

External evaluation of mobile phone technology-based nutrition and agriculture advisory services in Africa

Mobile phones, agriculture, and nutrition in
Ghana: Qualitative follow-up study report

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The contact point for the client is Dan Haglund [d-haglund@dfid.gov.uk]. The client reference number for the project is PO6420.

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Executive summary

The mNutrition intervention in Ghana

mNutrition is a global initiative supported by DFID, managed by Groupe Spéciale Mobile Association (GSMA), and implemented by in-country mobile network operators (MNOs) and third-party providers that aims to use mobile technology to improve the health and nutritional status of children and adults in low-income countries around the world. The potential to utilise mobile technology to change attitudes, knowledge, behaviours, and practices around health and agriculture for improved nutritional status has been recognised for some time, but to date there have been no rigorous evaluations of m-services at scale. mNutrition is implemented through existing mAgri and mHealth Value-Added Services (VAS) in 12 countries throughout sub-Saharan Africa and South Asia. The nutrition content aims to promote behaviour change around key farming practices and around dietary and child feeding practices that are likely to result in improved nutritional health within households.

The mNutrition service that is the focus of the evaluation in Ghana and this report is the Vodafone Farmers Club (VFC) service. GSMA partnered with and funded the MNO Vodafone Ghana through the mNutrition challenge fund. Vodafone Ghana partnered with local provider Esoko to launch VFC, which was a rebranding of Esoko's existing service with additional content provided. The service is a 'bundled solution', offering both agricultural and nutrition information through mobile voice and SMS services, in addition to free calls between VFC members. The objective of Vodafone's service is to create and scale commercially sustainable mobile services that enable smallholder farmers to improve the nutritional status of their households and increase their productivity. The VFC service is available to smallholder farmers across 71 districts in Ghana.

Evaluation design

The aim of the impact evaluation is to assess the impact, cost effectiveness, and commercial viability of two services¹ within the broader portfolio of the GSMA mNutrition programme. The evaluation is being conducted by a consortium of researchers from Gamos, IDS, and IFPRI. The team draws on a number of methods and interlinked components to gather evidence about the impact of the VFC service in Ghana, including a qualitative component, a quantitative component, and a business model and cost effectiveness component. The evaluation is being conducted in two regions of Ghana: the Central region and the Upper West region.

This report presents the findings of the third and final round of qualitative data collection, conducted in March and April 2019. Data collection was carried out by PDA in close coordination with the IDS qualitative team, led by Dr Inka Barnett.

The qualitative follow-up study sets out to explore some of the issues and impact areas highlighted in the previous rounds of the evaluation as requiring more depth and exploration. More specifically, the qualitative follow-up study aims to: (1) identify the underlying reasons for sustained or continuous engagement with VFC in a context within which most farmers have disengaged with the service² (only 14% of the treatment households currently still use VFC); and (2) explore pathways

¹ A mHealth service plus mNutrition in Tanzania, and a mAgri service plus mNutrition in Ghana.

² Previous qualitative rounds and the quantitative evaluation suggest a multitude of reasons for disengagement, with most reasons related to problems around the implementation of VFC (both at farmer and programme level) and not the content of the service.

by which VFC services promote a change in agricultural and/or dietary practices among farmers. The focus of this final qualitative data collection is the subgroup of treatment farmers who are still signed up and actively using VFC. A total of 53 in-depth interviews (IDIs) were conducted with farmers who still actively engage. Findings from the qualitative follow-up study will be combined and triangulated with the quantitative endline and business model/cost effectiveness endline. A combined Evaluation Report of all three research components will be available in early 2020.

Findings

Factors that influence continuous engagement with VFC

Previous findings (both from the qualitative and quantitative evaluation) found only very low levels of continued engagement of farmers with VFC services (i.e. only very few farmers continued to listen to recorded voice messages, read SMS, and/or use the call centre). Much of the limited engagement can be explained by implementation issues at the level of both the farmers and the programme. These issues included poor Vodafone signal coverage and strength, poor access to electricity to charge the mobile phone, limited access to and ownership of mobile phones, multi-SIM card behaviour with preferences for non-VFC SIMs, limited familiarity of farmers with recorded voice messages, a difficult registration process, and a poorly-functioning call centre. Nevertheless the limited engagement also highlights an urgent need to develop more effective strategies to promote farmers' engagement with the mobile phone-based agricultural service. If farmers fail to engage with VFC, they will miss the opportunity to see/listen to content that could help to them to actively improve their agriculture productivity and income, as well as their nutritional practices. The qualitative follow-up study found that various factors can influence continuous engagement with VFC, including: the characteristics of the farmer; the design and content of VFC; the mode of delivery of VFC; and the setting within which VFC is used. It should be highlighted again that these findings are based on a small sub-group of farmers that successfully received the VFC service and actively and continuously engaged with the service.

Characteristics of the farmer

The qualitative data suggest that the age, level of education, technical literacy and confidence, and poverty status of a farmer are not critical factors in continued engagement with VFC services. In contrast, all these factors have been shown to influence people's initial decisions to sign up for mobile phone-based or other digital services (Perski *et al.*, 2016).

Half of the interviewed female farmers who did not own a mobile phone and had subscribed to the service using the telephone number of another household member were excluded from some or even all of the service. In other words, access to a mobile phone did not ensure continued access to the service for women; only mobile phone ownership could do this (assuming there were no other technical barriers to accessing the service). This suggests that mobile phone-based services might be less effective in reaching and engaging female farmers in contexts with low levels of female mobile phone ownership.

Some inequalities with regards to the uptake of and engagement with the different components of VFC emerged among different groups of farmers. Some female and poorly educated farmers were less likely to contact the VFC call centre due to fears of being judged. To ensure more equal uptake of and engagement with the VFC call centre, perceptions around the call centre need to be changed.

High levels of self-motivation and an internal locus of control were personal attributes that most farmers who continued to engage with the VFC services shared. Including features and content in VFC that aim to strengthen self-motivation and improve farmers' perceived locus of control (e.g. through the tone of the messages) could help to motivate a wider audience of farmers to continue to engage with VFC.

Design and content of VFC

Farmers who perceived low levels of social support were especially motivated to continue to engage with VFC because the service provided them with a welcome feeling of being 'cared for' and guided. To reach farmers with perceived low levels of social support and to promote uptake and continuous engagement with VFC, the caring and guiding features of the service should be stressed.

The availability of human support through the VFC call centre was an important motivator for continued engagement with the VFC service for many farmers. Adding human support features to mobile phone-based information services could help to increase engagement with the service.

Poor farmers are more likely to continue to engage with VFC if the service satisfies their need for practical and hands-on advice on low-cost agricultural practices. This type of advice was often lacking from other sources of agricultural information (e.g. radio). Low-cost agricultural practices are particularly relevant to smallholders who lack the financial resources to purchase improved seed, pesticides, or other agricultural inputs.

Nutrition-related information is a welcome addition to the agricultural information service for women but attracts less interest among male farmers, whose focus remains on the agricultural advice. To reach men with nutrition advice other channels may be more effective (e.g. joint nutrition education for couples during antenatal visits).

Mode of delivery of VFC

Farmers continued to engage with VFC due to the service's provision of much-needed area-specific, time-sensitive weather, price, and agriculture information that farmers could not access otherwise. To ensure that the information is relevant, careful profiling of farmers with regards to their specific information needs, capacity (e.g. the capacity to bring products to distant markets), and location is important.

Farmers appreciated the high level of flexibility that the mobile phone-based service offered, which meant that they could intensify or lessen their engagement with the service depending on their individual information needs at different times. To strengthen farmers' willingness to engage even further, features that give farmers more control over the service should be considered (e.g. control over whether to receive SMS messages).

Technical problems – in particular, poor or fluctuating Vodafone network coverage – posed a challenge not just to the initial uptake of the service but also to continued engagement.

Setting in which VFC is used

Limited, irregular, or even non-existent contact with agricultural extension services made farmers more receptive to mobile phone-based agriculture information services. Farmers especially appreciated the continuous support and advice of a type they did not receive from other sources.

Findings on the pathways by which VFC promotes change

Ongoing engagement with VFC might not be necessary to trigger the desired changes in agricultural and nutritional practices; effective engagement with selected messages might be sufficient to trigger change. Rather than focusing on increasing levels of ongoing engagement with mobile phone-based interventions, it should be acknowledged that engagement with the intervention is likely to be dynamic and include periods with high and low engagement.

Farmers drew on VFC to inform their own contextualised and adapted agricultural practices, often in discussion with other farmers, and by combining different sources of knowledge. Thus, unilinear knowledge transfer and translation of VFC advice into practice (i.e. the content of the messages is directly adopted by the farmers) should not be expected, but rather the flexible use of the information to inform learning should be encouraged.

Farmers are willing to act upon low-risk, no-expense advice but more complex, higher-risk practices need to be supported by additional advice.

There were multiple barriers to the translation of the advice into practice, including financial constraints, long distances to local markets, and the unavailability of agricultural inputs and foods on local markets. Careful profiling of farmers to ensure tailored information and the provision of access to financial support (e.g. by linking VFC to a social protection programme) could help to address outstanding barriers.

Recommendations for policy and practice

In contexts with limited mobile phone ownership and gendered barriers to regular access to a mobile phone, mobile phone-based services might not reach female farmers and poor farmers who cannot afford a mobile phone. In these contexts, other more inclusive technologies (such as radios) or merged technology approaches (e.g. radio *and* mobile phones) may be more effective in reaching the intended target population.

Illiteracy and the inability to understand English were major barriers to the uptake of the VFC SMS on price and weather. We recommend offering the content of SMS as recorded voice messages (in local languages). However, as the weather and price information are highly time-sensitive and context-specific, and voice messages are more expensive to deliver and produce, providing this information as recorded voice messages may increase the implementation costs of VFC considerably (thus making the service less likely to be commercially viable).

Adding human support features to mobile phone-based services is likely to increase reach and long-term engagement. This could include a well-functioning call centre. To ensure use of the call centre, it is important that farmers are made fully aware of it and the conditions of use (e.g. the call centre can be contacted free of charge, call centre agents are farmers themselves and speak different languages, etc.). VFC could further strengthen the learning component of the service by increasing the promotion of peer-to-peer interaction and learning via the free farmer-to-farmer calls.

Mobile phone-based information services should focus on providing practical, hands-on, low- or, even better, no-cost, area-specific agricultural and nutrition advice, as these types of information were often lacking from other sources (e.g. radio or extension workers) or could only be accessed infrequently by farmers.

To increase the effectiveness of mobile phone-based behaviour change interventions, they could be joined up with other ongoing interventions (e.g. livelihood improvement programmes or social protection programmes), or with mobile money services that provide poor farmers with the financial resources needed to act upon VFC advice.

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List of abbreviations

DFID	Department for International Development
EA	Enumeration Area
GHS	Ghanaian <i>Cedis</i>
GSMA	Groupe Spéciale Mobile Association
IDI	In-Depth Interview
IDS	Institute of Development Studies
IFPRI	International Food Policy Research Institute
MIS	Market Price Information Systems
MNO	Mobile Network Operator
OPM	Oxford Policy Management
PDA	Participatory Development Associates
PPI	Poverty Probability Index
SIM	Subscriber Identity Module
SMS	Short Message Service
VAS	Value-Added Service
VFC	Vodafone Farmers Club

1 Introduction

1.1 mNutrition

mNutrition is a global initiative supported by the UK Department for International Development, (DFID), organised by Groupe Spéciale Mobile Association (GSMA), and implemented by in-country MNOs and third-party providers. It aims to use mobile technology to improve the health and nutritional status of children and adults in the developing world. The potential to utilise mobile technology to change attitudes, knowledge, behaviours, and practices around health and agriculture for improved nutritional status has been recognised for some time, but to date there have been no rigorous evaluations of m-services at scale. A consortium of researchers from Gamos, the Institute of Development Studies (IDS), and the International Food Policy Research Institute (IFPRI) have been contracted to conduct a rigorous mixed-methods evaluation to estimate the impact of two mNutrition services on children and adults, and to clarify how the context and the components of the mNutrition interventions shape their impact.

mNutrition is being implemented through existing mAgri and mHealth services in 12 countries across sub-Saharan Africa and South Asia. The nutrition content aims to increase knowledge and promote behaviour change around key farming decisions and practices, and around maternal and other household practices that are likely to result in improved nutritional health within households. The mNutrition initiative aims to lead to the following changes in outcomes: (i) increased adoption of new nutrition-sensitive agricultural practices, improved agricultural productivity, and greater use of post-harvest technologies; (ii) improvements in nutrition practices for women during pregnancy, infant and young child feeding, and micronutrient supplementation of children at risk; and (iii) increased demand for nutrition and agriculture extension services.

The evaluation is expected to measure the impact, cost effectiveness, and commercial viability of mNutrition, using a mixed-methods design. The evaluations are being conducted on two services: Ghana mAgri (the focus of this report); and Tanzania mHealth. In order to satisfy the objectives of the Terms of Reference, the evaluation is composed of the following components.

- A **quantitative impact evaluation** employing a randomised encouragement design to determine the causal effect of the service on dietary diversity, agricultural income, and production. A baseline survey was carried out before the start of the encouragement activities, and an endline survey 18 months later.
- A **qualitative impact evaluation** consisting of three qualitative data collection rounds (i.e. an initial exploratory qualitative study, in-depth case studies at midline, and rapid explanatory qualitative work after the quantitative endline survey data collection); this aims to provide understanding of the context, underlying mechanisms of change, and the implementation process of mNutrition.
- A **business model and cost effectiveness evaluation** employing stakeholder interviews, commercial and end-user data, document analysis, and evidence from the quantitative and qualitative evaluations to generate a business model framework and estimate the wider imputed benefits from the VAS for the range of stakeholders involved.

The mixed-methods evaluation design addresses the following research questions specified in the Terms of Reference (see Annex A):

1. What are the impacts and cost effectiveness of mobile phone-based nutrition and agriculture services on nutrition, health, and livelihood outcomes, especially among women, children, and the extreme poor?
2. How effective are mobile phone-based services in reaching, increasing the knowledge, and changing the behaviour of the specific target groups?
3. Has the process of adapting globally agreed messages to local contexts led to content that is relevant to the needs of children, women, and poor farmers in their specific context?
4. What factors make mobile phone-based services effective in promoting and achieving behaviour change (if observed), leading to improved nutrition and livelihood outcomes?
5. How commercially viable are the different business models being employed at country level?
6. What lessons can be learned about best practices in the design and implementation of mobile phone-based nutrition services to ensure (a) behaviour change and (b) continued private-sector engagement in different countries?

The primary target user of the evaluation results is DFID, along with other key stakeholders, including GSMA and its national members (including local MNOs implementing VFC services), national governments (in particular, the ministries of health and agriculture), and international agencies and donors, as well as community-level health and agriculture extension workers. The reports from the evaluation will be made publicly available on IFPRI and IDS's websites as well as DFID's Research for Development repository.

1.2 Objectives of mNutrition in mAgri

mNutrition within the mAgri programme aims to improve nutrition by promoting behaviour change around key farming decisions and practices – increasing the productivity, crop quality, and income of smallholder farmers.³ The objective of mAgri is to create and scale commercially sustainable mobile services that enable smallholder farmers to improve their livelihood and nutritional outcomes.

In Ghana, mNutrition is being implemented as part of the Vodafone mAgri VAS, a mobile extension service called VFC. The service is a bundled solution offering agricultural and nutrition information via voice and SMS services, in addition to free calls to other VFC members. This service is delivered in partnership with two core partners (Vodafone Ghana and Esoko Ghana). Esoko Ghana, a mobile phone-based rural information service, developed and curated the message content and operates the platform to send tailored SMS and recorded voice messages to member farmers. Esoko also operates the call centre. Nutrition message content was developed by the Global Alliance for Improved Nutrition (GAIN). GAIN created a large library of nutrition-sensitive agriculture messages and nutrition-specific tips designed to complement the agriculture messages provided by Esoko. To further strengthen the nutrition content, these messages were later supplemented by Grameen, with 26 messages focusing on animal-sourced food (e.g. eggs and dairy).

³ For a detailed landscape analysis on the context for implementing mNutrition and mAgriculture programmes, see Barnett *et al.* (2016).

1.3 Purpose and scope of the qualitative follow-up study

This report presents the findings of the third and final round of qualitative data collection conducted in March and April 2019. Data collection was carried out by PDA in close coordination with the IDS qualitative team led by Dr Inka Barnett.

This report is narrower in scope than the previous qualitative reports: its main objective is to explore some of the issues and impact areas highlighted in the previous rounds of the evaluation as requiring more depth and exploration. More specifically, the qualitative follow-up study aims to: (1) identify the underlying reasons for sustained or continuous engagement with VFC in a context within which most farmers have disengaged with the service;⁴ and (2) explore pathways by which VFC services promote change in agricultural and/or dietary practices among farmers. The focus of the final qualitative data collection is on the subgroup of treatment farmers who are still signed up and actively using VFC.⁵

This report has also been shared with the VFC team (i.e. Esoko, Vodafone, and GSMA) as part of ongoing regular communication between evaluation and programme staff to support and inform programme decision making. Findings from the qualitative endline study will also be combined and triangulated with the findings from the other two qualitative evaluation rounds, the quantitative endline, and business model/cost effectiveness endline in an overall final Evaluation Report to be published in early 2020.

1.4 Organisation of the report

Following the description of the methodology in Section 2, a brief contextual overview of the two regions selected for this evaluation is given in Section 3. Sections 4 and 5 present the thematic findings of the analysis structured around the two aims of the qualitative follow-up study (see Section 2.1). Section 6 draws together the findings of the qualitative follow-up study and provides recommendations for policy and practice.

⁴ Previous qualitative rounds and the quantitative evaluation suggest a multitude of reasons for disengagement, with most related to problems around the implementation of VFC (both at farmer and programme level) and not the content of the service.

⁵ Based on quantitative endline data n=267 farmers from the treatment group (i.e. the group that was encouraged to sign up for VFC) said that they are currently signed up for VFC (see Table 5.1 in Billings *et al.*, 2019)

2 Methodology

2.1 Aims of the qualitative follow-up study

The qualitative follow-up study is narrower in scope than previous qualitative rounds and aims to explore some of the specific issues and impact areas highlighted in the previous qualitative and quantitative rounds as requiring more depth and exploration.

The previous qualitative rounds (and, in particular, the qualitative midline study) and the quantitative evaluation have already provided in-depth insights into the challenges observed in the implementation and with the uptake of VFC services by farmers (Barnett *et al.*, 2019; Barnett *et al.*, 2018; Billings *et al.*, 2020 forthcoming). These challenges included contextual issues beyond the scope of this programme, such as gendered barriers to access to a mobile phone (especially in the Upper West region), poor access to electricity to charge the mobile phone, and poor Vodafone network coverage (especially in the Central region). There were also significant programme-related challenges including farmers' inability to activate the VFC SIM card without assistance, multiple or dual SIM card behaviour with a preference for the non-VFC SIM card, and the loss of the VFC SIM or mobile phone with the SIM card. There were also issues with the delivery mechanisms, including a lack of familiarity with recorded voice messages, illiteracy or the inability to understand SMS messages in English, and a lack of awareness of the VFC call centre. The quantitative impact evaluation quantified many of these findings and concluded that implementation challenges contributed to the low uptake of and engagement with VFC services. Only 34% (n=646) of households that received the intervention (i.e. VFC services) reported to have used the service in the last 18 months and only 14% (n=267) of the treatment households said that they were currently still using VFC (i.e. at the time of the quantitative endline data collection).

Despite the very limited use of VFC, the farmers who did actively engage with the service (i.e. who listen to recorded voice messages, read SMS, and/or contact the call centre) generally trusted and valued VFC, as is shown both in the qualitative and quantitative evaluations. This qualitative follow-up study specifically focuses on this sub-sample of farmers who repeatedly and over a long time period⁶ engaged with VFC services. Focusing on these farmers provides in-depth insights into factors that influence long-term engagement with VFC, highlighting the programmatic strengths of VFC and areas that could be improved to increase the efficacy and reach of the service. The qualitative follow-up study aims to address two overarching questions:

1. What factors influence farmers to continue to engage with VFC services?

A better understanding of the factors that influence continuous engagement with VFC services can help to inform the design of future mAgri and mNutrition interventions (e.g. by addressing specific information needs). Previous evaluation and research studies have shown that a lack of engagement with digital behaviour change interventions is common, and some studies have suggested a response relationship between the effectiveness of the intervention in changing users' behaviour and the length and level of engagement (Alkhalidi *et al.*, 2016; Donkin *et al.*, 2011). Lower engagement was often associated with lower intervention effectiveness. Finding strategies to promote sustained engagement with mobile phone-based interventions is therefore important.

⁶ i.e. the entire intervention period

2. What are the pathways by which VFC services promote a change in agricultural and/or dietary practices leading to improved nutrition and livelihood outcomes?

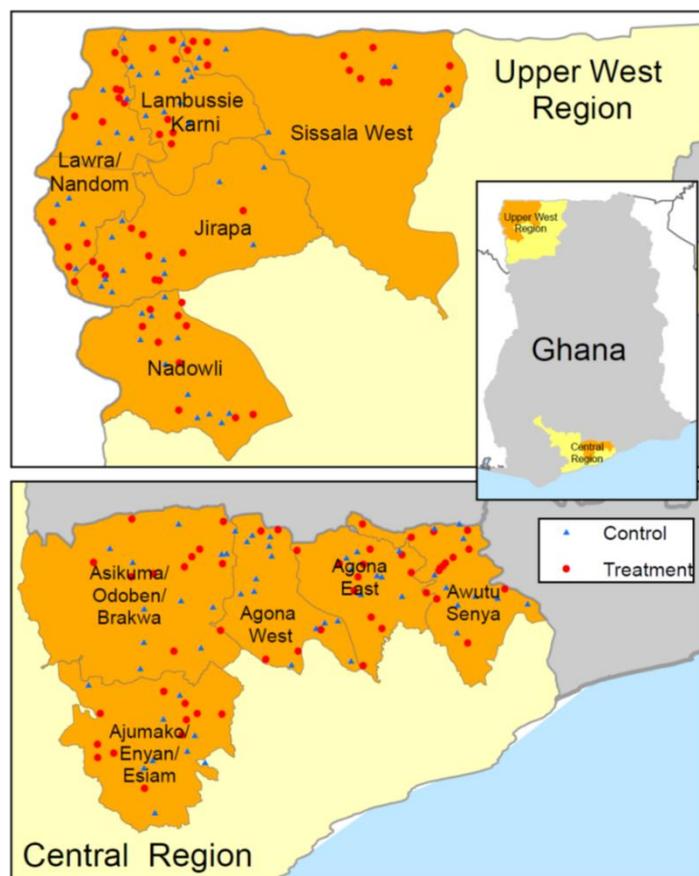
The qualitative midline found that farmers who actively engaged with the service also acted upon at least some of the advice. However, contextual barriers often impeded the translation of the advice into practice. The most commonly cited barriers were financial constraints and the belief that the costs of purchasing agricultural inputs and/or more nutritious food outweighed their benefits (especially as the benefits are often uncertain), as well as the risk-averse attitude of farmers and their unwillingness to invest time and resources in new practices that offered uncertain benefits. The quantitative impact evaluation found that there were some, though minimal, impacts of VFC services on dietary diversity (especially in the Central region and with regards to the consumption of dairy products among women), agriculture productivity, and income (Billings *et al.*, 2020 forthcoming). The qualitative follow-up study also aims to improve understanding of both the pathways of behaviour change and how the mobile phone-based VFC service contributed to this change.

2.2 Sampling strategy

2.2.1 Community and participant selection

The Central region and Upper West region (see Figure 1) were selected as the study regions for both the quantitative and qualitative data collection during the baseline phase and remained the focus for all subsequent data collections.

Figure 1: Map of areas selected for the evaluation with treatment and control villages



Source: Billings *et al.*, 2020, forthcoming.

As part of the quantitative baseline survey led by IFPRI, a total of 104 enumeration areas (EAs) were assigned as treatment villages, including 1,811 individuals who agreed to be registered for the mNutrition VFC service. Households in study communities that were randomly assigned to the treatment arm received extra encouragement to become a VFC member in the form of a price discount and door-to-door promotion.

The qualitative follow-up data collection was conducted in the same five municipalities that were also the focus of previous qualitative rounds (three in Upper West and two in Central) (see Table 1). Working in the same municipalities as in the baseline and midline allowed the team to draw on an existing rapport with the relevant district and community-level authorities.

Table 1: Municipalities sampled for endline data collection

Region	Municipality	Included in the baseline and midline?
Central	Asikuma / Odoben / Brakwa Ajumako / Enyan / Esiam	Yes
Upper West	Nadowli Jirapa Lambussie / Karni Lawra / Nandom	Yes

The initial plan was to conduct the qualitative follow-up study in the communities that were also the focus of the qualitative midline study (Barnett *et al.*, 2016). However, given the quantitative endline data on the use of VFC, it soon became obvious that the number of treatment households that still actively used VFC was extremely small (i.e. between one and four households per EA). To achieve our aim of interviewing at least 50 farmers who still actively engaged with VFC, we had to go beyond our initial selected EAs and also include EAs with active VFC users around the selected EAs. A detailed description of the farmers selected for the qualitative follow-up is included in Table 4 in Annex A. In each community, all farmers who still actively engaged with VFC were identified (based on the quantitative data; see column 5) and invited to participate in the interview. Overall, 76 farmers who still actively engaged with VFC were invited to be interviewed and 53 participated in the interviews. Most of the farmers who were invited but were not interviewed were either travelling (mainly in Upper West) or could not be reached in the time available in the interview schedule (mainly in Central). Overall, we interviewed 25 farmers in Upper West, and 27 farmers in Central.

The very limited number of active users of VFC per village (and the geographical distance between villages, as determined by GPS mapping) also made it logistically difficult to recruit sufficient numbers of farmers who were still actively engaged with the service to conduct focus group discussions, which we had originally planned to do (Barnett *et al.*, 2016). We therefore decided to not to carry out any focus group discussions but only IDIs with farmers who still actively engaged with VFC.

2.3 Data collection methods

As per the baseline and midline phases, the qualitative fieldwork was conducted by PDA in close collaboration with IDS, which drafted the data collection tool (i.e. the topic guide with lists of questions and prompts). Tool development was informed by the literature, findings, and tools from the previous phases of the project.

Quality assurance took place at three levels and is detailed in Annex A on methodology.

The data collection took place from 21 to 28 March 2019. It was carried out by six qualitative researchers (all male), who were split into two teams based on their knowledge of the region and the local languages spoken. Each team had an allocated leader and overall management and quality control was provided by the PDA research manager, in communication with IDS. The researchers worked in pairs, with one adopting the role of interviewer and the other the role of note taker. Each team discussed their findings extensively in debriefing sessions that were organised each evening after data collection.

2.4 Data management and analysis

IDIs were conducted in local languages: Twi and Dagaare. Interviews were audio-recorded (with consent), transcribed, and translated into English by the qualitative team. After data collection was completed, the field research team reconvened for a two-day synthesis workshop (with IDS participating remotely). During the workshop, initial emerging themes from the data were explored and discussed. Final data analysis was undertaken by the qualitative research team at IDS led by co-Principal Investigator Dr Inka Barnett, together with Dr Becky Faith and Becky Mitchell. Qualitative data analysis software (NVivo) was used to manage and code data. Qualitative data were analysed using a directed content analysis approach focused on the main qualitative evaluation questions. Data analysis started with open coding of several interviews and the development of an initial coding scheme that guided the coding of the remaining data. To enhance the rigour of the data analysis, coding was carried out by three researchers independently. Their coding schemes were then discussed and modified into one joint scheme. While the scheme guided the coding, the scheme was flexible enough to allow for unforeseen topics that emerged to be added at any point. The draft report was shared with the PDA team to ensure that the IDS team correctly interpreted the raw data collected and to allow for additional details to be added that would enhance the quality of the report.

2.5 Ethical approval

As an overall guiding principle, the research team sought to conduct itself in a professional and ethical manner throughout the study, with respect for integrity, honesty, confidentiality, voluntary participation, impartiality, and the avoidance of personal risk. These principles were guided by the Organisation for Economic Co-operation and Development's (2010) 'Development Assistance Committee Quality Standards for Development Evaluation' and DFID's (2011) 'Ethics Principles for Research and Evaluation', which are being followed for the duration of the evaluation.

Institutional ethics approval granted for the project by the IDS Research Ethics Committee in 2016 remains in place for the duration of the project. At national level, the research permit from the Ethics Committee of the Humanities based at the University of Ghana was renewed on 9 October 2018 and remains valid until 16 October 2019.

Confidentiality and data protection issues were discussed with the data collection team prior to starting data collection. Informed written or oral consent was collected from all participants prior to the start of the interviews. Participants did not receive any reward or financial compensation for their participation in the interviews.

For confidentiality, all identifying variables – such as names of villages or communities, district capitals, or other locations – have been replaced by pseudonyms in this report. All files containing raw and analysed data are securely stored in password-protected databases.

IDS and all sub-contracted partners undertaking data collection have specific arrangements in place for handling data generated from the project in accordance with the Data Protection Act (1998),⁷ which includes the processing and storage of any sensitive personal data and the maintenance of privacy. All intellectual property rights in any materials produced from the evaluation (including publication of research findings and any associated reports and data) remain the property of IDS and associated sub-contracted collaborators. DFID has unlimited access to any material produced from the evaluation. To promote the use and uptake of the evaluation findings, and in line with DFID's Open and Enhanced Access Policy, the evaluation team is committed to ensuring that all major report outputs and associated data generated from this project are made publicly available in an accessible format.

2.6 Limitations and challenges

Several methodological limitations need to be considered.

We were able to interview only 53 of the sampled 76 VFC farmers (69%). This limits the conclusions that can be drawn in the sense that the experiences with VFC of those not interviewed may be different from those who were interviewed. However, most of the VFC farmers that could not be interviewed could simply not be reached (as telephone numbers provided were no longer active or the farmers were travelling). Farmers who could not be interviewed also had similar characteristics to the farmers who were interviewed, and there were no specific patterns in the farmers we could not interview (e.g. relating to age, gender, poverty level, etc.). Also, it should be noted that 52 IDs is still a considerable size for a qualitative study.

Second, low engagement with VFC, and resulting low numbers of actively engaged VFC farmers, prompted us to adapt the sampling approach and cluster EAs. Consequently, logistics for the data collection in 30 villages became more challenging. It was also impossible to conduct in-depth contextual analysis for all 30 villages. However, as the villages in each of the selected districts were located close to each other, the context is likely to be very similar.

Third, all interviews were conducted by a team of young, educated, male field researchers. The characteristics of the field team might have affected participants' comfort and degree of honesty when answering questions (e.g. introducing a social desirability bias on the part of the participants). It is possible that female potential interviewees might have been uncomfortable being interviewed by young men who were unknown to them. However, the team was very experienced, familiar with local customs, and dressed appropriately according to local custom, in order to make participants feel at ease. A session was also organised at the end of the training to explain to the team how bias can have an influence on data quality.

⁷ And more recently the General Data Protection Regulation implemented on 25 May 2018.

3 Community profiles

This section provides a brief description of the districts and villages selected for the follow-up study. Given the very high numbers of villages (n=30), an in-depth contextual analysis of each village was impossible within the timeframe of the qualitative follow-up data collection.

Region	Description
Central	<p>Mixed farming is practised in most of the communities, as farmers grow cash crops (cocoa or rubber) alongside food crops for subsistence. Vodafone and MTN network connections were available in all three communities. In the Central region, most farmers do not own their land and have no or limited control over what they plant due to existing land tenure systems. In some communities, land is allocated by local chiefs. Although proceeds from cocoa cultivation need to be shared with the landowner, food crops are not necessarily shared with the owner.</p> <p>All the communities, including in remote areas, had access to electricity. Network coverage was, however, very poor in almost all the communities. The main roads are good, but connecting roads to villages are very bad and untarred.</p> <p>Very few communities had school buildings in good shape. In Kyebi, one of the communities in the Ajumako district, children in Junior High School need to walk for almost an hour to Ajumako to attend the nearest lower secondary school in the area. The only school in the Kyebi community enrolls up to primary six.</p> <p>The literacy rate is 78.2%, across CR, with the rate being higher in urban areas (82%) compared to rural areas (74%) (Ghana Statistical Service, 2017).</p> <p>In one surveyed community (Ahamakomuah), members come together to build schools and keep their village clean. They are organised around community centres for such meetings. We observed, as was the case in one community, that failure to observe these ordinances attracted a fine of GHS 10. This is a common practice in all the communities.</p> <p>The communities are small and people generally know each other.</p> <p>The communities visited had some form of traditional leadership. These were either chiefs or clan heads that had authority recognised by the entire community.</p>
Upper West	<p>The four communities visited in the Nadowli district – Mwanware, Tankasie, Dapuoh, and Daa – were located near the main road between Wa and Jirapa. Daa was an exception, as it was quite remotely located off the main road. It was also the least developed (with no electricity, poor mobile network connectivity, and a bad road network) in comparison to the others.</p> <p>More than half of the population (59.5%) in the region are illiterate. This is twice as high as the national average of 25.9% (Ghana Statistical Service, 2013).</p> <p>Food crop subsistence farming is common across all three communities and livestock rearing is an additional source of income. Vodafone and MTN are common networks across the three communities.</p> <p>The chief is the supreme authority in the community, followed by elders and opinion leaders, among whom are women.</p> <p>The main source of livelihood is agriculture – farmers grow food and (to a lesser extent) cash crops. They also rear animals for sale and consumption. Most farmers go to the neighbouring market or the district town market to sell their produce and animals.</p> <p>The communities visited are patriarchal in social structure. The main ethnic group in the district is the Dagaaba and the language spoken is Dagaare. A few community members speak Twi, the most widely spoken language in Ghana. Christianity and traditional religion are the dominant religions in the district.</p> <p>Community members were very receptive and are generally hospitable.</p>

4 What factors influence farmers to continue to engage with VFC services?

This section will start with a description of farmers' patterns of engagement with VFC services. This will be followed by a presentation of the various factors that have influenced farmers to continue to engage with the service during the last two years.

4.1 Patterns of VFC service use

The literature on engagement with digital interventions suggests that users often move dynamically between stages of engagement, disengagement, and re-engagement, and that engagement often includes different levels of usage over time (O'Brien and Toms, 2008, Perski *et al.*, 2016). Seven farmers in the qualitative sample said that they had temporarily disengaged with VFC but then re-engaged (see also Section 4.2). Reasons for disengagement included broken phones (n=2), travelling (n=2), engagement with farm work during the rainy season (n=2), and leaving the phone in the neighbouring village to be charged for up to a week at a time on several occasions throughout the year (n=1).

The other farmers all said they continuously engaged with the service but that the intensity of engagement often varied. For example, farmers said they were eager not to miss messages at the beginning of key farming periods such as sowing or soil preparation. This was because farmers expected that the messages would provide helpful advice and guidance for these periods. In fact, many farmers in the Upper West region said that they delayed important farming tasks until VFC messages instructed them to start. A female farmer explained:

At first, I did not know the right time to start planting. Whenever the first rain came, I planted, but most of the crops die because nowadays there is always a long gap between the first rain and subsequent ones to support crops. Since I started receiving tips from VFC, that situation has improved significantly because I do not start planting immediately after the first rain. I wait until VFC will signal us to start planting.

(Female farmer, 42 years old, very poor, Upper West)

Engagement with the service was usually less intense during labour-intensive farming periods, such as during the planting and harvesting seasons. During these times many farmers left their mobile phones at home when going to the fields and only returned late in the evening, when they were too exhausted to engage. Based on existing scientific evidence, some engagement with a digital behaviour change intervention is essential to trigger a change in behaviour; however, engagement does not necessarily need to be high intensity all the time (O'Brien and Toms, 2008; Perski *et al.*, 2016).

4.2 Factors that influence continuous engagement with VFC services

The literature suggests that, for a mobile phone-based intervention to effectively trigger a desired change in behaviours, some form of sustained or repeated exposure to and engagement with the intervention is important (Perski *et al.*, 2016). In the case of the VFC, different factors of influence emerged from the data; these included factors related to the farmer (and in this case demographic and psychosocial characteristics), the design and content of VFC, the mode of delivery of VFC, and the setting in which VFC was used.

4.2.1 Factors related to the farmer

Demographic characteristics of farmers

Table 2 (Upper West) and Table 3 (Central) present the demographic characteristics of the farmers included in the qualitative data collection. Most of the individual and household-level characteristics were extracted from the quantitative endline data. The last column of the tables provides details on the patterns of use of VFC services based on the qualitative interviews. In what follows, the influence of the different demographic characteristics of farmers on continuous engagement with VFC services will be discussed.⁸

⁸ It should be highlighted that these findings are based on qualitative analysis and a purposeful selected sub-sample of farmers rather than on a representative quantitative statistical analysis.

Table 2: Demographic characteristics of the farmers who continued to engage in Upper West

	Gender	Age	District	Poverty status	Education	VFC services used			
						SMS	Voice	Call centre	Others
1	Male	63	Jirapa Lambussie	Less poor	Illiterate		✓		
2	Female	20	Jirapa Lambussie	Less poor	Illiterate		✓		
3	Male	63	Jirapa Lambussie	Less poor	Illiterate	✓	✓	✓	✓
4	Male	35	Jirapa Lambussie	Less poor	Some education		✓		
5	Female	37	Jirapa Lambussie	Less poor	High school completed	✓	✓	✓	✓
6	Female	29	Jirapa Lambussie	Less poor	Some education		✓		
7	Male	35	Lawra	Poor	Illiterate	Partial*	✓		
8	Female	20	Lawra	Poor	Some education		✓		
9	Male	60	Lawra	Poor	Some education	✓	✓	✓	✓
10	Male	43	Nadowli	Poor	Illiterate	✓	✓	✓	✓
11	Male	30	Nadowli	Poor	Some education	✓	✓	✓	✓
12	Female	56	Nadowli	Poor	Illiterate		✓		
13	Female	37	Nadowli	Poor	Illiterate		✓		
14	Female	27	Nadowli	Poor	Illiterate	✓	✓	✓	✓
15	Male	84	Nadowli	Poor	Illiterate		✓		
16	Male	27	Nadowli	Poor	Some education	Partial*	✓	✓	✓
17	Female	49	Jirapa Lambussie	Poor	Illiterate		✓		
18	Female	58	Jirapa Lambussie	Poor	Some education	✓	✓	✓	✓
19	Male	53	Jirapa Lambussie	Poor	Illiterate	Partial*	✓	✓	✓
20	Male	43	Jirapa Lambussie	Poor	Illiterate		✓		
21	Female	42	Lawra	Very poor	Illiterate	Partial*	✓	✓	✓
22	Male	36	Lawra	Very poor	Illiterate	✓	✓	✓	✓
23	Male	35	Nadowli	Very poor	Illiterate	Partial*	✓		
24	Female	65	Jirapa Lambussie	Very poor	Illiterate		✓		

*Partial use of SMS services due to illiteracy – service user asked others to read messages for them

Table 3: Demographic characteristics of the farmers who continued to engage in Central

	Gender	Age	District	Poverty	Education	VFC services used			
						SMS	Voice	Call centre	Others
1	Male	42	Asikuma/Odoben/Brakwa	Less poor	Some education	Partial*	✓	✓	✓
2	Female	25	Asikuma/Odoben/Brakwa	Less poor	Some education	✓	✓	✓	
3	Female	45	Asikuma/Odoben/Brakwa	Less poor	Some education	✓	✓		
4	Male	37	Ajumako/Enyan/Esiyam	Less poor	Some education	✓	✓		
5	Male	34	Ajumako/Enyan/Esiyam	Less poor	Some education	Partial*	✓	✓	
6	Male	27	Ajumako/Enyan/Esiyam	Less poor	Some education	✓	✓	✓	
7	Female	32	Asikuma/Odoben/Brakwa	Less poor	Some education	✓	✓		✓
8	Female	48	Asikuma/Odoben/Brakwa	Less poor	Some education	✓+	✓+		
9	Female	39	Asikuma/Odoben/Brakwa	Less poor	Some education	Partial*	✓		
10	Male	40	Asikuma/Odoben/Brakwa	Poor	Illiterate	Partial*	✓		
11	Female	41	Asikuma/Odoben/Brakwa	Poor	Some education		✓		
12	Male	26	Asikuma/Odoben/Brakwa	Poor	Some education	✓	✓		
13	Female	37	Asikuma/Odoben/Brakwa	Poor	Some education		✓	✓	
14	Male	32	Asikuma/Odoben/Brakwa	Poor	Some education		✓	✓	
15	Female	22	Asikuma/Odoben/Brakwa	Poor	Some education	✓	✓		
16	Female	30	Asikuma/Odoben/Brakwa	Poor	Some education	✓	✓	✓	
17	Male	29	Asikuma/Odoben/Brakwa	Poor	Some education	✓	✓	✓	✓
18	Female	45	Asikuma/Odoben/Brakwa	Poor	Some education	Partial*	✓		
19	Male	46	Asikuma/Odoben/Brakwa	Poor	Some education		✓	✓	
20	Male	60	Asikuma/Odoben/Brakwa	Poor	Some education	✓	✓	✓	
21	Female	32	Ajumako/Enyan/Esiyam	Poor	Some education	Partial*	✓		
22	Male	24	Ajumako/Enyan/Esiyam	Poor	Some education	✓	✓		
23	Female	32	Ajumako/Enyan/Esiyam	Poor	Some education	✓	✓		
24	Male	42	Asikuma/Odoben/Brakwa	Poor	Illiterate		✓		
25	Female	30	Ajumako/Enyan/Esiyam	Poor	Some education	✓	✓	✓	
26	Female	50	Asikuma/Odoben/Brakwa	Poor	Some education	✓	✓		
27	Male	50	Asikuma/Odoben/Brakwa	Very poor	Some education	✓	✓	✓	✓
28	Female	52	Ajumako/Enyan/Esiyam	Very poor	Some education	✓	✓	✓	
29	Male	30	Ajumako/Enyan/Esiyam	Very poor	Some education	✓	✓	✓	

*Partial use of SMS services due to illiteracy – service user asked others to read messages for them. + Receives services but perceives them as a disturbance

Neither age, level of education, nor poverty appeared to influence continued engagement with VFC in a particular direction

Farmers who continued to engage with VFC over a long period of time were diverse in terms of age and level of education across both regions, and no specific pattern with regards to engagement with VFC emerged from the data.

In the Upper West region, no clear patterns emerged relating poverty status⁹ to engagement with VFC services overall or with specific components of the service (e.g. voice messages only). Farmers from the different classifications of very poor, poor, and less poor all continued to engage with the service with no clear patterns related to degree of poverty and types of engagement with the services. It should be highlighted that most farmers who were included in the treatment group can be categorised as poor farmers and it is therefore not surprising that most farmers in the qualitative sample were also categorised as poor.

In the Central region, only two very poor farmers still engaged with VFC (compared to 18 poor and nine less poor farmers). Less continued engagement among very poor farmers in Central could be because of implementation issues or because they found the VFC service less relevant or less useful. However, given the very small sample size, no definite conclusion should be drawn regarding poverty and continued engagement with the service.

However, other demographic characteristics of the farmers seemed to influence continuous engagement with the VFC service in different ways.

Gender: 'Access' to a mobile phone is not sufficient to ensure that female farmers are reached by VFC

In the qualitative sites in both regions approximately half of the farmers who still engage with VFC were female (Upper West: n=11; Central; n=15).¹⁰ When exploring further, we learned that three female farmers in Upper West and three in Central did not own a mobile phone and had registered with VFC using the mobile phone numbers of their husbands/sons. Three of these women said that the owner of the mobile phone shared some of the content of the voice messages with them but did not let them use any of the other VFC services. A young female farmer from Upper West explained how her husband shared the content of VFC messages with her, but only during the times when he stayed at her house. He was not able to share information when he stayed in the house of his other wife or travelled for work, which could result in long periods of disengagement with the service for her:

I registered with my husband's number [...] my husband still uses the service [...] but he has to travel often [...] so I'm disengaged often [...] now I did not hear from VFC for the past three months.

(Female farmer, 20 years old, poor, Upper West)

The remaining female farmers who still engaged with VFC all owned a mobile phone and used the VFC SIM card exclusively (or almost exclusively) in their phone.

⁹ Data on the poverty status of the interviewed farmers were extracted from the quantitative baseline survey. The quantitative survey used the Poverty Probability Index (PPI) to determine poverty levels. The PPI uses a country- and year-specific set of 10 questions to calculate the likelihood that a household is living below different national and international poverty lines. See Billings *et al.* (2018) for more details. For the purpose of the qualitative follow-up study, terciles of PPI scores were used to categorise very poor, poor, and less poor farmers.

¹⁰ The treatment group included more female than male farmers (1,157 female farmers versus 822 male farmers).

To sum up, the qualitative data suggest that there might be gendered barriers to continued engagement with VFC. This is because half of the female farmers who did not own a mobile phone were frequently excluded from (some or all of) the service. These findings corroborate the findings from the quantitative evaluation, which found significant gendered barriers to access to VFC (Billings *et al.*, 2020 forthcoming).

Education: SMS-based information will only engage a fraction of farmers in a population with high levels of illiteracy/inability to read English

While many of the farmers engaged frequently with the recorded voice messages, engagement with the SMS messages was less common and many farmers were excluded from the written information. In particular, in Upper West only nine farmers (of 24 farmers) said they either read the SMS messages themselves (n=6) or asked a literate friend or family member to read the messages for them. Many of the remaining farmers in Upper West were literate but were unable to read English (and did not know a person who could). In the Central region, more farmers were able to read the SMS messages (n=14) or asked other people to read the messages for them (n=7).

This finding suggests that SMS messages are not a good choice when aiming to convey information to a population with a high level of illiteracy. If SMS are used, they should be offered in local languages and not English (as with the recorded voice messages, which are already offered in a number of languages; however, some Ghanaian languages do not have a written script).

Technical literacy and confidence in using a mobile phone seem to be less relevant for continuous engagement than they are for initial uptake

Technical literacy, confidence, and familiarity with mobile phones emerged as important factors for the initial uptake of VFC (see previous qualitative rounds and evidence on other mobile phone-based interventions for farmers such as Masuki *et al.*, 2010 and Wyche and Steinfield, 2016). However, the findings from the qualitative follow-up study suggest that technical literacy and familiarity with the different features of a mobile phone are far less relevant for continuous engagement with the service. While most of the farmers in the qualitative sample own a mobile phone, their levels of confidence in using the phone, as well as their enthusiasm for digital technology, varied. Some farmers said that they used other mobile phone-based services (such as m-money), regularly used the voice message function, and saved VFC messages for future reference. Other farmers (mainly older farmers and women) only knew how to use the phone to receive and make voice calls and had to consult their children/other household members frequently to help them with even the basic functions of their phones.

This finding suggests that continued engagement with mobile phone-based services might be possible for farmers with different levels of technical expertise and not just technology enthusiasts.

Barriers to use of call centre by women and less educated farmers

A number of farmers felt intimidated by the idea of the call centre; most of these were female or had a low level of education. Several female farmers (n=4) and male farmers with no formal education (n=5) explicitly stated that they felt intimidated by the prospect of contacting the VFC call centre. For example, a very poor and uneducated farmer from Upper West who enthusiastically and continuously used the recorded voice messages, SMS (he asked a friend to read out the messages as he is illiterate), and free calls revealed that he was reluctant to contact the call centre:

I am not able to use the call centre because I am not educated [...]

(Male farmer, 35 years old, very poor, Upper West)

A widow from Upper West shared this fear and also believed that one needed to be able to speak English to contact the call centre:

I don't know how to use the call centre for I am not educated enough [...] I also cannot speak in English to these people in Accra [in the call centre]

(Female farmer, 37 years old, poor, Upper West)

Integrating a call centre into a digital behaviour change intervention has been shown to have enormous potential for engaging farmers and providing much-needed specific and timely information and advice (Cole and Fernando, 2012). However, misconceptions and fears about the service can result in the exclusion of the farmers who may gain most from the advice (as they are also often excluded from traditional extension services). To ensure that female farmers and uneducated farmers especially use call centres, perceptions around the call centre could be improved (e.g. by promoting the call centre as a local service staffed by agriculture experts who speak local languages). Calls should also be answered in the language that is spoken in the area where the call is coming from (rather than English).

Employment: Part-time farmers are less engaged with VFC and often perceive it as a disturbance

Three farmers specifically stressed that they were only part-time farmers and engaged in other (more lucrative) economic activities apart from farming. All three continued to engage with the service but the intensity of their engagement was often low (e.g. they did not read all messages/listen to all recorded voice messages). All three also complained that they often perceived the number of VFC voice messages that they received to be overwhelming and at times annoying.

I get angry sometimes because I will be working then I will get a VFC message and then shortly after another message will come. When it happens like that, I don't even read the message being sent and I just delete it.

(Male farmer, 37 years old, less poor, Central)

One of the farmers suggested that VFC should be offered only to full-time farmers as they are likely to value the service most. This finding highlights the importance of the careful profiling of the farmers in the initial stages of the sign-up for VFC. Part-time farmers could also receive less frequent voice and SMS messages compared to full-time farmers (e.g. profiling could focus on only one crop or farmers can choose not to receive frequent weather and market price SMS if they are not relevant for her/him)

Blind or partially blind farmers who are often excluded from traditional services may benefit from VFC

One educated farmer described how her eyesight had worsened considerably in recent years and how this had prevented her from accessing written information. It had also curtailed her mobility (and ability to consult the agriculture extension service in the next town). For this farmer, the voice messages were a welcome source of new information. Similar findings were reported in two recent evaluations of digital voice-based interventions in India and Pakistan (Raza *et al.*, 2019; Vashistha *et al.*, 2015). Both interventions were rolled out nationally and participants self-selected whether to engage. In both interventions take-up of the intervention among blind people was particularly high (although the interventions were not advertised as interventions for the blind). This suggests that voice-based digital services may be well placed to help to address the exclusion of blind people from information services.

4.2.2 Psychosocial characteristics of farmers

Self-motivation and an internal locus of control can increase the likelihood of continuous engagement

The literature suggests that personal traits and the attributes of farmers can play an important role in farmers' decision to engage with innovations and adopt new technologies, in their general well-being, and in their level of agricultural productivity (Hayati and Karami, 2005). One attribute that most of the farmers who still actively engage with VFC shared was a high degree of self-motivation and an internal locus of control (i.e. the belief that they have responsibility and can positively influence what happens to them and their families). For instance, an illiterate and poor 53-year-old farmer from the Upper West region (who leases a small plot of farmland) described how he had never stopped engaging with VFC services as he believed that the information will help him to improve his life:

I am motivated to use the VFC service and will continue to use it because it is good information which can help me in my farming. Even if my farm is small, if I follow their advice, I will get a good yield. I have never disengaged from their service since I joined the club.

(Male farmer, 53 years old, poor, Upper West)

Another very poor farmer from Upper West said:

I am a farmer and always looking to have plentiful yields from my farm, so I am motivated to use any advice that has the potential to help me achieve higher yields.

(Female farmer, 56 years old, poor, illiterate, Upper West)

The importance of farmers' internal locus of control as a driving internal force in the uptake of agricultural interventions (both digital and non-digital) has been stressed repeatedly in the literature (Abay *et al.*, 2017; Abay *et al.*, 2018; Heinström, 2010). To increase the uptake of and engagement with VFC, the services should therefore aim to strengthen farmers' self-motivation and perceived locus of control (Bernard *et al.*, 2014). This could be done through, for example, motivational stories of other farmers who have taken control of their productivity.

4.2.3 Factors related to the design and content of VFC services

Farmers' perceptions of the accessibility of the design and the content of VFC services have already been explored in the qualitative midline study and here as part of the assessment of the acceptance of VFC (Barnett *et al.*, 2019). The midline found that farmers valued practical, easy-to-understand information that was tailored toward their specific agricultural information needs. Farmers also had high levels of trust in the credibility of the information, mainly because the information was perceived as highly relevant for their lives and because they had heard the majority of the information from other sources previously. All of these design and content-related features of VFC also emerged as important factors for continued engagement with VFC in the qualitative follow-up study. However, there were also some additional factors that promoted sustained engagement.

Farmers with low perceived social support felt supported, special, and ‘cared for’ thanks to the regular VFC messages

Several farmers (from both regions) described how they continued to engage with VFC because the service gave them the feeling of ‘being cared for’, ‘being special’, and being guided (by a good willing friend). They appreciated this feeling as they had not experienced a lot of support from other sources.

The reason why I continue to use VFC services is that it makes me feel special and cared for [...] [I]f you are moving in the wrong direction and someone tells you to stand well or corrects you, then the person has really helped you. If you are walking into a ditch and someone who is aware there is a ditch ahead tells you to return and you return, then the person has really helped you.

(Female farmer, 41 years old, poor, Central)

Female farmers in particular often complained about some degree of isolation and loneliness given the solidarity of farm work and the high burden of chores in and around the house (see also the qualitative baseline report, Barnett *et al.*, 2018). A poor farmer and mother of four children described how she usually felt when receiving VFC messages:

I am happy and feel special [when I receive a VFC voice message], because [...] I personally have not had any encounter with the agriculture extension officers. I have not really enquired or sought for any help elsewhere. I also [...] do not have many friends to whom I could talk.

(Female farmer, 30 years old, poor, Central)

To conclude, continuous engagement with VFC among farmers with low perceived social support may be increased by stressing the constant support and ‘caring’ features of the service.

The availability of human support through the VFC call centre (independent of whether it was actually used)

The availability of some kind of real-time human support (e.g. through a call centre, as in VFC) has been shown to increase continued engagement with digital behaviour change interventions (Michie *et al.*, 2017).

Almost half of all farmers interviewed (n=22) said that they had used the VFC call centre to ask specific agricultural or nutrition-related questions. Some of these farmers said that they had contacted the call centre once or twice, whereas others said they used the call centre ‘a lot’. All but one farmer (who could not get through) said that they were very pleased with the professional advice they had received and described how it helped them to address a specific agriculture (or, in two cases, nutrition) problem they had faced. For example:

[W]hen I realised that pests were attacking my cocoa, I called the VFC call centre and they showed the pesticides to buy and when I followed their advice the cocoa is doing well.

(Female farmer, 37 years old, poor, Central)

Given that 74% of all farmers in the quantitative treatment group reported to have never contacted the call centre and 86% of the farmers no longer used VFC at the time of the quantitative endline (Billings *et al.*, 2020 forthcoming), the qualitative findings suggest that the use of the call centre may play a role in sustaining engagement with the service. This hypothesis is supported by the literature, which highlights that interactive digital intervention in which users are given the

opportunity to contact experts for support and advice report higher levels of engagement than one-way interventions (i.e. interventions in which information is only pushed out) (Couper *et al.*, 2010).

Some of the farmers interviewed in the qualitative follow-up study (including five farmers who had never actually contacted the call centre) said that they were aware of the human support at the call centre and that it was available at any time. They appreciated this responsiveness of VFC:

I feel happy anytime the call [with the recorded voice messages] comes. I am happy that they call me to deliver such information and even give me a number to call when I am having any difficulty [related to agriculture] or need further explanations on anything I don't understand about the message.

(Female farmer, 56 years old, poor, Upper West)

Farmers who experienced positive outcomes of engaging with VFC are likely to engage more and continuously, in a virtuous cycle of reinforced engagement

Many farmers described how the positive outcomes they had experienced from following advice given by VFC had helped to build their trust in the service and motivated them to continue to engage with the service. A farmer from Upper West described her experiences as follows:

Because when I followed the advice for the first time [a VFC SMS with a weather forecast that meant she consequently delayed planting], it helped me a lot [as my yield was better]. After that I followed more advice. Last year for instance, I had a better yield after applying the land preparation advice and also prepared fertiliser from manure. My yield was better regardless of the fact that rainfall was quite erratic. Also, my family has been ill less since I have started using the advice on food preparation and hand washing. These benefits motivate me to continue using the service.

(Female farmer, 29 years old, less poor, Upper West)

This suggests a positive feedback loop whereby farmers follow advice provided by VFC and are encouraged by positive results to continue to engage with the service. Thus, positive outcomes reinforce continuous engagement. Of course, there is also the risk that negative outcomes of following advice (or misinterpreting advice and consequently not achieving the desired outcome) may break this circular movement of engagement and farmers' willingness to engage further. This finding highlights the importance of designing the content of VFC as clearly as possible to prevent misinterpretations.

Farmers liked practical and specific information that they lacked from other sources

Most farmers explained that they had access to at least one other trusted source for agricultural information (apart from VFC). In most cases,¹¹ farmers referred to the radio and/or agriculture extension services. Farmers agreed that the content of VFC complemented other services; however, many of the VFC messages and, in particular, the information received from the call centre went further and provided more detailed and hands-on advice, which farmers often lacked from other sources. For instance, a poor farmer from Upper West reflected on the differences in the information he had received from various sources:

Yes, there are differences [in the different information sources]. VFC will normally categorise their information [based on the initial profiling of farmers] and will give you more specific information, whereas the agriculture extension officers give

¹¹ One female farmer said that her other information source was her father.

more general information. For example, if it's about prices, VFC will tell you the prices for specific markets close to you, but extension workers or the radio will only give you the general figures. The same applies to weather information: VFC will tell you the weather forecast for your specific place and where it will rain and the direction of the rain but the other sources will only give a general forecast.

(Male farmer, 30 years old, poor, Upper West)

Also highly valued was advice on low-/zero-cost agricultural practices to increase agricultural yields (e.g. low-cost approaches to pest management, or the use of composted on-farm manure as a zero-cost fertiliser). Many farmers stressed that other sources often did not provide these hands-on low-cost options, or if they did, it happened only very rarely (e.g. during an annual visit of agriculture extension).

How to prepare organic manure is the most useful service. This is because I do not have money to buy the recommended fertilisers from the market but with this advice, I am able to prepare my own fertiliser to apply to my crops which has contributed to improving my yields.

(Female farmer, 49 years old, poor, Upper West)

It should be highlighted that not all of the VFC voice messages contain practical advice. There are also a large number of messages with general agriculture and nutrition information. While most farmers also appreciated these messages, some felt they merely repeated what they had already heard from other sources and did not add any further details.

To ensure ongoing interest and engagement of farmers with VFC, the provision of practical advice based on careful profiling of farmers and their agricultural needs is important.

Nutrition information is a welcome add-on (especially for women) but agriculture information was a priority for farmers

Voice messages with nutrition information were appreciated by most of the female farmers (although three women highlighted that they had received very similar information during their recent antenatal visits). Male farmers' engagement with the nutrition content of VFC was considerably lower and most male farmers did not specifically mention the nutrition content during the IDIs. The ones that did usually explained that they shared the information with their wives, who were responsible for childcare and meal preparations.

However, one topic that was frequently mentioned by both male and female farmers was the VFC advice on hand washing. Many farmers said that they followed the advice with positive effects.

I follow the advice in order to prevent my children from falling sick and even the adults. It helps the child to gain strength and to grow healthy. We are advised to wash our hands with soap before and after eating. When you come back from the toilet, you also have to wash your hands before you do anything else. I really follow this advice and do it often.

(Male farmer, 35 years old, poor, Upper West)

These findings echoed the findings from the previous two qualitative rounds and suggest that combining nutrition advice with agricultural information might be effective when targeting female farmers, but that this is less the case for male farmers. Other channels for targeting men with nutrition information may be more effective (e.g. joint nutrition sessions during antenatal care).

Farmers feel empowered by the information

The potential of mobile phones as an empowering tool for farming communities has been discussed repeatedly in the literature (e.g. Furuholt and Matotay, 2011). The qualitative findings suggest that many farmers (and, in particular, female farmers who owned a mobile phone) felt empowered by the service. For example, being aware of the current market prices for their crops (thanks to VFC) was perceived as empowering in price negotiations with wholesalers at local markets but also when selling crops to traders who came into the community (which was very common as many farmers had no means of transporting their crops to distant markets):

The price information has helped improve the value we get for our farm produce. Even when we don't bring our goods to the market, with the information we are able to negotiate for higher prices from aggregators.

(Female farmer, 39 years old, less poor, Central)

The positive impacts of mobile phone-based market price information for farmers in Ghana have been reported previously. Farmers in northern Ghana who subscribe to mobile phone-based price alerts were able to sell their produces at a significantly higher price, with a price difference of 12.7% and 9.7% for maize and groundnut, respectively (Courtois and Subervie, 2014).

Other farmers described how VFC helped and empowered them in their interactions with agriculture extension workers:

Yes, when they [agriculture extension workers] come and tell us something, I also refer to the VFC messages to ask questions if they fail to touch on something VFC has told us. The last time they were here, it was about fertiliser application so I asked them the specific fertilisers we could use for different crops, and what they said pretty much confirms the VFC information.

(Male farmer, 30 years old, poor, Upper West)

4.2.4 Factors related to the delivery through mobile phones

VFC addresses a need for area-specific time-sensitive information that is currently not being addressed by other sources

Many farmers said that one reason for their continued engagement with VFC was that the service delivered important, area-specific, and time-sensitive information that they currently could not access anywhere else (or if they could, it would require additional time and effort from them).

Time-sensitive information included recorded voice messages with agricultural advice for key agricultural periods:

VFC advises on best farm practice, which is similar to what agriculture extension workers do. However, the VFC information is faster than the rest and requires that I act immediately, which is better than other sources.

(Male farmer, 84 years old, poor, Upper West)

Mobile-based information is best because it is faster. The other sources can be delayed.

(Male farmer, 35 years old, poor, Upper West)

The fastest way to provide important agricultural information is through the phone because if the agriculture officer does not come here in time, we will not receive the information in time.

(Female farmer, 39 years old, less poor, Central)

Time-sensitive information also included area-specific weather forecasts. Gaining access to reliable and localised weather forecasts has become increasingly important for farmers (especially in Upper West) given the unpredictability of rainfall patterns due to climate change:

At first, I did not know the right time to start planting. Whenever the first rain came, I planted, but most of the crops die because there is always a long gap between the first rain and subsequent ones to support crops. Since I started receiving tips from VFC, that situation has improved significantly because I do not start planting immediately after the first rain. I wait for subsequent rains and for such time that the VFC will signal us to start planting.

(Female farmer, 42 years old, very poor, Upper West)

The weather here is not that stable so getting this advice on when it's going to rain and when you can plant or apply chemicals has helped us a lot.

(Male farmer, 30 years old, poor, Upper West)

Market price information was also strongly time-sensitive and perceived as more useful when it was very area-specific (i.e. in comparison to the national-level price information delivered by other sources).

While these positive findings are encouraging, the literature on market price information systems (MIS) suggests that evidence for the impact of the use of these systems is mixed. For example, Burrell and Oreglia (2015) showed a 'disappointing lack of impact' for MIS systems as farmers lacked interest and barely used the price information. Burrell and Oreglia point out that price is only one factor in trade-related decision making: this is certainly true in the case of the farmer who had to ignore price information at times in order to sell crop for cash to meet urgent household needs.

Mobile phone-based information services can be used flexibly when and wherever there is a demand for information

One feature that distinguishes mobile phone-based behaviour change interventions from 'traditional' face-to-face behaviour change (e.g. via an agriculture or nutrition counsellor) is that participants have the flexibility to access support and voice messages when and where they want to (and not, for example, when the nutrition counsellor arranged a community meeting or the agriculture extension worker decided to visit a community) (Michie *et al.*, 2017).

The findings from the qualitative follow-up study describe how farmers engaged considerably more with VFC (and here in particular with the call centre, voice messages, and free farmer-to-farmer calls) when they faced an acute agricultural problem such as pest infestations or the failure of their crops to thrive. Farmers were actively seeking solutions for their specific problem during these times and VFC was often able to provide help.

Similarly, many farmers described how they engaged less with the service during times in which they were engaged with farming activities (e.g. harvest), while travelling, or during family festivities/funerals.

While farmers valued the flexibility the mobile phone-based service provided, a few complained about a perceived lack of control over the service. For example, many farmers were unable to read

the VFC SMS messages and therefore did not see any value in the regular SMS messages they received. Nevertheless, they had no control over this part of the service and were not able to stop the SMS. A few farmers also described not knowing how to leave VFC if they wanted to.

The previous literature echoes these findings and stresses that user engagement with digital interventions has been shown to be better when users feel they are in control of and free to make choices about intervention delivery (Perski *et al.*, 2016). VFC could therefore consider adding more features to give more control over the service to farmers (e.g. whether to receive information sequentially throughout the week or on one specific weekday only).

Farmers who continued to engage with VFC preferred mobile phone-based information because it was more convenient and they were less likely to miss information

In the qualitative midline study, many farmers preferred the radio as a more inclusive and accessible information channel. In contrast, most of the farmers who still actively engage with VFC said that they preferred mobile phone-based information. The portability and affordability of the mobile phone meant that farmers often had their devices with them at all times and were less likely to miss information:

The mobile-based services are better for providing information than other information sources like the radio and the agricultural officers. This is because I do not always listen to the radio. My phone is always with me so when they call to say do this and that, I get the information. I am more likely to follow the advice I get on the phone than on the radio.

(Female farmer, 41 years old, poor, Central)

Technical problems frequently prevent access to VFC services

The previous two qualitative rounds and the quantitative evaluation found that technical problems with the mobile phone – in particular poor or fluctuating Vodafone network coverage – and broken phones were major barriers to the uptake and continued engagement with VFC services. Even among the subgroup of farmers who continued to engage with the service, technical problems were common and reported by nearly half of the farmers interviewed. Most common were problems with the network (especially in the Central region):

I really like the advice VFC gives me. Also, if you don't know something [related to farming or nutrition] you can call them [the VFC call centre] and they will educate you on that. But recently the Vodafone network has become very bad here and it has become difficult to make calls. MTN network is the best here and so for now I prefer MTN but if Vodafone can do something about the network coverage then I will go back to Vodafone.

(Female farmer, 29 years old, poor, Central)

Thus, while many farmers struggled with these technical difficulties, they tried their best to continue to use the service as they valued the advice.

4.2.5 Factors related to the setting

Farmers with limited access to agriculture extension workers value the consistency of VFC

All farmers interviewed complained that their access to agriculture extension services was very limited, irregular, or in some cases non-existent. The reasons given for the limited access to agriculture extension services varied. Based on farmers' reports, agriculture extension workers in the Central region mainly provided advice to cocoa farmers and visited other farmers only very seldom. Another challenge was access to agriculture extension workers in remote communities, as the following quotation illustrates:

The agriculture officers are in town as we speak but normally, when they come, they only speak and go to those whose farms are close by – mostly by the roadside. But our farm is far in the forest; they do not usually come here.

(Male farmer, 42 years old, poor, Central)

Female farmers, in particular, often struggled to access information through traditional agriculture extension services as they lacked the time to attend community meetings organised by agriculture extension workers or did not feel welcome in all-male farmers' meetings, as a young female farmer from Upper West explained:

[F]or agriculture information, the extension officers when they visit the community, they only gather male farmers to educate them on farming practice, ignoring the females.

(Female farmer, 20 years old, poor, Upper West)

Within this environment of limited or difficult access to traditional agriculture extension services, engagement with mobile phone-based services was valued as a reliable and credible source of information. Farmers particularly liked the consistent flow of information that VFC provided (in contrast to sporadic visits by agriculture extension workers or occasional agricultural shows on the radio):

Mobile-based services are better compared to others because they are consistent, so you are consistently reminded or prompted about what to do so you don't forget. Radio or extension workers may share such information once and you may not hear it again, so you are likely to forget what they tell you. Therefore, I think mobile-based information is more likely to stick and be used than other sources of information.

(Female farmer, 42 years old, very poor, Upper West)

What makes VFC more helpful than the rest [i.e. other information sources] is that the communication and interaction from VFC is continuous. They [VFC recorded voice messages] call you all the time.

(Female farmer, 32 years old, poor, Central)

4.3 Summary of motivators for continued engagement with VFC

Section 4 has presented some underlying motives that help to explain why a small subgroup of farmers continued to engage with VFC services throughout the intervention period (March 2017 to March 2019). The findings suggest that engagement with VFC often followed dynamic patterns,

with varying levels in the intensity of engagement, depending on farmers' information needs at specific times throughout the agricultural calendar. For example, farmers were especially receptive to information about effective planting strategies at the beginning of the planting season but were often less engaged with VFC services in the middle of the labour-intensive planting period. There were also some farmers who completely disengaged with the service for a period of time (either voluntarily because they were preoccupied with other aspects of their lives, or involuntarily because of problems with their mobile phones).

The qualitative follow-up study found that continued engagement was influenced by the characteristics of the farmer who used the service; the design, content, and mode of delivery of VFC; and the setting in which VFC was used. With regards to the characteristics of farmers, age and level of education, technical literacy and confidence, and poverty status did not emerge as strong influences on continued engagement with VFC (although all of these factors have been shown in the literature to be important influences on the initial decision to sign up for mobile phone-based services).

The qualitative data revealed gendered barriers to the breadth of continued engagement with VFC, with female farmers who did not own a mobile phone themselves often being excluded from some or all of the VFC service. Access to a mobile phone could not ensure continued access to the service – only mobile phone ownership could (assuming there were no other technical barriers to accessing the service). Illiteracy and the inability to read SMS messages in English posed a barrier to both initial and continued engagement with SMS-based information.

Some inequalities with regards to engagement with the different components of VFC emerged. The call centre is intimidating for *some* female farmers and farmers with low levels of formal education, which affects their use of the service. High levels of self-motivation and an internal locus of control emerged as strong determinants for continued engagement with VFC independent of the age, poverty status, and education level of the farmer.

With regards to design and content-related influences, farmers who perceived low levels of social support were especially motivated to continue to engage with VFC as the service provided them with a welcome feeling of being 'cared for'. The availability of human support through the VFC call centre, the focus on practical, hands-on, very area-specific agricultural advice that was often lacking from other sources (e.g. radio), and the empowering properties of VFC emerged as strong motivators for continued engagement.

With regards to the mode of delivery, farmers continued to engage with VFC because the service satisfied their need for area-specific, time-sensitive information that was currently not addressed (or not addressed well) by other sources and because of the high level of flexibility the service provided. Technical problems – in particular poor Vodafone coverage – emerged as a major barrier to continuous engagement. With regards to the setting, farmers with limited and only occasional access to agriculture extension services valued VFC for the constant flow of agricultural information and advice.

5 What are the pathways by which VFC services promote a change in agricultural and/or dietary practices, leading to improved nutrition and livelihood outcomes?

All of the farmers interviewed explained that they had acted on at least some of the advice and had changed specific agricultural practices. Some farmers also reported changes related to their dietary practices and/or wider nutrition-related behaviours. The qualitative midline identified several contextual barriers that frequently impeded the translation of the advice into practice. The most commonly cited barrier in the midline was financial constraints and the belief that the costs of purchasing agricultural inputs and/or more nutritious food may outweigh their benefits (especially as the benefits are often uncertain).

The quantitative impact evaluation found that there were some, if minimal, impacts of VFC services on dietary diversity (especially in the Central region and with regards to the consumption of dairy products among women), agriculture productivity, and income (Billings *et al.*, 2020 forthcoming). To further expand these findings, the qualitative follow-up study focused on exploring the pathways by which VFC helped to trigger and promote changes in agricultural and nutritional practices among farmers who still engage with VFC. Overall, the specific mechanisms of behaviour change are likely to be different for different types of farmers and within different household and community-level settings. Also, agricultural decision making and actions do not take place in a social vacuum, but are shaped by ideas and practices negotiated by the social groups in which they are necessarily embedded (Murdoch and Lowe, 2003). In this context, power relations can be important in shaping the way particular ideas and knowledges gain legitimacy and authority within particular groups.

5.1 Effective engagement with VFC to trigger change does not need to be continuous engagement

As has already been highlighted in Section 4.1, farmers' engagement with VFC services often followed a dynamic process, with periods of higher intensity engagement and periods of lower intensity or no engagement. Based on the recommendation of an international workshop on the development of digital behaviour change interventions, effective engagement with mobile phone-based interventions does not need to be continuous and high intensity. More important is that the engagement is sufficient to trigger the desired change in behaviour (Michie *et al.*, 2017). The qualitative follow-up study suggests that even limited engagement with the VFC service can result in far-reaching change. The following quotation describes the experience of a 65-year-old, very poor farmer who used the VFC call centre only once:

I once used the call centre to ask how to rear livestock too. The experience was exciting as they educated me on how to build a pen and keep cattle and goats there in farming season. They also told me to store some of my groundnuts and beans to feed the animals with in the dry season. This I have followed and now I have more goats and cattle than my neighbours.

(Female farmer, 65 years old, very poor (at baseline), Upper West)

This finding adds weight to the suggestion that ongoing engagement might not be necessary for a mobile phone-based intervention to trigger desired changes in agricultural or nutrition practices. Effective engagement with a few messages (i.e. sufficient engagement to trigger a change in behaviours) or advice from the call centre might be enough and might result in large improvements

in farmers' lives. From a commercial point of view, occasional or sporadic engagement with VFC is, of course, not desirable, however – ongoing engagement would be preferred.

5.2 Farmers use information from VFC to develop their own contextualised and adapted approaches

It is well established that information (knowledge) alone is not necessarily enough to change behaviour (Levin, 2013). There are complex relationships between mediators (e.g. knowledge, attitudes, and beliefs) and actual behaviour: farmers may gain the knowledge, confidence, and intention to change agricultural practices, but this will not impact on their agricultural practices unless their environment enables them to act.

Financial constraints emerged as a major obstacle to the translation of the VFC into practices. However, in contrast to the midline, the farmers included in the qualitative follow-up were all highly motivated and thus tried to adapt the advice to work within their financial conditions (e.g. applying two bags of fertiliser per acre instead of four bags, as recommended by VFC, or consuming eggs whenever possible rather than several times a week, as recommended by VFC). The following quotations describe how farmers tried their best to follow the advice provided by VFC despite financial constraints:

I was advised by VFC to wear safety boots, nose masks, helmets and gloves because the herbicides we use on the cocoa farms are poisonous and so we need to have these protective covers. So far, I have managed to buy the safety boots but because of lack of money I have not been able to buy the rest. As for the herbicides VFC recommends, I don't have a problem getting them [in my village]. I even have some with me now. The herbicides are very strong and if you get some on your skin it really burns.

(Male farmer, 37 years old, less poor, Central)

I often cannot afford to buy the fertiliser that VFC recommends. But I prepare the manure myself as VFC instructed. I dig a hole and gather rubbish and animal waste in it. Later I will sprinkle this on my farm, as local fertiliser.

(Female farmer, 49 years old, poor, Upper West)

Farmers also adapted and contextualised how and for what they used VFC information. For example, most farmers who reported using the market price information used it to decide where and for what price to sell their crops. However, a few farmers used the information in a different way, to decide where to purchase the least expensive crops:

The VFC price messages have helped me access market information about prices for crops at the different market centres within my region. This helps me to decide where I can buy the cheapest products. I produce cakes for sale and need to buy beans and corn at the cheapest price possible in order to make higher profits. I find the market information the most useful.

(Female farmer, 37 years old, less poor, Upper West)

5.3 Farmers combine the information from VFC with other existing and new knowledge to inform action

The information provided by VFC usually did not trigger a change in farmers' behaviours in isolation, but was combined with other forms of knowledge and information to inform their decisions. Almost all farmers said that they had heard similar information from other sources previously (although these other sources often lacked practical guidance, as highlighted in Section 4.2). Hearing the same information from various sources increased farmers' trust in the credibility of the information from VFC.

Most farmers also discussed the information provided by VFC with another household member (usually the spouse) and nearly half of the farmers interviewed communicated with a peer about it. Discussing the information with others (especially other farmers) helped some farmers to contextualise the information better, combine it with other existing knowledge, and adapt it if necessary.

I was a bit afraid to use the new VFC information on my farm so I first called my brother who farms for a large cooperation in the south [of Ghana] to help me and explain whether the information is true and how it would work in practice [on my farm] and he did.

(Female farmer, 37 years old, less poor, Upper West)

A few farmers also used the free farmer-to-farmer calls to contact other farmers and discuss the VFC information:¹²

I also make calls to other VFC members to seek explanations and further discuss the voice messages that I do not fully understand. We discuss how best to use the information for us.

(Female farmer, 42 years old, very poor, Upper West)

For a long time, agriculture extension and information services were designed based on linear, one-way knowledge transfer theories assuming that agricultural innovations (and knowledge) originating in science could be transferred to farmers, who then adopted them (Black, 2000). Behavioural sciences in agriculture have moved away from this unilinear approach, as an increasing body of evidence suggests that it conflicts with how farmers actually use information. Current approaches propose that, rather than being passive knowledge users, farmers are active social agents that use information to inform learning and contextualised adaptation (Blackstock *et al.*, 2010). The qualitative data suggest that VFC services informed some social learning and adaptation processes. However, VFC could further strengthen the learning component of the service, for example by promoting peer-to-peer interaction and learning via the free farmer-to-farmer calls more.

5.4 Limited reach of VFC beyond subscribers as sharing was uncommon

Even households without access to a mobile phone could benefit from the VFC if farmers who received the recorded voice messages/SMS shared the content. GSMA monitoring and evaluation data suggest that farmers may have shared messages' content with up to 10 people (personal

¹² The majority of farmers were not aware of the free farmer-to-farmer call function.

communication). The qualitative midline found that farmers often shared content with spouses and occasionally other households' members, but very rarely with other farmers/peers. Reasons for not sharing included perceiving the content as irrelevant, fearing that others would not believe them or perceive them as arrogant, the perception that information is private, feeling protective over their VFC membership and the information they received from VFC, and simply forgetting to share. The qualitative follow-up study corroborated these findings and also suggests that some farmers were reluctant to share content as they did not want to be held accountable by fellow farmers if following the advice they passed on did not result in the expected benefits:

I don't share the information I received from the VFC with general public because if you share the information with someone and when the person follow the advice and it doesn't work, there will be a problem between the person and me.

(Male farmer, 53 years old, poor, Upper West)

Several female farmers also stated that they occasionally shared content with other female farmers but never male farmers (for many women this even included their husbands). Men were generally perceived as lead farmers within their households and communities, whereas women usually had supportive farming roles. Women feared that they would transgress the expected roles of women in their farming communities if they were to start giving agricultural advice to men:

I do not share with men except my husband because when I do people will think or say how can a woman know more about farming than a man. I only share with other women who are closer to me and my household, including my husband.

(Female farmer, 29 years old, less poor, Upper West)

VFC should consider experimenting with approaches to actively encourage message sharing among both female and male farmers (e.g. by sending reminders to share and highlighting the benefits of sharing, such as better well-being of the entire community). As it was considered a breach of social norms if female farmers shared information with male farmers, females should be encouraged to share with fellow females.

5.5 Farmers were more willing to act upon low-risk, no-expense advice

Generally, farmers were more willing to act on low-risk and no-expense advice (e.g. using weeds as fertiliser rather than burning them, producing fertilisers from composted manure, eating beans without flour, following hand-washing routines, etc.) than on high-risk advice (e.g. purchasing fertiliser, herbicides, and seeds, or changing how they plant their crops).

For perceived higher-risk practices in particular, farmers usually needed more motivation and evidence that the advice would work:

I tried implementing their advice on pest control when my maize farm was attacked by some pests. I was told to buy a specific pesticide to spread on the farm, which I did. The radio recommended the same to VFC, which influenced me.

(Female farmer, 58 years old, very poor, Upper West)

5.6 Barriers that prevent farmers from acting upon VFC advice

The most commonly cited barrier to the translation of VFC advice into practice was lack of money to purchase the agricultural inputs and foods recommend by VFC.

Farmers (and, in particular, female farmers) also frequently complained that the agriculture inputs or foods that VFC had recommended were not available within their vicinity. For example, a poor widow with several children explained:

I could not follow their advice on safer storage of my crops because the sacks that I was advised to use cannot be found in our community. I could try to buy them in the next town but I have no money or time to go there.

(Female farmer, 37 years old, poor, Upper West)

Another very poor widow with several children described her situation as follows:

They [VFC] may ask us to eat certain fruits but we cannot get these fruits here and I do not have a way to go somewhere to buy them. Here fruits are not sold like in the towns.

(Female farmer, 52 years old, very poor, Central)

This suggest the importance of careful contextualisation of VFC recorded voice messages, especially for female farmers, who often do not have the time or resources to travel.

While market price information was valued by many farmers, a common challenge was that the markets with the best prices were too far away for farmers to reach. Three farmers also pointed out that they had no means of transporting their crops to the recommended markets. Many farmers also explained that the small amounts of crops that they wanted to sell did not justify a trip to a distant market:

I am not able to fully take advantage of the price information because the market places that are recommended are too far from me considering the quantity of produce that I want to sell.

(Male farmer, 35 years old, poor, Upper West)

This again suggests that market prices need to be as localised as possible to be attainable by poor, small-scale farmers.

The quantitative evaluation found a small but significant change in the consumption of dairy products in the treatment group. Dairy consumption levels in Ghana are among the lowest in Africa and globally (Kunadu *et al.*, 2019). The literature suggests that the main reason for the low consumption of milk and milk products in Ghana is that milk is very often contaminated with pathogens and thus is perceived as a high-risk food in terms of contracting food-borne diseases (Addo *et al.*, 2011). In the qualitative interviews, none of the farmers referred to the consumption of dairy products and there are also no VFC recorded voice messages that promote the consumption of dairy. However, there are many voice messages on how to improve food hygiene when processing food, which may have also affected farmers' approach to and consumption of milk and milk products positively.

5.7 Summary of the findings on the pathways of change

This section presented the findings of the pathways by which VFC triggered a change in agricultural and/or nutritional practices among farmers. The findings suggest that effective engagement with VFC does not need to be continuous but does need to be sufficient to trigger a change in the desired agricultural and nutrition-related behaviours. For some farmers, this meant continuous engagement, whereas other farmers engaged less intensively but still made significant changes in their practices because of VFC. Farmers used advice from VFC to develop their own context-specific approaches and adaptation within their financial conditions and capacities, often in discussion with peers and in combination with other knowledge sources. There is some, albeit rather limited, evidence for traditional one-way, passive knowledge transfer; rather, information is used to inform learning. There were, however, multiple barriers to the translation of the advice into practices, including financial constraints, long distances to local markets, and the unavailability of agricultural inputs and foods on local markets.

6 Conclusions

The qualitative follow-up study had the aim of: (1) identifying the underlying reasons for sustained or continuous engagement with VFC in a context within which most farmers have disengaged with the service (due to implementation issues both at farmer and programme level); and (2) exploring pathways by which VFC services promote a change in agricultural and/or dietary practices among farmers. The focus of the final qualitative data collection is on the subgroup of treatment farmers who are still signed up and actively using VFC. In this section, key findings from the analysis will be summarised and recommendations presented.

6.1 Factors that influence continuous engagement with VFC and implications for policy and practice

Previous findings (both from the qualitative and quantitative evaluations) found only very low levels of continued engagement on the part of farmers with VFC services. While much of the limited engagement can be explained by implementation issues both at the level of the farmers and of the programme, it also highlights an urgent need to develop more effective strategies to promote farmers' engagement with mobile phone-based agricultural services. If farmers fail to engage with VFC, they miss the opportunity to see content that could help them to actively improve their agricultural productivity and income, as well as their nutritional practices. The qualitative follow-up study found that factors related to the characteristics of the farmer, the design and content of VFC, the mode of delivery of VFC, and the setting within which VFC is used can influence continuous engagement with VFC.

Characteristics of the farmer

The qualitative data suggest that the age, level of education, technical literacy and confidence, and poverty status of a farmer might be less relevant for whether s/he continues to engage with VFC services than they are for the decision to sign up to a mobile phone-based service. In contrast, all these factors have been shown to influence people's initial decision to sign up for mobile phone-based or other digital services (Perski *et al.*, 2016).

Female farmers who did not own a mobile phone and had subscribed to the service using the telephone number of another household member were often excluded from some or even all of the service. Access to a mobile phone could not ensure continued access to the service; only mobile phone ownership could do this (assuming there were no other technical barriers to accessing the service). This suggests that mobile phone-based services might be less effective in reaching and engaging female farmers in contexts with low female mobile phone ownership.

Some inequalities with regards to the uptake of and engagement with the different components of VFC emerged among different groups of farmers. There were some challenges of female and poorly educated farmers being less likely to contact the VFC call centre due to fears of being judged. To ensure more equal uptake of and engagement with the VFC call centre, perceptions around the call centre need to be changed (e.g. by highlighting that fellow farmers/agriculture extension workers will answer calls and not agricultural experts from Accra)

High levels of self-motivation and an internal locus of control were personal attributes that most farmers who continued to engage with VFC services shared. Including features and content into VFC that aim to strengthen self-motivation and improve farmers' perceived locus of control could

help to motivate a wider audience of farmers to continue to engage with VFC (e.g. through the tone of messages).

Design and content of VFC

Farmers who perceived low levels of social support were especially motivated to continue to engage with VFC because the service provided them with a welcome feeling of being ‘cared for’ and guided. To reach farmers with perceived low levels of social support and promote uptake and continuous engagement with VFC, the caring and guiding features of the service should be stressed.

For many farmers, the availability of human support through the VFC call centre was an important motivator for continued engagement with the VFC service. Adding human support features to mobile phone-based information services can help to increase continuous engagement with the service.

Poor farmers are more likely to continue to engage with VFC if the service satisfies their need for practical and hands-on advice on low-cost agriculture practices. This type of advice was often lacking from other sources of agricultural information (e.g. the radio). Low-cost agricultural practices are particularly relevant to smallholders who lack the financial resources to purchase improved seed, pesticides, or other agricultural inputs.

Nutrition-related information is a welcome addition to the agricultural information service for women but attracts less interest among male farmers, whose focus remains on the agricultural advice. To reach men with nutrition advice other channels may be more effective (e.g. joint nutrition education for couples during antenatal visits).

Mode of delivery of VFC

Farmers continued to engage with VFC as the service provides much-needed area-specific, time-sensitive weather, price, and agriculture information that farmers could not access otherwise. To ensure that the information is relevant, careful profiling of farmers with regards to their specific information needs, capacity (e.g. capacity to bring his/her products to distant markets), and location is important.

Farmers appreciated the high level of flexibility that the mobile phone-based service offered, which meant that they could intensify or lessen their engagement with the service depending on their individual information needs at different times. To strengthen farmers’ willingness to engage even further, features that give farmers more control over the service should be considered (e.g. control over whether to receive SMS messages).

Technical problems – in particular, poor or fluctuating Vodafone network coverage – posed a challenge not just to the initial uptake of the services but also to continued engagement.

Setting in which VFC is used

Limited, irregular, or even non-existent contact with agricultural extension services made farmers more receptive to mobile phone-based agriculture information services. Farmers especially appreciated the continuous support and advice, which they did not receive from other sources.

6.2 Key findings on the pathways by which VFC promotes change

Ongoing engagement with VFC might not be necessary to trigger desired changes in agricultural and nutritional practices; effective engagement with selected messages might be sufficient to trigger change. Thus, rather than focusing on increasing levels of ongoing engagement with mobile phone-based interventions, it should be acknowledged that farmers' engagement with the intervention is likely to vary over time.

Farmers drew on VFC to inform their own contextualised and adapted agriculture practices, often in discussion with other farmers and by combining different sources of knowledge. We should not expect unilineal knowledge transfer and the translation of VFC advice into practice; rather, the flexible use of the information to inform learning should be encouraged.

Farmers are more willing to act upon low-risk and no-expense advice, whereas more complex, higher-risk practices need to be supported by additional advice.

There were multiple barriers to translation of the advice into practices, including financial constraints, long distances to local markets, and the unavailability of agricultural inputs and foods on local markets. Careful profiling of farmers to ensure tailored information (although more intensive profiling will also mean higher implementation costs and might therefore not be possible or practical) and the provision of access to financial support may help to address some of the outstanding barriers.

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Annex A Methodology details

Table 4: Detailed descriptions of the participant selection for the qualitative follow-up study

District	Communities	Included in qualitative midline	Treatment household ¹	Still active VFC users in March 2019 ²	Still active VFC users interviewed	Non-response to interview
Upper West						
Lawra	Gombile	No	20	6	4	2
Nadowli	Tangasie	Yes	20	3	3	0
	Gylli	No	17	3	3	1
	Sigduore	No	17	1	1	0
	Piirung-Yiri	No	22	1	1	0
	Siikore	No	20	2	1	1
	Dapuoh	Yes	18	0	0	0
	Daa	Yes	15	0	0	0
	Mwanware	Yes	14	0	0	0
Jirapa Lambussie	Kwokow	No	17	3	2	1
	Baazu	Yes	17	4	3	1
	Tuggo-Kane	No	10	1	1	0
	Yahga	No	18	2	2	0
	Tizza Kan	No	16	2	2	0
	Nimbare	No	15	2	1	1
TOTAL (Upper West)	15		256	30	24	7
Central						
Asikuma Odeben-Brakwa	Domeabra Anibrinye	No	17	7	4	3
	Breman Mpechim	Yes	16	3	2	1
	Jamira	No	22	9	3	6
	Odokono Nkwanta	No	18	4	3	1
	Ohurobo	Yes	19	7	6	1
	Oliwa	No	17	4	4	0
	Juokora	No	16	5	1	4
	Gyamra	Yes	16	0	0	0
	Dokono Nkwanta	Yes	15	0	0	0
Ajumako Enyam	Ahenbrum	Yes	17	4	3	1

Esiyam	Baywura	Yes	19	4	3	1
	Amoanda	Yes	14	0	0	0
	Kyebi	Yes	19	0	0	0
	Ohyira	Yes	15	0	0	0
	Esikando	Yes	16	0	0	0
TOTAL (Central)	15		256	47	29	18
TOTAL	30		512	77	53	24

¹Based on quantitative baseline survey; ²Based on quantitative endline survey

Quality assurance in data collection was ensured on three levels. First, direct quality assurance was the responsibility of each of the two team leaders, who were senior staff members of PDA. They ensured that the right respondents were selected and interviewed, addressing emerging concerns in the field, and provided direction to other team members. Second, monitoring was done by the lead researcher from PDA through spot visits while the teams were doing the fieldwork. The lead researcher sat in on some of the interviews and participated in debrief sessions while with the research teams. Direct feedback was given to team members during these sessions. Third, remote quality assurance was provided by the lead researcher and other structures within PDA. Constant communication was maintained among the team leaders and with the lead researcher. This was important for discussing and addressing emerging challenges as they happened (e.g. further clarification needs related to the questions in the topic guide). The lead researcher also participated in the synthesis workshop in which emerging findings were discussed further.

Annex B Terms of reference

Call-down Contract

Terms of Reference

PO 6420: External evaluation of mobile phone technology based nutrition and agriculture advisory services in Africa and South Asia

Introduction

DFID (Research and Evidence Division) wishes to commission an external impact evaluation of mNutrition, a mobile phone technology based nutrition and agricultural advisory service for Africa and South Asia. mNutrition is a programme supported by DFID that, through business and science partnerships, aims to build sustainable business models for the delivery of mobile phone technology based advisory services that are effective in improving nutrition and agricultural outcomes.

mNutrition is primarily designed to use mobile phone based technologies to increase the access of rural communities to nutrition and agriculture related information. The initiative aims to improve knowledge among rural farming communities especially women and support beneficial behaviour change as well as increasing demand for nutrition and agriculture extension services. The mNutrition initiative launched in September 2013 will work in 10 countries in Africa (Cote d'Ivoire, Ghana, Malawi, Mozambique, Nigeria, Tanzania, Kenya, Rwanda, Uganda, Zambia) and four countries in South Asia (Bangladesh, India, Pakistan and Sri Lanka). The desired impact of mNutrition will be improved nutrition, food security and livelihoods of the poor.

Mobile phone based services have been endorsed by WHO as an effective strategy for behaviour change and for driving adherence to anti-retroviral treatment protocols¹³. There is currently scant evidence on the impact and cost-effectiveness of mobile phone technology based services for nutrition and agriculture and on the sustainability of different business models for their provision. A rigorous evaluation of mobile phone technology based nutrition services would add significantly to the current evidence base. An external evaluation team managed by the Evaluator, independent of the programme delivery mechanism, will conduct an assessment of the impact, cost-effectiveness and sustainability of mobile phone technology based information and behaviour change messages for nutrition and agriculture.

Background to mNutrition

Introduction

Undernutrition is a major challenge to human and economic development globally. It is estimated that almost one billion people face hunger and are unable to get enough food to meet their dietary needs. Agriculture is a major source of livelihood in many poor countries and the sector has a potentially critical role in enhancing health, specifically maternal and child health and nutritional status. A well-developed agriculture sector will deliver increased and diversified farm outputs

¹³ Horvath T, Azman H, Kennedy GE, Rutherford GW. Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection. *Cochrane Database of Systematic Reviews* 2012, Issue 3.

(crops, livestock, non-food products) and this may enhance food and nutrition security directly through increased access to and consumption of diverse food, or indirectly through greater profits to farmers and national wealth. Better nutrition and health of farmers fosters their agricultural and economic productivity. Current agricultural and health systems and policies are not meeting current and projected future global food, nutrition and health needs.

Despite major investment in agricultural and nutrition research and its uptake and application, there is significant social and geographic inequality in who benefits from these investments. Furthermore, in many developing countries, public extension systems for agriculture, health and nutrition are inefficient, have limited capacity and have a poor track record of delivery, especially in terms of supporting women and girls and the most marginalised populations¹⁴.

Several research and mobile network operators (MNOs) are testing a range of information and communication technology (ICT) solutions for improving access to a wide range of information and advisory services. Mobile phone based technologies are among the most promising ICT strategies, although current initiatives in nutrition are relatively small and fragmented.

What is mNutrition?

Enhancing access to the results of nutrition and agricultural research and development is potentially critical for improving the nutrition, health and livelihoods of smallholders and rural communities. mNutrition will harness the power of mobile phone based technologies and the private sector to improve access to information on nutrition, health and agricultural practices especially for women and farmers (both male and female). Specifically, mNutrition will initiate new partnerships with business and science to deliver a range of services including:

- An open-access database of nutrition and agriculture messages for use in mobile phone based communication (for example, information and behaviour change messages on practices and interventions that are known to have a direct impact on nutrition or an indirect impact via for example agriculture);
- A suite of mobile phone based nutrition and agriculture information, extension and registration services designed to: improve knowledge and generate beneficial behaviour change in nutrition and agriculture; increase demand for nutrition, health and agriculture goods and services; register and identify target populations for support; and, using real-time monitoring, support the conduct of nutrition risk assessments by community health workers.

The impacts of mNutrition are expected to include improved nutrition, food security and livelihoods of the poor, especially women in 10 countries in Africa (Cote d'Ivoire, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda and Zambia) and 4 countries in South Asia (Bangladesh, India, Pakistan and Sri Lanka). This impact will result from the increased scale and sustainability of mobile phone based nutrition and agriculture-based information services, delivered through robust public private partnerships in each country.

mNutrition has two major outcomes. One outcome will be cost-effective, sustainable business models for mobile phone enabled nutrition and agriculture services to 3 million households in 10

¹⁴ Alston, J. M. et al. 2000. A Meta-Analysis of Rates of Return to Agriculture Research and Development, Ex Pede Herculem? IFPRI, Washington, DC, 2000.

Anderson, J.R. 2007. Agricultural Advisory Services. A background paper for "Innovating through science and technology", Chapter 7 of the WDR 2008 July 2, 2007. World Bank. Washington DC

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countries in Africa and 4 countries in South Asia that can be replicated in other countries. Linked to this outcome, the second outcome will expect these services to result in new knowledge, behaviour change and adoption of new practices in the area of agriculture and nutrition practices among the users of these mobile phone based services.

These outcomes will be achieved through four outputs:

- Improved access to relevant mobile based health, nutrition and agricultural advisory services for 3 million poor people and community health workers across 10 SSA and 4 Asian countries;
- Launch and scaling of mobile phone based health, nutrition and agricultural advisory services targeted to poor people and community health workers;
- Generation and dissemination of high quality research and evidence on the impact, cost-effectiveness and sustainability of mobile phone based advisory services in nutrition and agriculture in South Asia and SSA; and
- Development of locally relevant content for mobile phone technology based agriculture and nutrition services meeting demands from users and community health workers.

In terms of promoting behaviour change and/or adoption of new practices, mNutrition will seek to achieve changes in one or more of the following areas:

- Adoption of new agricultural practices that are nutrition sensitive, improve agricultural productivity and utilise post-harvest technologies
- Changes in nutrition practices in either one or several knowledge domains including improved maternal nutrition practices during pregnancies; infant and young child feeding practice; and micro-nutrient supplementation to children at risk (i.e. Vitamin A, Zinc and Oral Rehydration Solution (ORS)).

mNutrition has started implementation from September 2013. For the 2 countries selected for the impact evaluation (Tanzania and Ghana), mobile network operators and content providers have been identified through a competitive process during the first half of 2014. The MNOs and content providers started developing and launching their services during the 4th quarter of 2014 and early 2015. The mobile phone based advisory services are expected to run at least till 3rd quarter of 2018.

mNutrition Project Coordination

DFID support to mNutrition will be channelled to GSMA, as well as directly to this associated independent external impact evaluation. GSMA is a global body that represents the interests of over 800 mobile operators. GSMA already works with the major mobile operators across Africa, (including Airtel, MTN, SafariCom/VodaCom) with a collective mobile footprint of more than 67% of total African connections. GSMA has a number of existing development initiatives, including mHealth and mFarmer, that are part of GSMA's Mobile for Development which brings together mobile operator members, the wider mobile industry and the development community to drive commercial mobile services for underserved people in emerging markets. GSMA will provide technical assistance to mobile phone operators, and support new partnerships with content providers to develop and scale up new nutrition and agriculture message services. GSMA will ensure sharing of best practices and promote wider replication and uptake of effective business models.

Objective and Main Questions

The objective of this work is to conduct an external evaluation of the impacts and cost-effectiveness of the nutrition and agriculture advisory services provided by mNutrition compared to alternative advisory services available in the two selected countries (Ghana and Tanzania), with particular attention paid to gender and poverty issues. The impact assessment is required to answer the following questions that relate to impact, cost-effectiveness and commercial viability:

- What are the impacts and cost-effectiveness of mobile phone based nutrition and agriculture services on nutrition, health and livelihood outcomes, especially among women, children and the extreme poor?
- How effective are mobile phone based services in reaching, increasing the knowledge, and changing the behaviour, of the specific target groups?
- Has the process of adapting globally agreed messages to local contexts led to content which is relevant to the needs of children, women and poor farmers in their specific context?
- What factors make mobile phone based services effective in promoting and achieving behaviour change (if observed) leading to improved nutrition and livelihood outcomes?
- How commercially viable are the different business models being employed at country level?
- What lessons can be learned about best practices in the design and implementation of mobile phone based nutrition services to ensure a) behaviour change and b) continued private sector engagement in different countries?

Further evaluation questions related to other aims of mNutrition will be addressed in at least 1 country (either Ghana and/or Tanzania):

- Are mobile phone based services a cost-effective way to register and identify at risk populations to target with nutrition support?
- Are mobile phone based services a cost-effective way for community health workers to improve the quality and timeliness of data surveillance (a core set of nutrition-related indicators)?

The content for the mobile phone based advisory services will be based on international best practices and widely endorsed protocols (i.e. by the World Health Organisation) and evidence-based nutrition-sensitive agricultural practices identified by international experts. Through an iterative multi-stakeholder process, international and country experts will localise and adapt the content to make it relevant to the specific target audience in the 14 countries. The adapted content and nature of messages is expected to vary across specific target audiences within and across countries. The main purpose of assessing the relevance of the content is not to evaluate the overall health and nutrition content but on how this content has been localised and adapted and to what extent the needs of the specific target groups within their particular context have been met.

In assessing the commercial viability, it is recognised that evaluating the sustainability/long-term financial viability of the mobile phone based advisory services will be difficult as mobile network operators may not be willing to provide this potentially commercially sensitive information. Therefore, GSMA will provide support through its access to aggregated confidential financial results of the mobile network operators providing the service. GSMA will provide a financial summary report on the commercial viability of the business models without compromising the commercial sensitivity of the data for the mobile network operators. The evaluator will assess and validate commercial sustainability through an analysis of the aggregated information provided by GSMA and additional qualitative business analysis approaches.

The Evaluator has the option of proposing refinements of the existing evaluation questions during the inception phase as part of developing the research protocol. These suggestions will be

considered by the Steering Committee and an independent peer review during the review of the research protocol as part of the inception phase.

Output

The output of this work will be new and robust evidence on the impact, cost-effectiveness and commercial viability of mobile phone based advisory services focusing on nutrition and agriculture delivered by public and private partners, and including the development of robust methodological approaches to impact assessment of phone based advisory services.

Recipient

The primary recipient of this work will be DFID, with the beneficiaries being GSMA, governments, international agencies, foundations, MNOs and other private companies and civil society involved in policies and programmes in nutrition and agriculture that are aimed at improving nutritional, health and agricultural outcomes. The findings of this impact evaluation are intended as global public goods.

Scope and timeline

The scope of this work is to:

- Develop a research protocol for the external evaluation of mNutrition;
- Design and undertake an external evaluation of mNutrition in two countries: Ghana and Tanzania;
- Contribute to the communication of the learning agenda, evaluation strategy and evaluation results.

The evaluation will be in two of the 14 mNutrition target countries; Ghana and Tanzania. These countries have been selected based on the phased start-up of mNutrition programme activities. The focus and approach in the two respective countries will be different allowing for a comparison of the effectiveness of approaches applied. In Tanzania, mNutrition will focus on mobile phone technology based nutrition and health services and registration and identification of target population. In Ghana, the mobile phone technology will focus on nutrition and agriculture sensitive services.

In terms of coverage in number of people being targeted for these services, in total 3 million people will be reached through mNutrition; including 2 million for nutrition sensitive agriculture advisory messages in 4 Asian and at least 2 African countries and about 1 million beneficiaries for mobile phone based nutrition services in 10 countries in SSA.

The evaluation contract period will be September 2014 to 31st December 2019. The development of the research protocol must be completed by month 4 for review and approval by DFID. Full details on tasks and deliverables are provided in sections below.

Statement on the design of the mNutrition evaluation

The evaluation design is expected to measure the impact, cost-effectiveness and commercial viability of mNutrition, using a mixed methods evaluation design and drawing on evidence from two case study countries and the M&E system of the programme. Overall, the proposed design should ensure that the evidence from the two case study countries has high internal validity and addresses the priority evidence gaps identified in the Business Case. Being able to judge the generalisability/replicability of lessons learned from the programme is of equal importance and so a

credible approach to generalization and external validity will be an important component of the overall evaluation design. The final evaluation design and methodology to generate robust evidence will be discussed in detail with DFID and GSMA before implementation.

For assessing cost-effectiveness, the Evaluator will further fine-tune their proposed evaluation approach and outline their expectations in terms of data they will require from implementers. A theory based evaluation design, using mixed methods for evaluating the impact has been proposed. During the inception phase, the Evaluator will put forward a robust evaluation design for the quantitative work, either an experimental or a quasi-experimental method, with a clear outline of the strengths and limitations of the proposed method relative to alternatives. During the inception phase, the Evaluator is also expected to identify clearly what will be the implications of the design for implementers in terms of how the overall programme would be designed and implemented and for evidence to be collected in the programme's monitoring system. The Evaluator will also assess the degree to which it is realistic to assess impacts by early 2019 for a programme where implementation started mid 2015 and, if there are challenges, how these would be managed.

The Evaluator, in its 6 monthly reports, will be required to provide information to feed into the DFID Annual Review and Project Completion Report of mNutrition.

Gender and inclusiveness

The impact evaluation will pay particular attention to gender and other forms of social differentiation and poverty issues. From current experiences, it is clear that access to and use of mobile services is differentiated along a range of factors, including gender, poverty, geographic marginalisation, education and illiteracy levels. Therefore, the impact evaluation will look at and analyse differentiated access to and potential utilisation of mobile phone based services for improved nutrition and agricultural production. Based on the findings, it will identify opportunities and challenges in having an impact on women in general and more specifically the poor and the marginalised.

Tasks

The Evaluator will perform the following tasks:

A. Finalise a coherent and robust evaluation approach and methodology based on their proposal (inception phase)

- Conduct landscape analysis of existing experiences in mobile phone based services for nutrition and agriculture based on available publications and grey project documents to identify additional critical lessons and priorities for evidence gathering and programme design and implementation;
- Ensure that gender issues and poverty issues are well integrated into the impact evaluation design;
- Develop robust sampling frameworks, core set of indicators and research protocols that allow the consistent measurement and comparison of impacts across study countries, taking into account differences in business models and programmes as needed;
- Work closely with mNutrition programme team in GSMA to familiarise them with impact assessment methodology, discuss evaluation approaches, identify and agree on data provided by programme monitoring system and possible modifications to design;
- Identify risks to the evaluation meeting its objectives and how these risks will be effectively managed;

- Review existing evaluation questions and if deemed relevant propose refinement of existing questions and/or add other questions;
- Prepare a research protocol, including an updated workplan, project milestones and budget. The research protocol will be subject to an independent peer review organised by DFID; and
- Develop a communication plan.

B. Implement and analyse evaluations of impact, cost-effectiveness and commercial viability in accordance with established best practices

- Based upon the agreed evaluation framework, develop and test appropriate evaluation instruments which are likely to include data collection forms for households, community health workers, service providers including health and agricultural services, content providers and private sector stakeholders including mobile network operators. Instruments will involve both quantitative and qualitative methods;
- Register studies on appropriate open access study registries and publish protocols of studies where appropriate;
- Conduct baselines and end-lines, qualitative assessments and business model assessments in both of the two impact evaluation countries;
- Conduct and analyse the evaluations and present findings in two well-structured reports addressing the evaluation questions. The reports should follow standard reporting guidelines as defined by, for example, the Equator Network. Primary findings should be clearly presented along with a detailed analysis of the underlying reasons why the desired outcomes were/were not achieved;
- The Evaluating Organisation or Consortium may sub-contract the administration of surveys and data entry, but not the supervision of those tasks, study design, or data analysis; and
- The country-specific mixed methods evaluation reports, cost effectiveness and business models studies and final evaluation report will be subject to an independent peer review organised by DFID.

C. Contribute to the communication of the learning agenda, impact evaluation strategy, and evaluation results.

- Develop a communication plan outlining the main outputs and key audiences;
- Conduct lessons learnt workshops in each of the 2 impact evaluation countries and key dissemination events; and
- Assist in communicating the results of the evaluation and contribute to the development and communication of lessons learnt about mobile phone based extension approaches in nutrition and agriculture.

Deliverables

The Evaluator will deliver the following outputs¹⁵:

During the design and study inception phase of maximum 4 months:

- A publishable landscape analysis report highlighting lessons learnt from existing initiatives on mobile phone based advisory services related to nutrition and agriculture by month 4;

¹⁵ Exact timeframe of deliverables will be agreed upon during the design phase as appropriate.

- A updated work plan with project milestones and budget by end of month 1 (possibly adjusted based on the approved research protocol by month 4);
- A communication plan outlining the key outputs, audience and timeline for review and approval by month 4; and
- A full research protocol by month 4 for review and approval. The research protocol should be registered with appropriate open access study registries;

Interim reports:

- 4 biannual progress reports for the External Evaluation as a whole, and for each country evaluation, against milestones set out in the workplan;
- Two desk reviews submitted by June 2016
- Two Baseline quantitative reports submitted by April 2017
- Two Baseline qualitative reports submitted by February 2017
- Two Cost-effectiveness reports 1 submitted by March 2017
- Two Business Model reports 1 submitted by March 2017
- Two Mixed Methods Baseline reports completed by September 2017
- Two Midline qualitative reports submitted by March 2018
- All survey data collected during the evaluation provided in a suitable format to DFID for public release.

At project's end:

- Two Endline quantitative reports submitted by June 2019
- Two Endline qualitative reports submitted by August 2019
- Two Cost-effectiveness report 2 submitted by July 2019
- Two Business Model report 2 submitted by July 2019
- Two Evaluation reports submitted by October 2019
- At least 1 article, based on the findings from the country evaluation reports, published in a research journal;
- A shared lesson learnt paper published and at least one presentation highlighting key lessons for similar initiatives of promoting mobile based technologies for providing extension services and the promotion of uptake of technologies by December 2019.

Research protocol and all final reports will be independently peer reviewed. This will be organised by DFID. Outputs are expected to be of sufficiently quality so that a synthesis of findings can be published in a leading peer-reviewed journal.

Coordination and reporting requirements

A mNutrition Advisory Group (AG) will be established for the programme which will a) provide technical oversight and b) maximise the effectiveness of the programme. The Advisory Group will meet on a bi-annual basis and comprises of representatives of DFID, NORAD and GSMA representatives and independent technical experts. The Evaluator will be managed by DFID on behalf of the mNutrition Advisory Group. The Evaluator will work closely with the mNutrition programme team in GSMA and its specific country implementing partners. The Evaluator will:

- Ensure coherence and lesson learning across all pilot impact assessments on the key evaluation questions and indicators identified.

- Incorporate a clear code of ethics; incorporate plans for open access publications and public access to data sets.

The Evaluator will work closely with the mNutrition project management team, in particular in the design of the overall evaluation framework and the evaluation plan for the specific project components and the countries selected for the evaluation. Collaboration and regular communication between Evaluator and mNutrition project management team and implementing partners in selected case study countries is crucial as the evaluation design may have implications for project implementation and vice versa. The mNutrition project management team will lend support in communication as requested by the Evaluator or the Advisory Group. The Evaluator will report directly to DFID who will manage the evaluation on behalf of the mNutrition Advisory Group. The main point of contact for technical matters is Louise Horner, Livelihoods Adviser and Hugh McGhie, Deputy Programme Manager for all other project related issues. The mNutrition Advisory Group will be the arbiter of any disputes between the evaluation function and the overall programme implementation.

At the end of each 6 months, the Evaluator will submit a brief report outlining key achievements against the agreed deliverables. Pre-agreed funding will then be released provided that deliverables have been achieved.

In addition to the 6 monthly reports outlined above, the Evaluator will provide information to feed into the DFID Annual Review of mNutrition. The 6 monthly reports will be a key source of information used to undertake the Annual Review and Project Completion Report for the programme. These reviews will be led by the Livelihoods Adviser and Deputy Programme Manager, in consultation with the mNutrition AG. All reviews will be made available publicly in line with HMG Transparency and Accountability Requirements.

Mandatory financial reports include an annual forecast of expenditure (the budget) disaggregated monthly in accordance with DFID's financial year April to March. This should be updated at least every quarter and any significant deviations from the forecast notified to DFID immediately. In addition the Evaluator will be required to provide annual audited statements for the duration of the contract.

Contractual Arrangements

The contract starts in September 2014 and will run till end of December 2019 subject to satisfactory performance as determined through DFID's Annual Review process. Progression is subject to the outcome of this review, strong performance and agreement to any revised work plans or budgets (if revisions are deemed appropriate).

A formal break clause in the contract is included at the end of the inception period. Progression to the implementation phase will be dependent on strong performance by the Evaluator during the inception period and delivery of all inception outputs, including a revised proposal for implementation period. Costs for implementation are expected to remain in line with what has been agreed upon for this contract, with costs such as fee rates fixed for contract duration. DFID reserves the right to terminate the contract after the inception phase if it cannot reach agreement on the activities, staffing, budget and timelines for the implementation phase.

DFID reserves the right to scale back or discontinue this assignment at any point (in line with our Terms and Conditions) if it is not achieving the results anticipated. The Evaluator will be remunerated on a milestone payment basis. DFID has agreed an output based payment plan for this contract, where payment will be explicitly linked to the Evaluator's performance and effective

delivery of programme outputs as set out in the ToR and approved workplan. The payment plan for the implementation phase will be finalised during the inception period.

Open Access

The Evaluator will comply with DFID's Enhanced and [Open Access Policy](#). Where appropriate the costs of complying with our open access policy should be clearly identified within your commercial proposal.

Branding

The public has an expectation and right to know what is funded with public money. It is expected that all research outputs will acknowledge DFID support in a way that is clear, explicit and which fully complies with DFID Branding Guidance. This will include ensuring that all publications acknowledge DFID's support. If press releases on work which arises wholly or mainly from the project are planned this should be in collaboration with DFID's Communications Department.

Duty of Care

The Evaluator is responsible for the safety and well-being of their Personnel (as defined in Section 2 of the Contract) and Third Parties affected by their activities under this contract, including appropriate security arrangements. The Evaluator is responsible for the provision of suitable security arrangements for their domestic and business property. DFID will share available information with the Evaluator on security status and developments in-country where appropriate.

The Evaluator is responsible for ensuring appropriate safety and security briefings for all of their Personnel working under this contract and ensuring that their Personnel register and receive briefing as outlined above. Travel advice is also available on the FCO website and the Evaluator must ensure they (and their Personnel) are up to date with the latest position.

The Evaluator has confirmed that:

- The Evaluator fully accepts responsibility for Security and Duty of Care.
- The Evaluator understands the potential risks and have the knowledge and experience to develop an effective risk plan.
- The Evaluator has the capability to manage their Duty of Care responsibilities throughout the life of the contract.

Annex C Topic guide

Once drafted, this topic guide was shared with Professor Laura Camfield from the University of East Anglia for external peer review, as well as with Vodafone, GSMA, PDA, IFPRI, and Gamos for their input. Following feedback received, IDS reworked the tools and presented them for discussion and refinement as part of a joint IDS–PDA researcher training workshop held on Monday 18 and Tuesday 19 March 2019 in Accra. The topic guides were piloted in a village in Agona East on 20 March. The pilot process allowed the team the opportunity to practice with and test the tools in a real-life context with existing VFC users who had signed up for the service as part of the quantitative baseline survey in April 2017. Afterwards the team debriefed together on their experiences and the issues raised by the pilot, and were given input and guidance from PDA and IDS staff who had observed the pilot activities. PDA's lead researcher was also available to provide continued guidance and support during the data collection. Collaboration with the IDS team was facilitated via a WhatsApp group.

Topic guide for in-depth interview with active VFC subscribers (who still engage with the service)

Purpose:

- Explore what motivates farmers to continue to engage
- Explore cycles of engagement
- Perceptions about the value of mobile phone-based information compared to other information sources
- Pathways of change: Translation of information into action
- Sharing of mobile phone-based information with peers

Sample: Smallholder farmers who are subscribed to VFC and who still engage with the service (selection will be done by IDS based on quant data)

Location: Household

Time for the interview: Approximately 60-75 minutes

Instructions:

- Ask the first two questions, then if it becomes clear that the person stopped using the service before October, use the questions in the section **Additional questions for non active VFC subscribers**
- If they have no idea about the service then probe them to ask if they ever received any Vodafone Farmer Club SMS messages or recorded messages and try and find out why they stopped using the service to find out

Thank the farmer for taking part in the study and explain that you are part of a research team.

Explain that her/his household signed up for Vodafone Farmers Club approximately two years ago. You know that they have recently been visited by a team of researchers who asked them questions about agriculture and Vodafone Farmers Club. Emphasise that you belong to the same team of researchers and would like to ask some further questions. Make it clear that you do not work for Vodafone or any other phone company but for a research organisation.

Explain that everything they say will be treated as confidential, will not be shared with other people in their village or household and that you will not use their real names. Explain to them that their participation is voluntary, and they can stop anytime and withdraw their data at any time.

Tell them that the discussion will take around 60-75 minutes and that you (and other note taker) would like to take notes and audio-record (so that you do not miss any information). Check that this is okay with them. Ask whether they have any questions.

No.	Questions	Prompts
1	How do you receive recorded voice messages with agri information or SMS with weather/market price information from VFC?	<ul style="list-style-type: none"> • Channel (own phone, somebody else's phone) • Fill in tracking sheet at this point? • Frequency – how often they get messages (how many times per week).
2	Which services of Vodafone Farmers' Club have you use? <ul style="list-style-type: none"> – Recorded voice messages with agri-tips and food tips? – SMS with weather information? – SMS with price information – Call centre to ask questions – Free calls to other VFC members 	<ul style="list-style-type: none"> • Are you using any of the services? Which ones? • Then ask them how often have you used this particular service?
3	What motivated you to continue using VFC services over the last 2 years?	<ul style="list-style-type: none"> • Were there periods when you did not engage with VFC? Why? What were these periods? E.g. times when they were busy with farming. • What period of time did you disengage/engage? When? • What made you start engaging again? Ask for internal and external factors which made them engage again? (Internal factors might be using the advice and it making a difference, external factors might be losing the phone, family issues) • Why did you disengage?
4	When you receive a recorded VFC voice messages or a VFC SMS how does it make you feel? Why?	<ul style="list-style-type: none"> • E.g. special, reduce loneliness, feel that his/her concern are validated • Annoyed, disturbed? • Why?
5	Do the VFC recorded voice messages/SMS messages change how you feel about Vodafone?	<ul style="list-style-type: none"> • Why? • Are you more likely to use Vodafone because of VFC? • Why/why not? • Exploring whether they trust any mobile phone networks.
6	In the last 2 years have you considered changing your mobile phone network?	<ul style="list-style-type: none"> • Why?

Say, you would now like to ask them a bit more about the SMS and recorded voice messages with agriculture and food tips that are part of Vodafone Farmers' Club.

7	In your opinion, were the SMS and recorded voice messages useful and/or appropriate?	<ul style="list-style-type: none"> • Messages were overall useful/not useful at all. Why? • What messages did you find particularly useful? For example, messages on: <ul style="list-style-type: none"> – The nutritional value of foods – How to preserve and store foods – Food hygiene and safety – Home gardening – Crop harvesting, seeding, weeding – Water management – Land preparation • Why? Can you give me an example of specific messages?
8	How is the information you receive through the voice messages/SMS different from agri/health information you receive through other channels, such as radio, agricultural extension workers other farmers? <u>Why?</u>	<ul style="list-style-type: none"> • Is it complementing other information sources or just repeating them? • Even if it's repeating information they've heard elsewhere, does this additional prompt make it more likely that they will follow the advice? • Do you verify the information you receive with agricultural extension workers?

Say, you would now like to ask them a bit more about the other Vodafone Farmers' Club services.

9	Have you used the other services that are part of Vodafone Farmers' Club? Were they useful? <u>Why?</u>	<ul style="list-style-type: none"> • Call centre (Have you ever tried to use it? How was it?) • Free calls to other Vodafone Farmers' Club members • Can you tell me more? and give examples for each
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<p><i>Say: you would now like to ask them whether they have tried anything/have done anything differently because of Vodafone Farmers' Club voice services.</i></p>		
10	<p>Have you ever followed the advice given in the recorded voice messages or SMS? Why/Why not? (ask for examples)</p>	<ul style="list-style-type: none"> • Did you do anything different in agriculture and nutrition? What did you try and what problems and barriers did you face? • <u>Why</u> did you decide to try the advice given? What motivated you? Was there anything that prompted you to change? • Have you heard the same information from a different source? How did this influence your decision to try and follow the advice? • <u>What were the barriers to acting on the advice in the messages?</u> <ul style="list-style-type: none"> ○ <u>Confidence</u>: It was too hard ○ <u>Knowledge</u>: Did you feel the message provided enough information about the issue? Why not? What did you do? (e.g. ask others, access other information sources) ○ <u>Social influences</u>: How did views/opinions/expectations of your husband/family/friends influence you? ○ <u>Money and time</u>: Did your personal circumstances influence you?
11	<p>Are mobile phone-based services better for providing information than other information sources (e.g. other farmers, agri-extension workers, radio)?</p>	<ul style="list-style-type: none"> • Do you think mobile phone- based information can be useful on its own? • Are you more likely to follow advice from other information sources (e.g. agricultural extension workers, other farmers, radio? Why?
12	<p>Have you shared any of the advice you got through VFC services with others? Why? What motivated you to share?</p>	<ul style="list-style-type: none"> • When the share this advice, do they let people know that they got the information from a mobile service? • Who do you share the advice with and how do you share it? • When you share advice, how does the other person perceive it? • Probe the barriers for sharing; <ul style="list-style-type: none"> ○ Do people worry about being seen as knowing too much? ○ Is it because they think the information should be private? ○ Are there gender barriers to sharing – so women not sharing information with men?

Thank you. Do you have any questions or comments about the service?