	2.9	−0.3	3.5	2.9
Primary not completed	**15.5**	14.6	15.6	−1	16	0.9	16.6	14.8
Primary	**32.3**	34.9	33	1.9	29.7	−4.3*	26.9	35.6
Secondary not completed	**8**	7.2	7.3	−0.1	9.3	2.1	9.2	7.3
Secondary	**27.3**	23.4	30.4	−7**	27.8	0.8	27.3	27.3
Tertiary	**13.7**	15.7	11.1	4.6**	14.3	1	16.6	12
Living standards								
Income and wealth								
Durable asset index (PCA)◆	**0.18**	0.18	0.17	0.01*	0.18	0.003	0.18	0.18
Total gross household income (KSH)	**317,514**	319,894	305,983	13,910	325,457	12,781	355,224	294,604
Total net household income (KSH)	**190,755**	200,997	184,297	16,700	188,167	−4,164	204,007	182,704
Income diversification								
# of different income sources (1)	**2.9**	2.9	3	−0.04	2.9	−0.03	2.9	2.9
Income diversification index: Gini-Simpson index◆	**0.427**	0.43	0.426	0.005	0.424	−0.004	0.409	0.437

Source: 2024 baseline survey.

Figure 3 presents a detailed breakdown of household usage of ICT devices, highlighting their specific functionalities among households associated with the future BDEC trainees (G1, orange) and the controls (G2, green), with similar frequency bars across the two groups. Basic communication functionalities are universal: 97 percent of G1 and 94 percent of G2 use a phone to receive calls, while 95 percent and 92 percent, respectively, make calls; there is also widespread reliance on SMS (receiving: 78 percent vs. 74 percent; sending: 61 percent vs. 57 percent). Internet access (around 68 percent) and social media engagement (63 percent vs. 58 percent) are similarly distributed in both groups, confirming that most households already use ICTs for information and networking. App-based messaging (59 percent vs. 54 percent) and airtime top-ups (52 percent vs. 48 percent) also register substantial uptake. Financial transactions via mobile channels are well established: About 37 percent use ICTs to receive money and 31 percent to send it, mirroring earlier findings on the dominance of M-PESA. Entertainment ranks next: roughly 40 percent listen to music and just over one-quarter play games, with only minor differences between G1 and G2. In sum, the figure underscores highly similar communication and finance-oriented digital behavior at baseline among treatment and control households, providing a solid platform for assessing whether BDEC can push farmers beyond basic services toward more sophisticated, agriculture-specific digital tools.

Figure 3. Prevalence of households using ICTs (%)



Source: Authors' elaboration based on the 2024 baseline data.

Note: ICTs = information and communication technologies.

Conclusions

Despite their potential, digital tools face limited adoption in sub-Saharan Africa due to infrastructure gaps, high costs, and literacy challenges. In collaboration with FtMA in Kenya, IFPRI was commissioned by the Mastercard Foundation to evaluate the impact of a digital integration program (BDEC) targeting agripreneurs/FSCs on farmers' agricultural outcomes in Kenya's potato value chain. This note summarizes the findings from the baseline survey that included two key components: an FSC survey covering 140 FSCs and a farmer-level survey including 1,532 households. Baseline findings offer a comprehensive snapshot of the socioeconomic, digital, agricultural, and gender dynamics within Kenya's potato value chain. The observed minimal baseline differences among FSCs and households served by BDEC-trained and non-BDEC-trained FSCs establish a strong and comparable foundation for robust causal inference in the cluster randomized controlled trial. While digital tool adoption is widespread among both FSCs and farm households, its use remains largely concentrated in communication and financial apps, with agriculture-specific apps having limited uptake. The data underscores the important role of FSCs, especially those benefiting from BDEC training, in bridging existing digital gaps, enhancing service delivery, and providing critical support to farmers. Nevertheless, persistent challenges highlight key areas where future targeted interventions would prove crucial to maximize impact. For example, an emerging pattern is the persistence of gaps in digital access for women: while basic mobile phone ownership is more common among women, smartphone ownership is dominated by men. This disparity has important implications for many agriculture-specific programs relying on smartphones, which may limit women's access to the cutting-edge digital tools supported by BDEC. These findings shed light on the significant potential of digital integration to address structural challenges, enhance inclusivity, and build greater resilience within Kenya's potato value chain.

Box 2. Policy Implications

- Expand digital training for FSCs and farmers to improve adoption and literacy.
- Address gender gaps in smartphone access to ensure inclusivity.
- Promote agriculture-specific app adoption beyond communication and finance apps.
- Support youth engagement through tailored digital solutions and incentives.

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