9 Agricultural Extension, Promoter Farmers, and Nudges to Encourage Technology Adoption Among Men and Women Smallholders in Sub-Saharan Africa

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Abstract

This chapter considers the use of information nudges to encourage smallholder farmers in sub-Saharan Africa to adopt new technologies. The use of these nudges takes place in a context of inadequate formal extension services, where promoter farmers frequently provide the advice that extension agents would normally provide. The limited evidence on the effectiveness of information nudges in this context suggests that they are promising in terms of their potential to encourage farmers to adopt new technologies. However, for understanding the effectiveness of information nudges, a triple interaction effect needs to be evaluated: the identity of the person doing the nudging (typically the promoter farmer or extension agent) interacts with the nudge, and these two together, as well as on their own, interact with the identity of the person being nudged (typically the smallholder farmer who is encouraged to adopt new technologies). The challenge to understand this triple interaction effect points to a new research agenda.

Keywords

Nudges · Promoter farmers · Agricultural extension · Technology adoption · Smallholder farmers

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J. J. Okello et al. (eds.), *Behavioural Interventions and Agricultural Innovation*,
https://doi.org/10.1007/978-3-032-31066-8_9

1 Introduction

The provision of agricultural extension services in sub-Saharan Africa is inadequate due to insufficient resources and inefficient bureaucracy, which in turn limits smallholder farmers adoption of agricultural technologies that reduce risk, enhance productivity, or increase profitability (Wiggins et al., 2021; Kristin & Franzel, 2018). In an attempt to bolster formal extension services, progressive farmers from local communities (alternatively called lead farmers, model farmers, or promoter farmers) are often selected to provide, through a demonstration process, the type of information that extension officers would ordinarily provide (Khaila et al., 2015; Holden et al., 2018; Takahashi et al., 2019; Ragasa, 2020; and Ochieng et al., 2022). While promising, the promoter-farmer approach suffers from its own limitations, which relate in part to the loss or distortion of information that occurs when it is transmitted through unofficial channels. Information nudges may help overcome the imperfect transmission through promoter farmers (Kondylis et al., 2017; Holden et al., 2018; and Niu & Ragasa, 2018).

Information nudges are low-cost interventions based on insights from behavioural economics that can lead to behavioural change that is in the best interests of people.[1] For example, to encourage farmers to adopt a positive attitude towards quality seed, one can use posters that make farmers aware of the losses they could avoid by adopting the seed as an information nudge. It is a *nudge* because it evokes the feeling of loss aversion by making use of insights from behavioural economics indicating that farmers are loss averse. It is an *information* nudge because it combines this insight with the provision of information that helps farmers make the correct decision for their farms. Other examples of information nudges can be found in Textbox 9.1.

Textbox 9.1 Role, Impact, and Reach of Information Nudges

Information nudges have been used to encourage the adoption of water-saving technologies and innovative practices, with large effect sizes (Chabé-Ferret et al., 2019); nudge attendance to farmers markets, which was found to be ineffective (Didero et al., 2021); improve environmental and health outcomes by increasing compliance with pesticide use regulations (Buchholz & Musshoff, 2021; Michels et al., 2023); show how others change behaviour in order to influence uptake of eco-friendly practices (Boenke et al., 2022); provide price references to nudge commodity-traded produce (Belay & Ayalew, 2020); allow social comparison to encourage sustainable rice farming (Sasaki et al., 2024); and encourage investment in organic farming (Boun My et al., 2022).

(continued)

[1] In Thaler and Sunstein's (2008) account, nudging uses two fundamental principles, libertarian paternalism and choice architecture. Liberal paternalism supports people in making decisions they would make if they were fully informed and free of temptation, and choice architecture is the environment in which decisions are made. Thus, choice architects influence people's decisions and behaviours simply by leading them to better options for themselves (Sunstein & Thaler, 2003).

Textbox 9.1 (continued)

In developing countries, widespread initiatives primarily involve the use of information and communication technologies (ICT), especially short message service (SMS) and videos, with mixed results. The popularity of these two approaches can be attributed to their affordability and broad reach. An evidence synthesis of six SMS-based information campaigns in East African countries, designed to promote agricultural lime adoption, suggests that it is possible to influence farmer behaviour by delivering SMS reminders that encourage experimentation with certain fertilisers. These interventions have been shown to increase knowledge, though adoption is not sustained in subsequent seasons (Fabregas et al., 2025). Though the programmes differed in design, target populations, and information content, the meta-analysis yielded a modest effect size relative to intervention costs, with little evidence of fatigue or crowding out. Furthermore, the study found that the impact increases with the intensity of nudging but not with phone calls, more specific information, or the inclusion of behavioural framing.

Similarly, there is evidence of the positive effects of mobile phone-based information nudges, which have been shown to be effective in promoting new technology adoption in Burkina Faso compared to traditional extension methods, particularly among low-literate farmers (Maredia et al., 2018). Van Campenhout, Spielman, and Lecoutere (2021) provide evidence that information nudges in the form of videos increase maize farmers knowledge and adoption of recommended practices, with little indication that SMS reminders or interactive voice responses have an incremental effect.

In this chapter, the scope for information nudges to support smallholder farmers in SSA is assessed. The use of these nudges takes place in the context of inadequate formal extension services, where promoter farmers frequently provide the advice that extension agents would normally provide. We review the evidence on the effectiveness of information nudges in this context and conclude that they are promising in terms of their potential to encourage farmers to adopt new technologies. However, the effect of these nudges is heterogeneous and crucially depends on the identity of promoter farmers and receiving farmers, with gender being a key mediating factor. In Sect. 2, we review agricultural extension services in SSA and identify a potential role for information nudges. In Sect. 3, we review the influential promoter-farmer approach, focusing on those challenges that are likely to interact with nudges. In Sect. 4, we focus on farmer diversity and how that interacts with nudges. In Sect. 5, we conclude by highlighting the triple interaction that needs to be evaluated for better understanding of the effectiveness of information nudges, namely: the person doing the nudging (typically the promoter farmer or extension agent) *multiplied by* the nudge *and then by* the person being nudged (typically the smallholder farmer who is encouraged to adopt new technologies). In other words, the overall effect of the nudge can be understood as the combined influence of three factors: the characteristics and timing of the person delivering the nudge (typically the promoter

farmer or extension agent), the timing of the nudge itself, and the receptivity of the person being nudged (typically the smallholder farmer encouraged to adopt new technologies).

This points to an important new research agenda.

2 Information Nudges to Support Agricultural Extension Services

In this section, we review the difficulties with agricultural extension services in SSA and assess the scope for information nudges. Sub-Saharan Africa faces challenges in agricultural technology adoption in part due to farmers limited awareness of the benefits, profitability, and optimal utilisation of agricultural innovations (Wiggins et al., 2021). Farmers may fail to adopt productivity-enhancing, risk-reducing innovations when they are unaware of their existence, do not understand their benefits, or lack the knowledge and skills to use them (Magruder, 2018; Takahashi et al., 2020; Suri & Udry, 2022). For that reason, access to agricultural extension at the early stage of technology dissemination, which is characterised by information disequilibrium and high perception of risk, helps farmers adopt and better utilise agricultural technologies such as improved seeds (Kristin & Franzel, 2018). Yet, formal extension services face constraints arising from insufficient resources, bureaucratic inefficiencies, and a lack of responsiveness to evolving demands in the sector (Lecoutere et al., 2023). As a result, most farmers in SSA do not have access to sufficient relevant information and are slow to adopt innovations that could improve agricultural productivity and reduce risk (Magruder, 2018; Suri & Udry, 2022).

Not only are they inadequate, but extension services are also uneven and reach women ineffectively (Mudege et al., 2016). About half of the farmers without access to agricultural extension services in SSA are women from low-income households, restricting their ability to make informed decisions regarding crop selection, technology adoption, and farming practices (FAO, 2023). Women are also less likely to access and benefit from extension programs because they are designed for and targeted at male household heads (Ragasa et al., 2013). Extension services overlook the productive, reproductive responsibilities, and preferences due to gender roles (Diaz & Najjar, 2019), and view women as making a negligible contribution to farm activities (Lecoutere et al., 2019). Moreover, agricultural information received by men is not communicated to the women within their households (ibid.).

Extension services neglect gender-divided labour, women's mobility, time allocation, and norms that dictate the relationships they can form. Gender norms have an impact on women's capacity to pursue and apply agricultural training (Mudege et al., 2016, see Textbox 9.2 for details). Women farmers prefer certain channels or associations with female extensionists for enhanced communication and friendliness, or because they understand them better (Achandi et al., 2018). This creates differential access to extension, which may be an important cause of women's lower adoption rates of improved seed (Puskur et al., 2021). Further, women, compared to men, tend to have lower and impeded access to productive resources, including

Textbox 9.2 Gender Norms and Access to Extension Services and Training (Mudege et al., 2016)

Agricultural extension services provide a way to bridge the gap between science (global and local research) and practice (local farmer level), and are assumed to lead to better farmer decision-making, improved agricultural performance, and better outcomes. These services help farmers unpack the technical information about innovations, whether a technology—as in the case of an improved crop variety or livestock breed—or complementary practices required to optimise gains from their use. They also help reduce the risk and uncertainty associated with adopting innovations. In a study conducted in Malawi, the authors found that women and men differ significantly in their access to extension services and training. The study was conducted among potato farmers in the Southern region of Malawi, where the potato is ranked highly as a food and cash crop by both women and men. It also found that selection of the gender of farmers who participated in field days and workshops where agronomic training was provided was done by extension agents in collaboration with village headmen (both cases dominated by men). In addition, hosts of demonstration plots were lead farmers, and predominantly men. Thus, participation in training events, field days, and hosting of demos was skewed heavily towards men. The authors attributed this to gender norms. For instance, when invitations to the training events did not specify the number of women and men to attend, it was men who did so, in the guise of representing women. In some cases, women were forbidden by their husbands from attending training. Village headmen who oversaw the training recruitment did not want to inform women directly. They argued that "it was difficult [socially] to approach women to inform them about impending meetings and training opportunities without informing their husbands" (pg 298, paragraph 1, lines 6–7). Sometimes invitation to training events came at short notice, giving women no time to prepare (by rescheduling domestic chores) to attend. In other cases, gender and power relations worked against women, preventing them from being selected as information disseminators to other women, a practice that has been found more effective in reaching women with new information. Gender role expectations and gender stereotypes in communities reinforced these biases. Men, it was believed, understood new things better and are the "knowers", with women as recipients of knowledge from men. This, the authors argued, strengthened the stereotypic view that women are not intelligent and is "disempowering to women because it erodes their agency and self-esteem…" (pg 303, paragraph 3, line 5–6).

those that are required to obtain agricultural information, such as mobile phones (Burrell, 2010; Kotut & Alikhan, 2024). It has, for instance, been shown that if men and women had equal access to labour, land, and extension services, they would have an equal likelihood of adopting high-quality seeds (Doss, 2018). For instance,

according to Wahome et al. (2021), female farmers in Kenya are less likely to employ the tissue banana culture method; however, women would have an equal chance to adopt the invention if they were provided with sufficient information about it. Therefore, complementary extension channels have been explored from various angles to support the constrained systems and increase reach to marginalised groups, especially women.

One such approach involves leveraging promoter farmers to augment existing systems and broaden their scope (Kondylis et al., 2017). Extensions to agricultural extension systems that make use of promoter farmers are described as more inclusive, cost-effective, and involving a wider range of stakeholders (Wellard et al., 2013). Moreover, advocates of this model argue that peer learning can trigger significant social multiplier effects in the dissemination of agricultural technologies, which are essential complements to formal extension systems (Hogset & Barrett, 2010). In root and tuber crop projects like sweet potato, because of the low involvement of private actors, the use of promoter farmers is particularly popular—in various forms, such as community extension workers and decentralised vine multipliers (Adam et al., 2018). Information materials, new techniques, and tools are provided to promoter farmers to disseminate quality seeds and improved practices on a wide scale (Mandal, 2023). Promoter farmers host nutrition education sessions, demonstrate best practices, organise field days, and multiply and distribute high-quality seeds and improved varieties. However, despite the prevalence of promoter farmers in agricultural extension projects, insights into their comparison with adopting farmers and the associations of their characteristics with their performance in supporting quality inputs commercialisation are missing.

Relying solely on interpersonal interactions may limit the scalability and reach of commercial seed interventions, particularly in large or geographically dispersed communities. Akbarpour et al. (2020) emphasise the importance of simple contagion, a sufficiently long adoption period, and frequent social interaction within the social network of the promoter farmer relied on for diffusion. Integrating the efforts of promoters with information nudges is therefore seen as a promising way forward. For instance, when promoting high-quality seed, a poster showing its comparative advantage and placed in areas frequented by farmers can reinforce a message about the benefits of quality seeds, amplifying the effects of exposure to information about high-quality seeds provided by promoter farmers.

The transmission of information from promoter farmers to end-user farmers may introduce noise and imperfections, potentially exacerbating uncertainty regarding the benefits of adopting a new technology (Munshi, 2004). For promoters, information nudges can serve as reminders and reinforce the information conveyed during central training sessions, offering supplementary support to alleviate uncertainties and enhance the adoption of new agricultural practices. Information nudges may aid in mitigating the issue of information loss within promoter extension models, as highlighted by Kondylis et al. (2017), Holden et al. (2018), and Niu and Ragasa (2018). Kondylis et al. (2017) reveal substantial information loss from extension agents to both promoter farmers and other farmers in the community. These findings question the effectiveness of the promoter farmer approach in advocating specific

agricultural technologies, suggesting a significant gap in knowledge transfer despite training. Information nudges may potentially help bridge the gap.

Moreover, the promoter extension method often fails to account for the multifaceted dynamics of information diffusion in agriculture, where drawing from diverse sources is paramount (Beaman et al., 2015). To address this limitation, incorporating information nudges alongside traditional extension strategies can foster information dissemination. Empirical findings from Beaman et al. (2021) indicate that the conventional approach may suffer from limited effectiveness, as agricultural knowledge tends to remain localised and fails to extend significantly beyond the initially targeted individuals. Similarly, Berg et al. (2019) observed that health information shared by unincentivised agents tends to circulate primarily within specific social groups, such as castes. Information nudges serve as effective tools for reaching multiple audiences and enhancing the reach and impact of extension efforts.

Beaman et al. (2015) discovered that farmers in Malawi required information from diverse outlets before they were open to experimenting with techniques like pit planting. Genius et al. (2014) revealed that in the uptake of irrigation technology in Greece, the effect of extension services and social learning was more pronounced when combined. Information nudges complement these promoter-peer interactions by serving as conversation starters, reminders, or prompts for further dialogue among community members. There could be limitations to relying solely on interpersonal interactions in commercial seed interventions, particularly in large or geographically dispersed communities, which suggests considerable potential for integrating information nudges in agricultural extension services.[2]

3 Promoter Farmers Nudging and Being Nudged

As discussed in the previous section, promoter farmers are used to supplement agricultural extension. The use of this approach comes with its own challenges. In this section, we concentrate on the challenges that may interact with information-based nudges. It leads to the insight that the identity of promoter farmers becomes part of the nudge, which therefore requires explicit research attention when nudge effectiveness is evaluated.

Formal extension services have yielded unsatisfactory performance in sub-Saharan Africa, prompting the need for system restructuring and intensified efforts. An efficient agricultural extension program helps farmers make better decisions, increase their revenue, and ensure food security. It also helps farmers develop better technical habits, such as the use of quality inputs and seeds. However, formal

[2] Although outside the scope of this chapter, it is important to note that implementing information nudges in agricultural extension faces challenges related to: (i) access to mobile phones and network penetration (Aker et al., 2016; Fabregas et al., 2025), and (ii) the necessity of repetitive application and reinforcement to sustain impact, since a short-term effect on behaviour may not equate to habit formation and scalability (Jayanth et al., 2022; Fabregas et al., 2025).

extension services and outside assistance from development partners like NGOs and other international organisations have shown their limitations and need to be complemented to meet the challenges of the modern world (Amoussohoui et al., 2023). Despite considerable challenges (see Textbox 9.3), promoter farmer extension has the potential, through social learning, to harness the leadership existing in the farming community and networks to achieve and complement the goal of agricultural development.

Textbox 9.3 The Use of Promoter Farmers to Complement Agricultural Extension Services

The use of promoter farmers in agricultural extension within sub-Saharan Africa has been a topic of significant research and scrutiny. De Janvry et al. (2016) and Pamuk et al. (2014) have pointed out that this approach has yielded unsatisfactory results. One of the primary reasons cited for this is the presence of underfunded extension systems, which limit the effectiveness of the promoter farmer model. Additionally, the selection of inappropriate promoter farmers further exacerbates the issue, hindering the diffusion of agricultural technologies (de Janvry et al., 2016; Pamuk et al., 2014). For studies illuminating challenges of the promoter-farmer approach along these lines, see Khaila et al. (2015), Holden et al. (2018), Takahashi et al. (2019), Ragasa (2020) and Ochieng et al. (2022).

A strand of literature focuses on providing performance incentives to promoter farmers; see BenYishay and Mobarak (2019) for a representative example. In a recent study, Balew et al. (2023) shed light on the importance of incentivising group leaders within farmer communities to promote knowledge sharing. In their study on integrated pest management (IPM) in Ethiopia, incentivising group leaders with rewards and utilising loss-framed messaging increased the effort of knowledge dissemination among these leaders. However, despite this increased effort, the study observed a lack of significant experimentation with IPM among follower farmers. Similarly, Okello et al. (2023), using a field experiment, provide public recognition to promoter farmers for disseminating information about improved seeds and find that this does not affect receiving farmers knowledge or willingness to pay for improved seeds.

Motivational factors play a significant role in the engagement of promoter farmers, with challenges such as competing employment opportunities potentially leading to a loss of interest in their advisory roles (Ochieng et al., 2022). Studies emphasise the importance of providing performance-based incentives tailored to the specific motivations of promoter farmers, whether driven by a desire for knowledge enhancement or altruistic intentions (Fisher et al., 2018). Additionally, increased and targeted training of promoter farmers can help ensure they possess the necessary skills and knowledge to fulfil their roles (Khaila et al., 2015).

A discussion point is the suitability and credibility of promoter farmers, particularly regarding their social connections and representativeness of the farming community. To drive extension projects, promoter farmers are chosen with heterophilous ties, high status, influence, or leadership qualities, whereas at other times, homophilous representatives of the average farmer are preferred (Khaila et al., 2015; Ragasa, 2020; Beaman et al., 2021; Amadu, 2023).

The performance of the promoter farmers, besides the superiority of the technology, hinges on relationships between promoter farmers and their peers' ties, facilitating or impeding social learning (Shikuku, 2019). According to innovation diffusion theory, the relationship between a communicator and an information receiver can be one of homophily, where the similarity in characteristics with the average farmer exists for support, or heterophily, where the transmission of novel ideas occurs between dissimilar individuals (Rogers, 1995). Initially, promoter farmers were selected based on their connection to follower farmers, reflecting demographic and agricultural similarities. However, some projects also favour innovative promoters who are central to their networks to facilitate contagion or promoter farmers with slightly higher status (Nakano et al., 2015; Beaman et al., 2021). The inclination has provoked discussions regarding different modes of promoter selection and types of ties, namely homophily and heterophily, and their efficacy in technology diffusion.

A strand of literature argues for the superiority of homophily, centrally connected promoters and kinships. Beaman et al. (2021) emphasise that targeting farmers with high connections in their communities drives the adoption of new agricultural technologies. In their study, failure to engage central farmers resulted in limited diffusion. Over 3 years, it was found that pit planting increased significantly in villages where central farmers were involved and supported complex contagion with multiple exposures for adoption. BenYishay and Mobarak (2019) state that promoters' social identity affects other farmers learning and adoption behaviours. The authors also determine that similarity in farm size, input practices, and belonging to common social groups could be key to the high efficacy of promoters, in support of Wang et al. (2020). Beaman and Dillon (2018) contend that the vertical flow of information from the promoter farmer to peer farmers fails, and successful information exchange is likely to be based on horizontal, socially proximate relationships. In their study, Nakano et al. (2015) observed that ordinary farmers who maintained a kinship or residential connection with promoter farmers displayed a higher propensity to adopt new agricultural technologies. While the promoter farmers immediately experienced a surge in technology adoption following training, the non-trained ordinary farmers exhibited a delayed but eventual catch-up in their adoption rates.

Regarding heterophily, Maertens (2017) suggests that promoter farmers play a significant role in peer learning, while Holden et al. (2018) and Fisher et al. (2018) observe positive impacts of the promoter-farmer approach in sub-Saharan Africa. Nonetheless, BenYishay and Mobarak (2019) observe that ordinary farmers, especially when incentivised, may outperform promoter farmers as trainers in technology diffusion efforts. In support, Takahashi et al. (2019) demonstrate that rather

than promoter farmers, randomly selected training participants, representative of the majority in a community, effectively work as catalysts to disseminate information to non-training participants. Offering a compromise, Fisher et al. (2018) argue that an optimal approach is for promoter farmers to serve as initial conduits for disseminating new information, while the homophily positions promoter farmers to drive wider technology diffusion. Combining the ties entails training promoter farmers to introduce new technologies to socially proximate farmers who possess slightly higher capabilities than the average farmers.

Regarding social identity of promoter farmers, Shikuku (2019) and Kondylis et al. (2017) reveal that women trainers increase the intensity of reaching, translating to better awareness, adoption and mitigating gender bias. These findings underline the heterogeneous dynamics within farmer networks, with mixed empirical findings adding complexity to the promoter-farmer approach. Vasilaky and Leonard (2018) conducted a field experiment in Uganda aimed at establishing new information channels by pairing female cotton farmers who had not previously interacted. During training sessions, the authors encouraged these farmers to exchange technological insights in the production process. This intervention yielded a significant increase in productivity for the paired individuals, highlighting the value of connecting female farmers who typically operate outside traditional agricultural information networks. Furthermore, Mekonnen et al. (2018) found that network effects are pronounced among female farmers compared to their male counterparts.

Based on the above discussion, the ideal candidate for the promoter role is changeable. Should this individual be heterophilous, bringing diverse perspectives, or rather reflecting the ordinary characteristics of the majority within the community? Matching the characteristics of promoter farmers with those of peers can result in favourable outcomes following the homophily theory; in contexts of dissimilarity, mitigating cognitive dissonance is essential to prevent conflicting messages (Lazarsfeld & Merton, 1964).

Limited evidence exists on how the identity of promoter farmers, when these are involved in communicating information nudges to their fellow farmers with the aim of the latter to adopt new agricultural technology, interacts with (a) the identity of the farmer receiving the nudge and (b) the information nudges themselves. The study of Beaman and Dillon (2018) underlines the gender disparities that exist in information diffusion within social networks, indicating that women farmers are less likely to receive information when targeting strategies that prioritise central nodes based on betweenness centrality within village-level networks. Further, Lecoutere et al. (2023) show that involving women in receiving information improved their knowledge outcomes positively; nonetheless, men's knowledge outcomes suffered when information was solely provided to the female co-head. Their results suggest that women may not always share the information received with their spouses. Then Shikuku (2019) shows that information diffuses more if the disseminating farmer is female compared to male, as they are more dependable and apply more effort in reaching other farmers. The author concludes that training female promoters might increase competence and acceptance of messages. Pan et al. (2018) delved into comparable matters in Uganda, focusing on women

promoter farmers who facilitated training and access to hybrid maize seeds, especially for fellow women smallholder farmers. The study identified substantial positive effects of adopting recommended cost-effective agricultural practices and inputs within households and household food security.

For the peers, Kondylis et al. (2016) noted that providing information about sustainable land management practices to farmers in Mozambique had different effects on male and female farmers. The study found that female farmers were less effectively reached than their male counterparts, and a positive impact on awareness and adoption among female farmers was observed when additional female extension agents were introduced to engage with them in Mozambique. Lambrecht et al. (2016) explored the effectiveness of extension services based on whether information was provided jointly to both male and female co-heads, exclusively to the male co-head, or exclusively to the female co-head within households. Focused on integrated soil fertility management practices in eastern DR Congo, they discovered that when both male and female co-heads participated together in extension information events, the adoption rate increased the most.

4 Farmer Diversity and the Effectiveness of Information Nudges

The discussion so far suggests that the identity of promoter farmers is likely to matter when a nudge is being used alongside them to encourage farmers to adopt new technologies. We next focus on the identity of the farmers considering adoption, which leads to the insight that the nudge interacts not just with the identity of the person doing the nudging but also with that of the person being nudged.

The existing knowledge on smallholders' adoption of agricultural technology highlights four crucial conditions (FAO, 2018, 2024; Huyer et al., 2024). Firstly, the technology must be of high quality and cater to the specific needs and preferences of individuals from diverse demographic and socioeconomic backgrounds. Secondly, the technology should be readily available to all smallholder women and men farmers in the appropriate locations and at the right times. Thirdly, the accessibility of the technology is vital, meaning that farmers, irrespective of gender and socioeconomic characteristics, should have access to reliable information about the technology, be able to afford it, and physically obtain it. Lastly, both women and men must be able to use and control the technology, ensuring equity and empowerment. By meeting these conditions, agricultural technology can effectively contribute to overall food security and benefit all farmers.

However, an especially significant hindrance to the progress of farming in developing countries is the lack of gender equity, which poses a serious threat to the effectiveness of agricultural research at all levels, from seed delivery and livestock value chains to the management of rural landscapes (Tavenner & Crane, 2019; Harris-Fry et al., 2020; Njuki et al., 2023). Gender-based inequalities exist in access to and adoption of technology and are often attributed to differences in resource access between female and male farmers. For instance, women face challenges

accessing capital, credit, land, and extension services, creating a gender gap in agricultural technology adoption (Doss, 2018; Njuki et al., 2023).

Beyond gender, other factors associated with the adoption of technology are essential to explore in agricultural contexts. While gender dynamics undoubtedly influence decision-making, understanding additional factors such as farmers socioeconomic characteristics, access to credit, knowledge and awareness of the technology, and market conditions adds to the understanding of effective demand. We highlight next the particular factors that are relevant for understanding a potential role for information nudges.[3]

First and most obvious is the role of information provision (Bridle et al., 2020; Okumu et al., 2021; Mobarak & Saldanha, 2022). Limited access to information contributes to low agriculture technology adoption. When farmers have a limited desire to invest in agricultural innovations because they are unaware of their benefits, the adoption is low (Suri & Udry, 2022). Offering pertinent information about the innovations can increase the adoption rate (Fabregas et al., 2025). This information enables farmers to comprehend the advantages associated with using such innovations. Thus, there is an opportunity to use information nudges to influence farmers adoption of new technology.

Second, farmers are attentive to the physical attributes and appearance of inputs, especially of seed. Accordingly, in the case of incomplete and asymmetric information, a seed's visual appearance may be among the signals that farmers try and use to infer unobservable quality. Consequently, in such situations, farmers may misperceive input quality as a credence attribute despite sufficiency (Wossen et al., 2022; Michelson et al., 2021). Maredia and Bartle (2023) evidence this in a study that found that farmers bids for certified seeds increased by 8% in response to positive quality signals, while they decreased by 17% for ware potatoes in response to negative quality signals, indicating farmers probable quality misperceptions due to information asymmetry. Using information nudges can correct such misperceptions and perhaps increase the likelihood that a new technology is adopted.

Studies have shown that nudges may contribute to farmers behaviour change (Becchetti et al., 2020; Fabregas et al., 2019). In a framed experiment, Davidson and Goodrich (2023) show that information nudges motivate enrolment in index insurance covering pasture, forage, and rangeland. The authors conclude that providing enrolment recommendations may alleviate choice overload and increase the likelihood of enrolment. Belay and Ayalew (2020) nudged farmers in crop choice using price information. The authors argue that providing access to reference price information increases the average farm gate price, influencing farmers crop choice decisions. In Kenya, among sugarcane farmers, nudges were important in motivating fertiliser usage (Casaburi et al., 2014).

[3] Other factors important for technology adoption include farmers risk and ambiguity aversion (Holden & Quiggin, 2017; Crentsil et al., 2020; Chavas & Nauges, 2020), downside risk aversion (Mukasa, 2018), time inconsistency and self-control (Duflo et al., 2011), and locus of control (Abay et al., 2017). Potentially, these factors could interact with information nudges in complex ways; these are outside the scope of this chapter.

While encouraging, more attention needs to be paid in future research to farmer diversity, which is an insight that may be obtained from the literature on market segmentation. Müllensiefen et al. (2018) define market segmentation as identifying distinct groups of farmers with similar characteristics, explaining a phenomenon. This approach can help tailor information nudges to specific groups, ensuring they are effective and advantageous for particular groups of farmers. The importance of customer targeting and personalised approaches in agriculture is emphasised by Orr et al. (2021) and Kilwinger et al. (2021). Per Orr et al. (2021), customer segmentation forms the initial stage, followed by targeting, development and the dissemination of innovation. Kilwinger et al. (2021) argue that because farmers and their farms vary, implementing uniform interventions may only be effective for a specific group of farmers, leaving others disadvantaged. According to Frelat et al. (2016), the productivity of crops in sub-Saharan Africa can be significantly enhanced by considering the diversity within farming households, including variations in farm size and access to efficient markets. In Rwanda, Dawson et al. (2016) highlighted that green revolution interventions had unintended negative consequences, exacerbating social inequity by neglecting the impacts on local land tenure, agricultural practices, and the differing needs and preferences of diverse groups within local communities.

Hazell (2019) has contended that farming households are not the same and may require different technologies and delivery methods to suit their unique circumstances. The same applies, therefore, to information nudges too. Mausch et al. (2021) emphasise that treating farmers as homogeneous groups without considering these factors oversimplifies the relationship between technology adoption and their demographic profiles. While a one-size-fits-all approach may be easier to apply on a larger scale, it may not be as effective as nudging approaches, considering each farmers unique characteristics, their farm, and their practices.

5 Conclusion

Inadequate formal agricultural extension services limit the adoption of new agricultural technologies by smallholder farmers in sub-Saharan Africa. As a result, even when these technologies are risk-reducing, more productive and/or more profitable, adoption does not take place. Faced with this challenge, the use of promoter farmers (or model or lead farmers), who demonstrate to peer farmers that new technologies may be in their best interests, has become common. One limitation that arises, given the informal nature of the arrangement, is the loss and/or distortion of information. Information nudges have been proposed to help overcome the imperfect transmission of agricultural advice from promoters to other farmers. The evidence on the effectiveness of such nudges is, however, still limited.

The available evidence suggests that information nudges have potential when it comes to encouraging smallholder farmers in sub-Saharan Africa to adopt new technologies. An important insight that emerges from the literature is that the identity of the promoter farmer becomes part of the nudge when such farmers are instrumental

in administering it. Moreover, due to pervasive norms, female farmers face inequalities in accessing productive resources, including quality inputs, information, and extension services. In many farming communities, social interactions also follow gendered norms, which dictate who can associate with whom. Consequently, the effectiveness of nudges may be gendered, depending on whether the promoter farmer is male or female and whether the peer farmer is more likely to approach, trust, seek advice, and adopt recommendations from someone of the same gender. Furthermore, the effort exerted by the nudger may also be influenced by gender. It has been demonstrated in some contexts that male promoter farmers tend to put less effort into reaching out to peer farmers with agricultural information.

It follows, therefore, that for understanding the effectiveness of information nudges, a triple interaction effect needs to be evaluated: the identity of the person doing the nudging (typically the promoter farmer or extension agent), how this interacts with the nudge itself, and how these two factors independently and together interact with the identity of the person being nudged (typically the peer farmer who is encouraged to adopt new technologies). The challenge of understanding this triple interaction effect points to a new research agenda. Research should aim to unpack the role of gender in these interactions, particularly within dyadic relationships; assess the effectiveness of different types of nudges for men and women; and examine how the identity of the information recipient subsequently influences the adoption of the technology (i.e. improved varieties, in our case).

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