How inclusive are smallholder farmers' access to Digital Agricultural Platforms? Lessons from the EzyAgric Digital Platform in Uganda.

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Abstract

This study investigates the barriers to accessing digital agricultural platforms in Uganda, focusing on EzyAgric. Using a cross-sectional qualitative design, we analysed 29 scripts from focus groups, interviews, and key informants. The Rapid Inclusivity Assessment tool identified proto-personas at risk of digital exclusion, while the Digital Divide Framework provided a theoretical basis. Three main personas emerged: tech-savvy youth (low-risk), middle-income farmers (medium-risk), and older subsistence farmers (high-risk). Key barriers include financial constraints, limited digital literacy, a lack of trust, and cultural norms. Women face additional challenges, such as financial dependency and time constraints, while elderly farmers struggle with unfamiliarity with and preference for traditional methods. Recommendations include improving the infrastructure, providing targeted digital literacy training, designing user-friendly interfaces, building trust, and considering cultural norms. The study emphasises holistic, intersectional approaches and public-private partnerships to promote equitable access to digital agricultural platforms.

Keywords: digital inclusion, digital agricultural platforms, EzyAgric, women, elderly, proto-personas

Introduction

Digital platforms offer real-time information, expert advice, and resources to smallholder farmers in SSA, enabling informed decision-making on crop selection, input utilisation, and marketing strategies. Recent studies have shown that adopting digital tools can increase productivity, enhance earnings, and reduce postharvest losses (Rajkhowa & Qaim, 2021; Kudama et al., 2021; Mapiye et al., 2021). However, the benefits are not equally distributed because of barriers, such as low digital literacy, financial constraints, and underdeveloped rural infrastructure (Magesa et al., 2023; Gumbi et al., 2023; Morepje et al., 2024). These challenges create a persistent digital divide that hampers equitable access (Xie et al. 2021). Further research is needed to investigate the exclusion levels among smallholder farmers in SSA and their root causes to inform potential solutions.

Studies have identified barriers contributing to the digital divide among smallholder farmers in SSA, but an understanding of digital exclusion levels and obstacles to using digital platforms remains limited, especially for diverse demographics within farming communities. Research has explored issues, such as low digital literacy (Kudama et al. 2021; Magesa et al. 2023), and financial constraints (Gumbi et al. 2023; Kudama et al. 2021), and infrastructure challenges (Gumbi et al. 2023; Morepje et al. 2024), and social and cultural barriers (Kudama et al. 2021; Gumbi et al. 2023). However, gaps persist in the comprehensive understanding of digital exclusion in agriculture, particularly for women and elderly farmers. Further research is required to develop targeted interventions that can bridge the digital divide and ensure equitable access to digital agricultural platforms for all smallholder farmers in SSA.

Uganda exemplifies the challenges and opportunities in SSA's agricultural landscape of SSA (Kudama et al. 2021). Smallholder farmers face significant barriers in accessing digital platforms that can enhance productivity, resilience, and market access. These obstacles include limited digital literacy, infrastructure deficits, the high costs of devices and data, and low adoption rates influenced by affordability and perceived value (Mastenbroek et al. 2020; Mhlanga and Ndhlovu 2023). Although digital platforms offer potential benefits, their adoption remains low. The existing research lacks a comprehensive understanding of the sociocultural contexts affecting digital platform adoption among Ugandan smallholder farmers, particularly regarding sociocultural and age-related factors.

This study specifically aims to investigate the socio-cultural and age-related barriers to digital agricultural platform adoption among smallholder farmers in central Uganda, focusing on the EzyAgric platform. Using EzyAgric as a case study, this study explores access barriers to this comprehensive platform, which offers integrated services through multiple channels. Despite its wide reach and innovative design, EzyAgric's low active user rate (20% of 400,000 registered users) highlights a significant gap between its potential and actual utilisation.

This study employs a multidimensional approach drawn from the digital divide framework to examine digital exclusion among Ugandan smallholder farmers, considering tangible, psychological, social, and economic factors. It investigates barriers to accessing the EzyAgric digital platform, focusing on sociocultural and age-related factors that contribute to varying digital exclusion risks. The study also explored the specific challenges faced by women and elderly farmers in accessing the platform.

Methodology

This study used a cross-sectional qualitative design, employing literature reviews, interviews, and focus-group discussions. This approach enables data triangulation and provides a more comprehensive perspective. It incorporated a 2022 scoping study from central Uganda, conducted under WP3 of the CGIAR Rethinking Food Markets Initiative, to evaluate digitally enabled cross-value chain services. This study assessed how these services address inefficiencies, create opportunities for improvement, and identify scalable innovations. Additional analysis of the scoping study data was conducted.

Data collection was guided by checklists developed after the literature review. The study included 29 scripts: 12 focus group discussions (FGDs), four in-depth interviews, and 13 key informant interviews. Participants were selected from farmer groups using the EzyAgric Digital Platform. Key informants chosen for their knowledge of EzyAgric included staff, farmer group leaders, and village agents. Four in-depth interviews were conducted with farmers, evenly split by gender, to gain comprehensive user insight. Additionally, 12 FGDs, segregated by sex and consisting of 8-12 participants each, explored their experiences with EzyAgric and other digital agricultural platforms. The enumerators received training and clarity testing before data collection.

To analyse the data, we used the Rapid Inclusivity Assessment for Digital Agriculture Services tool (Steinke & Schumann, 2022). This framework identifies proto-personas at risk of digital exclusion owing to contextual and demographic factors. We developed proto-personas based on the demographic characteristics and experiences of interviewees who used the EzyAgric platform by utilising data from FGDs and in-depth interviews. This tool elucidates the systemic inequalities in societal structures. We categorised proto-personas' digital exclusion levels as strong, medium, or low, based on the obstacles they encountered using the EzyAgric platform and their degree of vulnerability. We complemented proto-personas with thematic analysis (Braun & Clarke, 2006) to capture the broader contextual factors influencing EzyAgric access. Our structured approach began with data familiarisation, followed by the use of the Atlas.ti software for data organisation and theme identification. Illustrative quotes were extracted to provide rich descriptions of participants' experiences, highlighting the complexities and barriers in accessing the platform.

Theoretical framework

This study applies the Digital Divide Framework and integrates multiple theoretical perspectives to examine the access to and inclusiveness of the EzyAgric platform in Uganda's agricultural sector. This comprehensive approach allows for a nuanced examination of the digital inequalities in the agricultural sector. Using Van Dijk's framework, this study investigates how mental, material, skill, and usage access shape inequalities in the adoption and use of EzyAgric, exploring farmers' willingness to use the platform, challenges in accessing the necessary technology, digital competencies, and disparities in utilisation among different farmer groups. Furthermore, to gain a holistic understanding of the platform's accessibility, this study builds upon Warschauer's (2003) emphasis on contextual factors and Gilbert et al.'s (2008) model that evaluates inclusiveness through information delivery, technology use contexts, social networks, and institutional mechanisms. This combined approach enables a comprehensive understanding of how contextual, technological, social, and infrastructural factors interact to influence platform adoption, inclusiveness, and effectiveness in addressing access barriers in Uganda's agricultural sector and similar developing contexts. By integrating these theoretical perspectives, this study provides valuable insights into the complex dynamics of digital agricultural platforms in developing contexts.

RESULTS AND DISCUSSION

Proto-Personas and Levels of Digital Exclusion Risk

Focus group discussions (FGDs) and in-depth interviews revealed three personas among smallholder farmers with varying digital access. These personas reflect the differences in digital literacy and engagement with the EzyAgric platform. Personas were categorised into low, medium, and strong levels of digital exclusion. We examined each of these personas in detail, starting with those at the lowest risk of digital exclusion.

Low Digital Exclusion: *Tech-savvy, middle-income youth aged 20-35 years*

This persona represents younger farmers owning smartphones and regularly having access to Internet usage, coupled with stable electricity for charging their devices. These farmers are actively engaged with the EzyAgric platform to access a variety of services and agro-input markets such as seeds, fertilisers, agrochemicals, and agricultural information. These farmers had previous exposure to mobile phone technology and felt confident navigating the EzyAgric platform. The persona reported enhanced farming practices as one male youth shared, "*EzyAgric has made life easier; we have access to appropriate information about the growth of crops and the prices of inputs. The prices on the platform help me to know the current market prices so that when I am going to buy agro-inputs, I am not exploited.*"

This persona represents younger tech-savvy farmers who have integrated digital services into their practices. This is not surprising, as research has shown that younger farmers tend to portray greater familiarity with digital tools, owing to their tendency to be more open to innovative practices. For example, Hoang & Tran, (2023), show that younger smallholder farmers are often

better positioned to adopt digital technologies such as the internet, mobile applications, and digital platforms (Hoang & Tran, 2023). However, challenges such as unreliable Internet connectivity and limited app features persist, restricting full-platform utilisation, especially in areas with inadequate infrastructure. Ma et al. (2023) noted that poor infrastructure in rural areas creates a digital divide even among technically capable farmers. This highlights that digital exclusion in agriculture is not just about device ownership, but also about Internet quality and reliability, which can limit access to platforms such as EzyAgric. Consequently, even relatively tech-savvy farmers may face obstacles in maximising the benefits of digital agricultural platforms owing to resource limitations or poor Internet speeds.

Social factors significantly influence digital adoption among farmers, with studies showing that peer networks and technology-savvy individuals often mediate technology adoption in rural communities (Fox et al. 2021). However, this influence varies based on factors such as community support systems. The interplay of technological, infrastructural, and social factors highlights the complex nature of digital exclusion, even among farmers who are technologically adept.

Medium Digital Exclusion: *Middle-income farmers aged 30-50 years*
This persona owns smartphones but faces challenges, such as irregular Internet usage, high data costs, and inconsistent electricity supply, limiting the consistent use of digital tools. Engagement with the EzyAgric platform is mainly for checking agricultural information and often requires support. Interaction with other digital platforms is sporadic and occurs mainly during agricultural exhibitions or training events. One female farmer noted, "…*during the agricultural exhibitions, there is some training on how to use digital platforms to access services and they are usually practical, so I often try out the different Apps and I even have them downloaded on my phone but rarely use them after that"*.

This persona exemplifies a broader issue of digital agricultural platform adoption among smallholder farmers in rural areas. Despite smartphone ownership, high data costs, inconsistent Internet connectivity, and unreliable electricity hinder access to digital platforms. These infrastructural deficiencies disproportionately impact smallholder farmers in SSA (Mhlanga and Ndhlovu, 2023). While smartphone ownership indicates progress, connectivity costs and unreliable power exacerbate exclusion, which leads to sporadic digital engagement.

The interplay between technological ownership and infrastructural limitations reveals the disconnect between smartphone possession and effective digital participation. This vulnerability underscores the fact that material access alone does not ensure meaningful inclusion; enabling conditions are necessary for sustained usage (Van Dijk, 2002). The stark gap between device possession and meaningful digital participation highlights the often-overlooked aspects of digital inclusion, emphasising the need for comprehensive strategies that address both access and enabling factors in promoting digital agricultural platforms.

This persona's digital exclusion is exacerbated by disinterest, lack of confidence, and anxiety regarding digital tools. The interplay between these factors and limited ongoing support creates significant barriers to digital adoption of farming practices. This aligns with Warschauer's (2003) emphasis on continuous reinforcement for effective digital platform utilisation. Gong et al. (2024) noted that a lack of perceived utility or familiarity with digital tools can create mental barriers, causing farmers to revert to traditional practices. The combination of psychological and practical obstacles manifested in this persona underscores the complexity of inclusion in digital agricultural platforms. These findings highlight the need for targeted interventions that address both skill development and attitudinal changes, emphasising the importance of a multifaceted approach aimed at increasing access to digital agricultural platforms.

The gap between initial exposure and practical application highlights a critical area for intervention in digital agricultural initiatives. This skill gap hinders the full utilisation of digital platforms by this persona. While training sessions at agricultural exhibitions provide initial exposure, the lack of sustained, personalised training leaves this persona with insufficient digital competencies. These findings corroborate a study by McCampbell et al. (2021), who found limited capacity among farmers in Rwanda to access and use phone-based services, especially those requiring smartphones. Digital exclusion due to skill access is important among middle-income farmers, who often have moderate resources to own the necessary gadgets but lack the specialised knowledge or confidence to fully utilise digital platforms independently. Moreover, Fox et al. (2021) noted that when farmers struggle to reliably access and use digital services, they increase the perceived effort required and may decrease their willingness to continue using such tools. The disconnection between available technology and its ability to use it effectively represents an important challenge in bridging the digital divide in agriculture. This underscores the need for comprehensive and ongoing digital literacy programs tailored to the needs of middle income farmers.

This limited engagement pattern not only characterizes the persona but also contributes to their digital exclusion. The sporadic nature of platform engagement, primarily during events or with external assistance, suggests structural and contextual barriers to consistent interactions with digital services. Using Gilbert et al.'s (2008) framework, we see that the frequency and quality of digital engagement are critical for realising the benefits of ICT tools in agriculture. The disconnect between initial enthusiasm and sustained use underscores the need for reliable internet access and confidence in autonomous platform use. Consequently, farmers often fail to leverage the full potential of digital platforms for decision-making, productivity, and market access. This pattern of initial enthusiasm followed by limited sustained use highlights the challenges of integrating digital tools into rural agricultural practices, aligning with broader trends in digital adoption among rural communities. The challenge, therefore, lies not just in introducing digital tools but also in fostering sustained engagement.

Strong Digital Exclusion: *Older subsistence farmers aged years 50 and above.*
This persona primarily represents subsistence farmers aged ≥ 50 years. Some basic button phones are incompatible with EzyAgric and other digital platforms, while others do not possess any mobile devices. Their interaction with EzyAgric or other digital platforms is minimal or non-existent. These farmers perceive smartphones as unnecessary for their agricultural activities, and view digital platforms as irrelevant or too complex for their needs. Farmers depend heavily on traditional farming methods and community networks for agricultural information and support.

Digital exclusion among subsistence farmers stems from complex, interrelated, tangible, and intangible barriers. These barriers are often compounded by demographic factors. Mental obstacles, such as disinterest and anxiety towards mobile technology, unfamiliarity, and fear of failure also contribute to digital exclusion for this persona. While younger farmers may be more receptive to digital technologies, older farmers may face additional challenges. A generational divide exists, with younger farmers being more likely to embrace digital platforms (Fanelli, 2023). Material access challenges such as poor connectivity and unreliable power exacerbate psychological barriers. Failed attempts owing to infrastructural issues reinforce negative beliefs about digital tools (Fox et al., 2021). The combination of psychological and infrastructural barriers creates a self-reinforcing cycle of digital exclusion.

In addition to these external factors, cultural and social norms play a role in digital adoption. Strong reliance on traditional methods and the perceived reliability of community networks further hinders digital adoption (Rust et al., 2021; Zvobgo et al., 2023). To address these multifaceted barriers, innovative approaches that bridge traditional and modern practices are necessary. Integrating indigenous knowledge with modern digital tools may be an effective approach (Nigussie et al. 2020). Furthermore, leveraging existing social structures could be key to overcoming resistance to digital adoption. Peer networks and community support can play a crucial role in building trust and confidence in technology.

Table 1: Characteristic of proto-personas and digital exclusion features

Proto Persona	Level of Digital Exclusion Risk	Characteristics of Proto Persona	Key Obstacles	Distinct Features
Tech-savvy, middle-income youth aged 20-35 years	Strong	1. Own smartphones 2. Regular internet access 3. Stable electricity 4. Active use of EzyAgric for: - Purchasing agro-inputs (seeds, fertilizers,	Infrastructural Limitations Limited App Features	• Confident in using digital tools and actively integrate them into their practices • Social networks and peer influences amplify digital adoption within this group

		agrochemicals) - Obtaining market information and extension 5. Prior experience with mobile phone technology for agricultural purposes 6. Confident using EzyAgric		• Exclusion is primarily resource-driven rather than attitudinal.
Middle-income farmers aged 30-50 years	Medium	1. Own smartphones 2. Irregular Internet access 3. Inconsistent electricity supply 4. Sporadic use of EzyAgric, mainly for obtaining agricultural information	High Data Costs: Irregular Internet and Power Supply. Limited Digital Literacy and Confidence	• Partial exposure to digital platforms • Engagement with digital platforms is sporadic and reliant on external events (e.g., agricultural exhibitions). • Psychological barriers such as anxiety and perceived difficulty. • Struggles with a combination of structural, financial, and attitudinal barriers.
Older subsistence farmers aged 50 and above	Low	1. Minimal to no engagement with EzyAgric 2. Own basic button phones or no phone 3. View smartphones as unnecessary for farming 4. View digital platforms as irrelevant or too complex 5. Rely on traditional farming methods 6. Depending on community networks for agricultural information and support	Lack of Device Ownership: Many farmers either lack mobile devices altogether or possess basic phones incompatible with platforms like EzyAgric. Perceived Irrelevance of Digital Platforms: Farmers view digital tools as unnecessary or overly complex for their subsistence-oriented practices. Psychological Barriers: Disinterest, fear of failure, and unfamiliarity with technology	• This persona's exclusion is both tangible (device unavailability, poor infrastructure) and intangible (mental and cultural barriers). • The digital divide is significantly generational, with older farmers showing lower receptiveness to new technologies. • Unlike younger groups, overcoming exclusion for this persona requires targeted interventions addressing both cultural and psychological

	compound their exclusion. Cultural Reliance on Traditional Methods: Strong dependence on community networks and indigenous practices inhibits exploration of digital alternatives.	resistance alongside infrastructural deficits.

The degree of digital exclusion among farmers varies due to the complex interplay of infrastructural, socioeconomic, and psychological factors. Technologically adept youth primarily face resource-driven obstacles such as inadequate Internet connectivity and platform limitations. Middle-income farmers grapple with both infrastructural deficits and a lack of confidence, while older subsistence farmers are the most excluded, hindered by device unavailability, psychological resistance, and preference for traditional methods.

The spectrum of digital exclusion risks ranged from low to strong. Farmers in the low digital exclusion category demonstrated strong digital engagement with minimal barriers. Those in the medium category face periodic challenges that limit their consistent use of digital tools. The strong digital exclusion group is at the greatest risk of being left behind due to barriers, including technological, perception, cultural, and lack of resources.

Addressing these challenges requires the implementation of tailored strategies that incorporate infrastructural investment, cost-effective data solutions, digital literacy programs, and culturally sensitive approaches. Through a comprehensive understanding of the distinct needs of each group, interventions can be more efficacious in bridging the digital divide and enhancing the adoption of digital agricultural platforms such as EzyAgric. These findings underscore the significance of targeted interventions to ensure equitable access to agricultural technologies and prevent further marginalisation of vulnerable farmer groups.

Sociocultural and Age-related Constraints faced by women and elderly farmers in accessing the EzyAgric Digital platform.

This section explores the sociocultural and age-related factors influencing women's and the elderly's access to the EzyAgric digital platform. Key findings revealed significant differences in barriers between these groups, primarily driven by financial constraints, digital literacy, trust issues, and cultural norms. Understanding these barriers is crucial for developing targeted strategies for enhancing digital inclusion in agriculture.

The following subsections examine each identified factor and analyse its specific manifestations and effects on women and the elderly. These insights provide a foundation for exploring potential solutions to the digital divide in agricultural technology adoption. By identifying these barriers, we set the stage for discussion on tailoring digital platforms to meet diverse user groups' needs.

Financial Constraints

Both women and elderly farmers expressed financial challenges, especially regarding the use of the EzyAgric Agri shop component, which allows farmers to shop for genuine input online. These financial challenges were particularly evident in their responses to the data and mobile money charges. During the FGDs, both groups reported facing high data costs, with one female respondent stating, "*Most people with smartphones cannot afford data access the Agrishop*." The added withdrawal charges on the mobile money service were a further discouragement of use: "*When you pay using mobile money, there are withdrawal charges that you incur; if these are removed, then using mobile money to buy inputs would be the best option*." While both women and the elderly faced financial constraints, the nature of these challenges differed between them.

For women, financial dependency on male partners and the prioritisation of household or children's needs over personal digital access restricted their ability to invest in technology. Limited income-generating opportunities, resulting in resource allocation that often favours other family members, have also been reported to affect women. In contrast, elderly farmers primarily rely on government contributions and limited income sources, making spending on technology inflexible. Their preference for traditional farming methods, perceived as less costly, also deterred their investment in digital platforms. This financial inflexibility of the elderly, coupled with their familiarity with conventional farming practices, influenced their decision to invest in the EzyAgric platform.

Limited Digital proficiency

Women and elderly farmers reported challenges with the EzyAgric digital platform owing to limited digital proficiency. Women cited difficulties in English language comprehension, while elderly farmers struggled to navigate the platform's interface. A female participant noted, "*Some of us cannot read well and understand the language used on the EzyAgric platform, even some of the signs like 'add to cart*." Another participant added, "*The EzyAgric Apps use English, which is difficult for those who understand only Luganda."*

Elderly farmers face additional challenges. One older farmer stated, "*We find smartphones difficult to use, and the EzyAgric App is even more complicated, so I prefer the basic button phone*." These issues were attributed to a lack of training, limited attendance at agricultural exhibitions where digital platforms are promoted, and age-related cognitive challenges. For elderly farmers, minimal exposure to digital tools in their formative years and fear of making mistakes or damaging devices compounded these difficulties.

The experiences of women and older farmers with EzyAgric revealed that the digital divide in agriculture extends beyond access to technology, encompassing language barriers, user interface design challenges, and digital literacy issues. These insights highlight the intersection of gender, age, and digital literacy when adopting digital agricultural platforms, underscoring the complexity of implementing such solutions. These reported difficulties suggest that a one-size-fits-all approach may not be effective for all user groups, potentially hindering widespread adoption among women and elderly farmers. Addressing these barriers is crucial to ensuring equitable access to digital agricultural tools. Low levels of digital literacy emphasise the need for targeted training and support programs to enhance the capabilities of agricultural communities. As noted in previous studies, literacy challenges often intersect with gender and age disparities, further disadvantaging certain groups from digital agriculture (World Bank, 2021; Okello et al. 2022). Effectively bridging this digital divide requires a comprehensive approach to training, including a focus on vernacular languages, visual aids, and interactive learning to address literacy and language barriers (Hilty & Aebischer, 2021).

Lack of Trust

Lack of trust has emerged as a critical barrier to the adoption of the EzyAgric platform, particularly among women and the elderly. This lack of trust manifests in various ways, with participants expressing scepticism regarding the platform's legitimacy and reliability. Past negative experiences shaped attitudes, with one woman noting, "*Most digital platforms are frauds so they cannot be trusted by farmers*." Another farmer highlighted the difficulty in convincing other farmers, stating, "*The farmers think that purchasing inputs on the platform has no guarantee and so it is money wasted*." This mistrust was compounded by limited awareness of the benefits of the platform. These sentiments were echoed across different demographic groups, highlighting the pervasive nature of trust.

Given the distinct trust-related barriers for women and the elderly, the development of targeted strategies is crucial. While both groups share concerns about trust, the underlying causes differ. Women's hesitance stems from prior scam experiences, limited understanding of the security features of the EzyAgric App, and the social pressure to engage with unfamiliar digital platforms. By contrast, the elderly demonstrate a general distrust of new technologies due to unfamiliarity, with negative experiences deepening their scepticism about the EzyAgric platform's usefulness and reliability.

Addressing these barriers requires strategies tailored to the specific concerns and experiences of each group. The trust issues observed with the EzyAgric App reflect a broader trend in rural digital adoption, where the fear of fraud, data misuse, and technological unfamiliarity remain pervasive (Fabregas et al. 2020). Building trust requires transparency and accountability in platform operations, such as providing clear information about data security, costs, and benefits.

Leveraging trusted intermediaries, such as extension agents or community leaders, can build credibility and encourage wider adoption (Mogues et al., 2022). This approach aligns with findings that emphasise the role of participatory methods in fostering trust and acceptance among rural populations (Aker et al., 2016). By prioritising transparency and utilising trusted intermediaries, digital platforms can effectively address trust issues and promote adoption in rural contexts.

Cultural and social norms

Cultural and social norms affect women's access to zyagric. Expectations of women's caregiving roles and discouragement from engaging in modern technology reinforce their exclusion from digital spaces. Similarly, older farmers face unique obstacles in using the EzyAgric platform because of misconceptions about age and learning capacity (*too old to learn*). Social isolation and limited peer influence contribute to their lack of engagement with not only EzyAgric, but also other digital platforms.

These societal and cultural barriers not only limit access but also shape preferences for traditional farming methods over digital solutions. Both women and older farmers expressed a preference for familiar practices in financial transactions and farming approaches. Some find cash transactions more appealing, as one respondent noted, "*Cash on delivery gives me assurance that my items will be delivered to me because when it's delivered, I then pay for them*." Others prefer to avoid the perceived complexity of digital tools entirely, exemplified by the sentiment, *"Some people do not want things that disturb them... they grow their beans, sell the rest, and that is all."*

The preference for cash-based systems highlights the broader issue of digital exclusion and the need for tailored solutions that address the specific concerns of different user groups. Although digital solutions offer numerous benefits, their adoption varies across farmer demographics, underscoring the complexity of promoting widespread adoption and the necessity for targeted strategies. Sociocultural considerations play a crucial role in shaping access and usage patterns, particularly among women and elderly farmers. Gender-specific barriers, such as women's time-poverty due to caregiving roles and restricted mobility, require platforms to be accessible in ways that align with their schedules and localised needs (Doss et al., 2018; Ragasa et al., 2021). Age-related challenges also impact digital platform adoption, necessitating user-friendly designs and sustained community engagement to challenge perceptions that technology is exclusively for the younger generations (Luo et al., 2021). Addressing these diverse challenges requires a holistic approach that incorporates local cultural norms and social dynamics into platform deployment, fostering inclusivity by aligning interventions with the lived realities of these groups (Njuki & Sanginga).

The figures below show the underlying causes of the barriers faced by women and elderly farmers to accessing digital agricultural platforms.

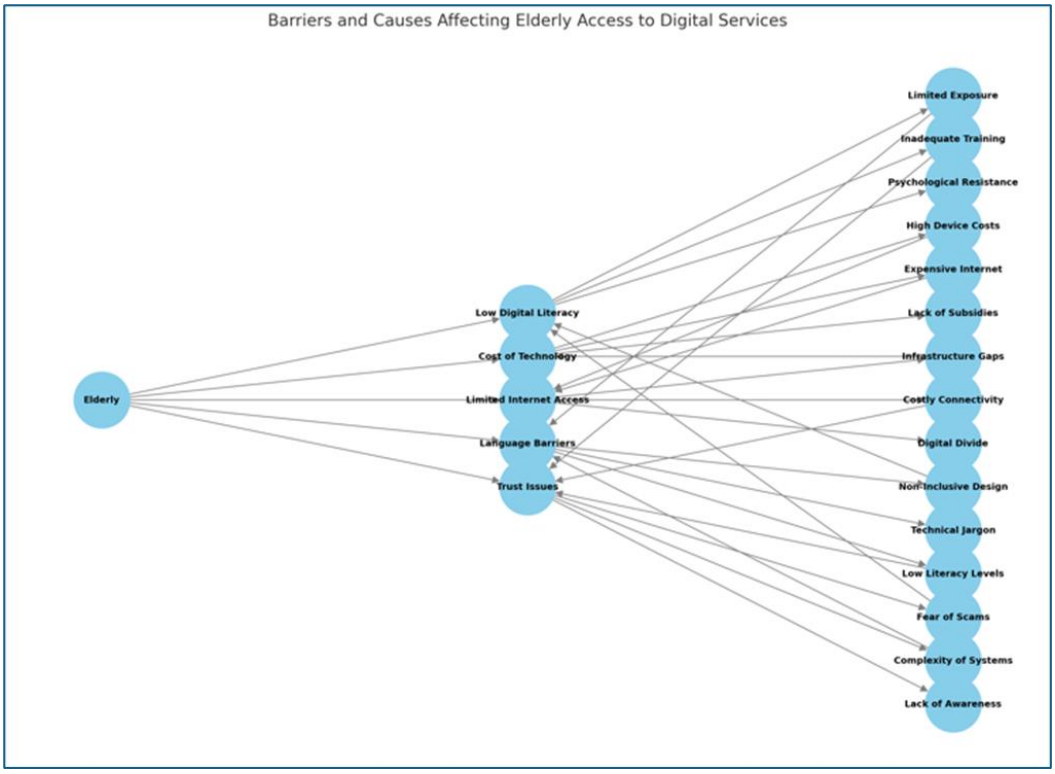

Figure 1: Barriers Affecting the Elderly Farmers' Access to Digital Agricultural Platforms and their Causes

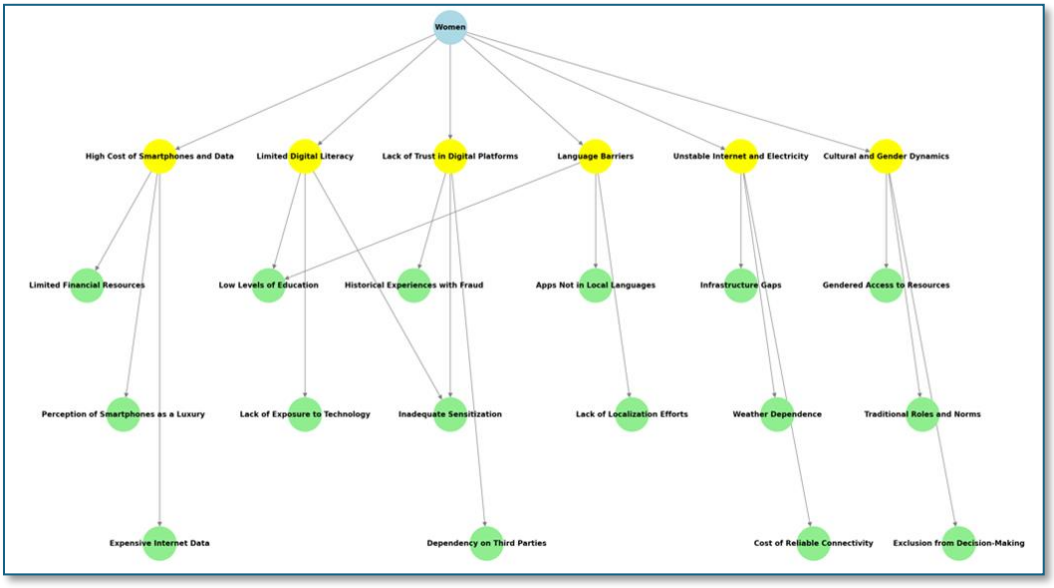

Figure 2: Barriers Affecting the Women Farmers' Access to Digital Agricultural Platforms and their Cause

CONCLUSIONS

The findings of this study highlight critical barriers to inclusive access to digital agricultural platforms, including sociocultural constraints, digital literacy gaps, and trust issues. These challenges are not unique to EzyAgric, but reflect systemic issues documented across Sub-Saharan Africa and other developing regions. Deliberate context-specific strategies are needed to ensure that disadvantaged groups, such as women and elderly farmers, benefit equitably from digital agricultural platforms and technological advancements in agriculture.

Variability in technology savviness among smallholder farmers is a crucial consideration for policymakers and practitioners aiming to ensure equitable benefits from digital platforms. This diversity in digital engagement, as seen in varying levels of technological literacy among personas, underscores the need for inclusive digital training and support. Nehrey (2023) suggests that strategies to address the digital gap should focus not only on providing technology but also on building digital literacy skills for farmers at different proficiency levels.

For digital agricultural platforms to be truly inclusive, they must address accessibility and usability issues. First, ensuring widespread infrastructure, such as reliable Internet and electricity, is critical. Mhlanga and Ndhlovu (2023) emphasise that digital infrastructure is a prerequisite for successfully integrating technology in agricultural practices. Second, platforms must incorporate design features that accommodate varying levels of digital literacy, from beginners to advanced users, to remain useful and accessible to all farmers. Additionally, Aker (2011) suggested that platform scalability—how they adapt to different farming contexts—can significantly affect their widespread adoption.

Digital agricultural platforms have the potential to bridge knowledge gaps for disadvantaged farmer groups, particularly women, by providing timely information and resources (Tripathi and Rajeev, 2023; Tang, 2022). In Uganda, platforms such as EzyAgric could reduce gender disparities in agricultural knowledge access, but this requires addressing the specific barriers faced by disadvantaged farmers. To enhance inclusivity, three key areas require attention.

1. Material barriers: Addressing unaffordable data costs and unreliable electricity through subsidised connectivity, offline functionality, and rural infrastructure investment (Mhlanga and Ndhlovu, 2023; Morepje et al., 2024).

2. Digital skills: Implementing ongoing, context-specific training programs delivered by trusted actors such as extension workers or farmer organisations to reduce skill and mental barriers (Makokha et al., 2020).

3. Urban-rural digital divide: Designing inclusive platforms that accommodate varying levels of digital literacy, infrastructure access, and socioeconomic contexts.

Addressing these intersecting vulnerabilities is crucial to prevent digital platforms such as EzyAgric from perpetuating inequalities and to ensure that all farmer groups can fully participate in the digital transformation of agriculture.

The intersectional nature of barriers—where gender, age, and socioeconomic factors compound access challenges—necessitates holistic tailored solutions. Acknowledging the diversity within farming communities is crucial for equitable access. Digital platforms must adopt inclusive design principles, catering to varied literacy levels, languages, and user capacities (Khalil et al., 2021). Monitoring frameworks should disaggregate data according to demographic factors to ensure equitably impactful interventions (Ragasa et al., 2021).

Although this study focuses on user-level barriers, broader systemic changes are necessary. Public-private partnerships can drive the development of affordable, locally relevant digital platforms. Policy interventions promoting gender equality in resource access, including mobile phones and Internet connectivity, can level the playing field for marginalised groups (Njuki & Sanginga, 2013). Creating enabling environments that prioritise inclusivity ensures that digital platforms meaningfully contribute to agricultural development.

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