

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

Mobile phones, nutrition and agriculture in Ghana:
Initial exploratory qualitative study report

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Executive summary

The mNutrition intervention in Ghana

mNutrition is a five-year global initiative supported by the Department for International Development (DFID) since 2013, organised by GSM Association (GSMA), and implemented by in-country mobile network operators (MNOs) and third party providers to use mobile technology to improve the health and nutritional status of children and adults in low-income countries around the world. mNutrition is implemented through 14 mAgri and mHealth programmes in twelve countries throughout sub-Saharan Africa and South Asia. mNutrition has two major anticipated outcomes. The first is developing cost-effective, sustainable business models for mobile phone-enabled nutrition and agriculture services for one million households in Africa and Asia that can be replicated in other countries. The second is to promote behaviour change around key farming practices and dietary and child feeding practices that are likely to result in improved nutritional health within a household.

DFID has committed to conducting an independent evaluation of mNutrition. Given the budgetary limitations, the decision was made to select two countries for inclusion in the evaluation: the mHealth programme in Tanzania and mAgri programme in Ghana. The mNutrition intervention that is the focus of the evaluation in Ghana is the Vodafone Farmers' Club (VFC). The service is a 'bundled solution', offering agricultural and nutrition information in addition to voice and SMS services.

The main channels of content delivery are SMS (text messages) for weather and price information and voice messages for agriculture and nutrition information. While SMS is available in English, voice messages are available in ten local languages. The content for all agricultural messages is provided by Esoko Ghana, a mobile phone-based rural information service, with support from the Global Alliance for Improved Nutrition (GAIN), which has helped Esoko to develop production, processing and consumption messaging regarding 13 nutritious crops.

The VFC product is available only through a dedicated Farmers' Club SIM and is activated upon subscribing monthly to the service. VFC is available to farmers and people in the farming ecosystem, such as market women and input dealers in 71 districts of Ghana, although promotion and active subscription of farmers via VFC agents varies between regions.

Evaluation design

The aim of the impact evaluation is to assess the impact, cost-effectiveness and commercial viability of mNutrition. The evaluation is being conducted by a consortium of researchers from Gamos, the Institute of Development Studies (IDS) and the International Food Policy Research Institute (IFPRI). The team draws on a number of methods and interlinked components to gather evidence about the impact of the mNutrition intervention in Ghana, including:

- A **quantitative impact evaluation**, employing a randomised encouragement design to determine the causal effect of the programme on dietary diversity, agricultural income, and production. A household survey will be conducted at the start of the programme and two years later in treatment communities, which receive the encouragement in form of additional marketing and promotion; and control communities, which do not receive the encouragement but have still access to the mNutrition intervention.
- A **qualitative impact evaluation**, which consists 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) and 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 value-added service for the range of stakeholders involved.

Audience of the evaluation

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 mNutrition services), national governments (in particular the Ministry of Health and Agriculture), international agencies and donors, as well as community-level health and agriculture extension workers and the study communities.

This report

This report presents the thematic analysis of the findings from the initial exploratory qualitative study carried out between October and November 2016 in six purposefully selected communities where VFC will be implemented. The first qualitative data collection phase was designed as a rapid qualitative exploratory study, which allows contextual analysis of social, economic and environmental factors that may hinder or facilitate the uptake of the mNutrition intervention and its effectiveness in promoting behaviour change. The initial qualitative study focused on four thematic aims:

1. Access to, use of and attitudes towards and acceptability of mobile phone technology by male and female smallholder farmers;
2. Barriers to and facilitators of the potential uptake of mobile phone-based messages by female and male smallholder farmers;
3. Smallholder farmers' information needs and current information-seeking behaviours related to agriculture and nutrition;
4. Social, economic and environmental factors that may influence behaviour change related to agriculture and nutrition.

Gender and poverty are taken as cross-cutting issues to be considered across all four themes. Findings from this exploratory study will form an important basis for the more in-depth qualitative midline and the explanatory qualitative study after quantitative endline data collection.

The findings from the initial exploratory qualitative study will inform data collection and analysis of the quantitative baseline and first phase of business model/cost-effectiveness work. Findings from all three components will also be integrated in a mixed-method baseline report of the mNutrition impact evaluation in Ghana. Findings will also be shared with the mNutrition programme teams in Ghana as part of ongoing regular communications between evaluation and programme staff to support and inform programme decision-making. The report findings will also be presented and discussed as part of an upcoming 'Lessons Learned' stakeholder workshop which is planned to take place in Ghana with key external stakeholders in early 2018.

Methods

Multiple data collection tools were used including semi-structured in-depth interviews with farmers (IDI), key informant interviews (KIIs), expert interviews (EIs), community member interviews and focus group discussions (FGDs). In total 32 individual interviews and 12 FGDs were conducted.

The selection of the six communities was informed by the quantitative sample locations in order to provide insights into different geographic contexts. Three communities located in Central Region (CR) – Asara, Dolira, Soloba – and three in Upper West Region (UWR) – Foli, Nzoro, Tangoro – were purposefully selected¹. At community level participants were sampled to illustrate characteristics of different relevant sub-groups including vulnerable groups (i.e. male and female smallholder farmers, food crop subsistence and market-oriented agriculture, farmers with different levels of education). The selection of the participants was informed by an initial community-mapping exercise. The qualitative study is not intended to be representative or allow for generalisable conclusions, but to provide initial insights into multiple contextual factors. The qualitative sample for this contextual study is not a longitudinal sample and different from the samples that will be selected for the in-depth qualitative midline and explanatory follow-up study conducted after the quantitative endline survey.

Summary of key findings

Access, use and attitudes towards mobile phones

The majority of farming households in CR and UWR have access to a mobile phone and attitudes towards mobile phone technology were positive overall. However, mobile phones were predominately owned and controlled by men and women's access was limited. Reaching female farmers with the mNutrition intervention could be challenging and might depend on intra-household sharing of information.

Farmers are comfortable with the call function of mobile phones, but less familiar with other functions including SMS and voice messages. mNutrition voice messages might be an effective approach to inform farmers, as long as farmers know how to operate the voice message function on their mobile phone. Limited technical skills in operating the voice message function could mean that farmers miss mNutrition voice messages and/or do not know how to listen repeatedly to them. Subsequent qualitative rounds of the evaluation need to explore, in more depth, barriers to and facilitators of the uptake of voice messages.

Farmers frequently distrust MNOs, which might negatively affect the uptake of the mNutrition intervention if mNutrition is promoted as a Vodafone product or farmers associate it with Vodafone. Mobile network strength and stability is the main determining factor for the choice of network operator. Poor Vodafone network strengths and preference for a different provider with better network coverage might negatively affect subscription to or activation of VFC SIM cards in some communities.

Potential barriers to and facilitators of the uptake of mNutrition messages

Patchy network coverage, limited access to electricity (UWR) and power cuts could result in mNutrition messages being delayed or missed. Economic and logistical barriers to regular access

¹ For confidentiality, all identifying variables (such as village/community names, district capitals and other locations) have been replaced by pseudonyms.

to call credit (especially for female farmers) could result in deactivation of the subscription to the mNutrition packages (if new credit is not purchased within a specific time period).

Multiple SIM card use is common to capture best tariffs and network coverage. However, as dual SIM card phones are still rare, most farmers manually exchange SIM cards and could therefore easily miss the mNutrition messages.

High levels of illiteracy pose a barrier to all text-based information. Voice-based mNutrition messages could enable more farmers to gain access to information (as long as they understand the language the messages are provided in).

Information needs and information-seeking behaviour

Information on how to increase agricultural yields are a priority for poor farmers and mNutrition agriculture messages could address existing needs. On the other hand, farmers only identified a few information needs related to nutrition and uptake of nutrition messages might be less enthusiastic (especially among male farmers). Knowledge levels on infant and young child feeding (IYCF) practices were generally good, as information is delivered to all women within the context of antenatal care and monthly child growth monitoring. However, information around healthy food choices for adults (to support the energy levels during physical labour) during times of economic hardship and the dry seasons are needed.

Farmers' information needs are gender specific, with female farmers having less access to agricultural information due to limited social mobility, in addition to greater constraints in acting on this due to social, economic and environmental barriers. mNutrition might help to address some of the existing gaps (access to inputs, etc.).

Information needs varied by season and also by region. In CR, farmers identified information needs on the production of food crops, as most available information focused on cash crops and cocoa; whereas any type of agricultural information was welcomed in UWR, where existing agriculture extension services are patchier.

Information needs related to agricultural marketing strategies and market prices were highlighted by national experts, but were less of a priority for smallholder farmers, as the context of the local markets allowed limited flexibility and room for manoeuvre (e.g. fixed prices, over-supply of agricultural products due to limited storage) and farmers had their own sources of information.

Agriculture extension services are the most trusted source for agricultural information. However, access to agriculture extension services is limited due to staff shortages, long distances and poor transport links (UWR), social, economic and mobility barriers (for female farmers). Services can also lose farmers' trust rapidly if the advice given does not yield the expected results or is perceived as incorrect.

Information delivery channels that encourage active interaction and communication are preferred for both agriculture and nutrition information. Up-take of one-way information delivery via mNutrition messages might be limited and the interactive components of the service need to be promoted (e.g. call centre).

Social, economic and environmental factors that may influence behaviour change

Household poverty and low income might pose a substantial barrier to change in both agricultural and dietary practices, as farmers cannot afford to buy additional inputs or foods. mNutrition messages could potentially address this barrier if they focus on low- or no-cost inputs and foods.

The existing land tenure system in CR could pose a barrier to agricultural change, as farmers rely on land owners' approval for any changes. The unavailability of profitable markets for agricultural products in both CR and UWR could pose a barrier to the improvement of agricultural incomes, as agricultural products can only be sold at low or fixed prices.

Food insecurity, limited time for food preparation, limited participation of women in household decisions regarding food choices, food preferences and traditions and limited agricultural diversification may act as barriers to improvements in dietary diversity if not considered sufficiently in the mNutrition messages.

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List of abbreviations

CR	Central Region
DCD	District Coordinating Directors
EI	Expert Interview
FGD	Focus Group Discussion
GHS	Ghanaian Cedes
GAIN	Global Alliance for Improved Nutrition
GSMA	GSM Association
IDI	In-Depth Interview
IDS	Institute of Development Studies
IFPRI	International Food Policy Research Institute
KII	Key Informant Interview
MNO	Mobile Network Operator
MOFA	Ministry of Food and Agriculture
PDA	Participatory Development Associates
PHC	Population and Housing Census
SMS	Short Messaging Service
TAM	Technology Acceptance Model
UWR	Upper West Region
VFC	Vodafone Farmers' Club

1 Introduction

1.1 The mNutrition intervention in Ghana

mNutrition is a five-year global initiative supported by the Department for International Development (DFID) since 2013, organised by GSM Association (GSMA), and implemented by in-country mobile network operators (MNOs) and third party providers to use mobile technology to improve the health and nutritional status of children and adults in low-income countries around the world.

mNutrition has two major anticipated outcomes. The first is developing cost-effective, sustainable business models for mobile phone-enabled nutrition and agriculture services for one million households in Africa and Asia that can be replicated in other countries. The second is to promote behaviour change around key farming practices and dietary and child feeding practices that are likely to result in improved nutritional health within a household (see Annex A for GSMA's theory of change of mNutrition).

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. In addition to internal programme monitoring and evaluation (M&E) processes, DFID has committed to conducting a rigorous independent evaluation of mNutrition in order to generate high-quality evidence on the impact, cost-effectiveness and sustainability of mobile phone based advisory service in nutrition and agriculture.

mNutrition is implemented through 14 mAgri and mHealth programmes in a total of 12 countries throughout sub-Saharan Africa and South Asia. Given the budgetary limitations, the decision was made to select two countries for inclusion in the evaluation: the mHealth programme in Tanzania and mAgri programme in Ghana. The mNutrition programme that is the focus of the evaluation in Ghana is the Vodafone Farmers' Club (VFC). The service is a 'bundled solution', offering agricultural and nutrition information via voice and SMS services in addition to free calls to other Farmers' Club members. The value-added services components include:

- **Weather information:** Three SMS messages in English with local weather information per week
- **Market price information:** One SMS message in English with local market price information per week for a selected crop and selected market
- **Agri and nutrition tips:** One weekly recorded voice message in the selected local language with seasonal agricultural or nutrition tips (3 agri tips and 1 nutrition tip² per month) for the selected crop
- **Call centre:** Free access to a call centre with advice available from an agricultural expert
- **Free calls and SMS messaging** to other VFC members

² Negotiations to increase the number of nutrition messages from 1 to 3 messages a month are currently underway as of August 2017.

- **Discounted SMS and calls** to non-VFC members

In total, 20 messages per month are sent to the subscriber. The mode of content are SMS text messages for weather and price information and voice messages for agricultural tips and nutrition information. While SMS are in English, voice messages are available in ten local languages. Esoko Ghana, a mobile phone-based rural information service, develops and curates the agriculture message content and operates the platform to send tailored SMS and recorded voice messages to member farmers. Esoko also operates the farmer Call Centre.

Nutrition message content was developed by GAIN. GAIN created a large library of nutrition-sensitive agriculture messages and nutrition-specific tips designed to complement the agriculture messages provided by Esoko. GAIN created 312 crop-specific messages (13 messages per crop for 24 Esoko-supported crops) with nutrition information on topics including food preparation, food hygiene, safety and storage, and processing. GAIN also developed many general nutrition-specific tips as well as messages for 13 crops that are not yet part of the Esoko profile. Agri tips developed by Esoko cover recommended planting time and information on best practices for cultivation and harvest.

The VFC service is available through a dedicated Farmers' Club SIM and is activated upon subscribing monthly to the service. Current Vodafone members can also migrate their SIM to the VFC service. The subscription fee for the mNutrition packages was initially GHS 2 (GBP 0.34) per month. At first members had to initiate monthly payments using airtime credit on their phone. As a result of very low rates of monthly membership activation, the program was modified to automatically deduct GHS 2 from a member's airtime credit each month. If a member's credit fell below GHS 2, their membership status would become inactive until they loaded sufficient credit on their phone to cover the monthly subscription fee, which would be automatically deducted when the credit was loaded. From October 2016 to June 2017, the service was provided free in order to increase subscriptions. In June 2017 the monthly service fee was reinstated at GHS 0.5 (GBP 0.09).

The VFC service is designed to offer customized information to farmers based on their selected preferences. Initially, each new member was profiled by a Vodafone agent at the time of registration, indicating their preference of location for weather and market price information, their preferred language for receiving recorded voice messages, and their preferred crop choice for agricultural tips and price information. It became apparent that much of the profiling data was not being collected by agents at the time of SIM registration. As a result, Esoko and Vodafone modified their strategy so that all profiling would be done through a follow-up call to new members by the Farmers Club call centre after the SIM registration process was completed. However, when Vodafone suspended the monthly service fee and initiated a large push to increase the program member base, it became infeasible for Esoko to follow-up with each new VFC member individually. Instead, new members were given the default profile options based on their district of residence, receiving agri and nutrition tips on the crop most widely grown in that district. Farmers would need to contact the call centre themselves to request customized profile options.

VFC is available to farmers and people in the farming ecosystem, such as market women and input dealers in 71 districts of Ghana, although promotion and active subscription of farmers via VFC agents varies between regions.

1.2 Overview of the evaluation design

The evaluation of the mNutrition intervention is intended to measure the impact, cost-effectiveness and commercial viability of the service. The evaluation will address the following research questions as stated in the DFID Terms of Reference (TOR) (see Annex B):

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 of and changing the behaviour of the specific target groups (male and female smallholder farmers)?³
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 evaluation is being conducted by a consortium of researchers from Gamos, the Institute of Development Studies (IDS) and the International Food Policy Research Institute (IFPRI). The team draws on a number of methods and interlinked components to gather evidence about the impact of the mNutrition intervention in Ghana, including:

- A **quantitative impact evaluation**, employing a randomised encouragement design to determine the causal effect of the programme on increasing the knowledge and changing the behaviour of farmers related to agricultural practices and dietary behaviours. The quantitative evaluation will focus on the estimation of the impact on dietary diversity, agricultural income, and production. The quantitative team will conduct large-scale, statistically representative household surveys at the start of programme implementation and two years later (i.e. baseline and endline of the evaluation) in both the treatment communities, which receive the encouragement in form of additional marketing and promotion; and the control communities, which do not receive the encouragement but still have access to the mNutrition intervention. The quantitative evaluation will be conducted in two regions of Ghana: Central Region (CR) and Upper West Region (UWR).

³ There is no consensus on how best to define smallholder farming in Ghana and different approaches are in use based on landholding size (e.g. 1.25ha, 2ha, <5ha), wealth ranking or ownership of resources, vulnerability to risks or labour force contribution (Barnett and Srivastava 2017). In the initial exploratory qualitative study, smallholder farmers were defined based on landholding size (<2ha).

- A **qualitative impact evaluation**, which consists 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). The qualitative evaluation stream aims to provide understanding of the context within which mNutrition is embedded, and which might facilitate or hinder the uptake of the intervention. The qualitative impact evaluation also explores the underlying mechanism of change in response to the intervention and assesses implementation processes. Qualitative data collection will be conducted in a sub-sample of the quantitative communities in both CR and the UWR. Qualitative data collection will only be conducted in treatment communities in order to provide in-depth information on the effects of the intervention.
- A **business model and cost effectiveness evaluation** employing stakeholder interviews (from Vodafone, Airtel and other MNOs) commercial and end user data and document analysis and evidence from the quantitative and qualitative evaluation data to generate a business model framework and estimate the wider imputed benefits from the value-added service for the range of stakeholders involved. It will relate the model to the GSMA theory of change and consider the effectiveness of the customer journey, with a particular focus on commercial viability and sustainability of service delivery. This component will rely on ongoing mixed methods data collection, with two intensive phases of in-country data collection with key stakeholders in early 2017 and 2019.

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 mNutrition services), national governments (in particular the Ministry of Health and Agriculture), international agencies and donors, as well as community-level health and agriculture extension workers. Findings will be shared with GSMA through sharing of all draft and final reports, regular calls and email exchange, a newsletter and two stakeholder events planned per country. GSMA provided feedback on the initial drafts of this report and will receive a copy of the final report.

1.3 Purpose and scope of the initial exploratory qualitative study

This report presents the thematic analysis of the findings from the first qualitative data collection round carried out between October and November 2016 in six purposefully selected communities where VFC will be implemented. The selection of communities was informed by the quantitative sample locations in order to provide insights into different geographic contexts. Three communities located in CR – Asara, Dolira, Soloba – and three in UWR – Foli, Nzoro, Tangoro – were purposefully selected for this study (see section 2.4 for sampling strategy). Data collection was carried out by Participatory Development Associates (PDA) in close coordination with the IDS qualitative team led by Dr Inka Barnett.

The first qualitative data collection phase is designed as an initial exploratory qualitative study, which allows an initial contextual analysis of social, economic and environmental factors that may hinder or facilitate the uptake of the mNutrition intervention and its effectiveness in promoting behaviour change. In particular, this exploratory qualitative study aims to gain insights into the use and acceptability of mobile phones, barriers to and facilitators of the uptake of mobile phone-based messages, smallholder farmers' information needs related to agriculture and nutrition, and factors that may influence behaviour change. Findings from this study will form the basis for the design, tool development and analysis of the qualitative midline case studies. The midline aims to investigate how and why the VFC intervention triggers (or not) behaviour change related to agricultural practices and nutrition.. Another aim of the first qualitative data collection phase is to inform the development of the quantitative baseline survey and here, in particular, the encouragement strategy employed in the treatment communities.

The findings from the initial exploratory qualitative study will be combined and triangulated with the quantitative baseline and business model/cost-effectiveness study in a workshop planned for December 2017. The two-day workshop will inform the development of the integrated mixed methods baseline report of the mNutrition impact evaluation in Ghana (see Annex C for a timeline of the qualitative, quantitative and business components of the impact evaluation). Findings will also be shared with the mNutrition programme teams in Ghana as part of ongoing regular communications between evaluation and programme staff to support and inform programme decision-making. The report findings will also be presented and discussed as part of an upcoming 'Lessons Learned' stakeholder workshop which is planned to take place in Ghana with key external stakeholders in early 2018.

1.4 Organisation of the report

After the description of the methodology in section 2, a brief overview of the profiles of the six communities selected for the qualitative data collection will follow in section 3. This section highlights, in particular, differences in agricultural contexts that may be relevant for the uptake and effectiveness of the mNutrition interventions and sets the context of the larger quantitative sample. Section 4 presents the thematic findings of the analysis structured around the four aims of the initial exploratory qualitative study (see the following section 2.1). For each aim, potential implications of the findings for the uptake and effectiveness of mNutrition, as well as for the evaluation design, are presented. Section 5 draws together the findings in a conclusion.

2 Methodology

2.1 Aims of the initial exploratory qualitative study

The initial exploratory qualitative study focuses on four thematic aims:

1. Access to, use of and attitudes towards and acceptability of mobile phone technology by male and female smallholder farmers;
2. Barriers to and facilitators of the potential uptake of mobile-phone based messages by female and male smallholder farmers;
3. Smallholder farmers' information needs and current information-seeking behaviours related to agriculture and nutrition;
4. Social, economic and environmental factors that may influence behaviour change related to agriculture and nutrition.

Gender and poverty are taken as cross-cutting issues to be considered across all four themes.

The qualitative evaluation component is closely integrated with the quantitative and business model/cost-effectiveness evaluations at all stages of the evaluation to inform, enhance and triangulate the design, data collection and analysis within the overall mixed methods design framework. This initial exploratory study aims to inform the quantitative baseline survey, the analysis and the encouragement approach chosen. The study data also informs, complements and enhances the business model analysis and data collection.⁴

The sequence of the initial exploratory qualitative study, midline case studies and explanatory qualitative follow-up study will, in combination, help to address the following research objectives stated in the DFID TOR (see Annex B) and the specific objectives of GSMA:

- What factors make mobile phone-based services effective in promoting and achieving behaviour change (if observed) leading to improved nutrition and livelihood outcomes?
- 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 contexts?
- 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?

⁴ Please see the first business report: Batchelor, S., Scott, N and Sharp, J. (2017, forthcoming) External evaluation of mobile phone technology based nutrition and agriculture advisory services in Africa and South Asia: Mobile phones, nutrition and agriculture in Ghana: Business Modelling Baseline Report' for details.

2.1.1 Access to, use of and attitude towards and acceptability of mobile phone technology

Under the first aim, this exploratory study seeks to understand smallholder farmers' access to and use of mobile phone technology. Particular attention is thereby paid to women's' access to mobile phones, the practices of mobile phone sharing (i.e. allowing another person or family member to use one's mobile phone for communication purposes), everyday uses of mobile phones (e.g. for business, social interaction, emergencies), which technical functions are used most and which ones least. This exploratory study also explores farmers' attitudes towards mobile phones in general (e.g. how useful they perceive mobile phones to be in rural life), MNOs and factors farmers consider when selecting an MNO.

2.1.2 Barriers to and facilitators of the uptake of mobile-phone based messages

Under the second aim, barriers to and facilitators of the reception and uptake of mobile phone-based messages are investigated from a technological perspective and from the perspective of the farmer. The technological assessment includes questions on access to electricity, network coverage and stability, hardware issues, mobile phone credit and behaviours and practices related to the use of SIM cards. To gain in-depth understanding of farmers' perspectives on mobile phones, this qualitative exploratory study draws on the widely used Technology Acceptance Model (TAM) (Venkatesh and Davis 2000; Venkatesh and Bala 2008). Informed by the TAM, perceived ease of use, self-efficacy and control over mobile phone technology, and perceived usefulness of mobile phone based information are explored.

2.1.3 Farmers' information needs and current information-seeking behaviours

Under the third aim, this initial exploratory qualitative study explores existing information gaps and needs related to agriculture and nutrition. Information needs are investigated from the point of view of the farmers (male vs female, mainly cash crop vs mainly food crop subsistence farming) as well as from the perspective of national knowledge experts. Farmers' current information-seeking behaviours will be explored by asking questions around what kinds of information are currently available in the community, which information providers farmers trust and why, which channels and delivery modes for information they prefer, and what barriers farmers face when attempting to access information. Particular attention is paid to female farmers' information needs and gender-specific barriers to accessing and sharing information.

2.1.4 Social, economic and environmental factors that may influence behaviour change

Under the fourth aim, barriers to and facilitators of behaviour change are investigated for agriculture- and nutrition-related behaviours separately. The focus is on social (e.g. traditions, culture, gender norms including female participation in decision-making), economic (e.g. challenges related to access to agricultural inputs or nutritious, fresh food) and environmental (e.g. access to water, soil quality, land) factors.

2.2 Data collection methods

Multiple data collection tools are being used to obtain qualitative data from different sources and perspectives. The use of different data sources is important to allow for triangulation of different qualitative findings. The main data collection tools are semi-structured in-depth interviews with farmers (IDIs), key informant interviews (KIIs), expert interviews (EI), and community member interviews and focus group discussions (FGDs) – the different categories are described below in Table 2.2.

Table 2.2: Data collection tools for initial exploratory qualitative study by region and community

Tools	Central Region District 1			Upper West Region District 2			National	TOTAL
	Asara	Dolira	Soloba	Foli	Nzoro	Tangoro		
Individual interviews								
In-depth interviews with farmers	2	2	2	2	2	2	NA	12
Key informant interviews (local)	3	3	3	2	2	2	NA	15
Key informant interviews (national)	NA	NA	NA	NA	NA	NA	2	2
Expert interviews (national)	NA	NA	NA	NA	NA	NA	3	3
Total IDIs	5	5	5	4	4	4	5	32
Focus group discussions								
Farmers with phone	1 (male)	1 (female)	1 (male)	1 (male)	1 (male)	1 (female)	NA	6
Community members with phone	1 (female)	1 (female)	1 (female)	1 (female)	1 (female)	1 (male)	NA	6
Total FGDs	2	2	2	2	2	2	0	12

In-depth interviews – these were conducted with female and male smallholder farmers who owned or had regular access to a mobile phone. Smallholder farmers were defined as male and female farmers who have their own or work on farms of up to 2ha. Interviews were guided by a semi-structured topic guide to ensure that similar ground was covered in each interview. All IDIs were conducted by two team members to provide complementary insights, check for consistency and ensure accuracy. The interviews were audio-recorded (after receiving prior written/oral consent) and notes were taken during the interview. Given the gendered hierarchies and male-dominated tenure system in Ghana, the research team ensured female farmers' voices were adequately represented.

Key informant interviews – these were conducted locally and nationally. Local KIIs were carried out with influential people in the community including community chiefs, agriculture extension workers, health workers and local mobile phone agents (see Table 2.4 for details). Interviews were conducted by two team members, guided by a semi-structured interview schedule and audio-recorded with interviewees' consent. National KIIs were carried out with staff members of leading MNOs (namely Vodafone, MTN and Airtel).

Expert interviews – these were conducted with one national and two international experts on agriculture and nutrition in Ghana to triangulate the findings collected with the other tools and to set the sub-national findings into context. EIs were guided by a topic guide, audio-recorded and conducted by a post-doctoral researcher based at IDS.

Focus group discussions – these were carried out with 7-11 smallholder farmers each. FGDs were conducted with homogeneous groups of male or female farmers (one per community) but represented a diversity of respondents, including subsistence farmers and market-oriented farmers or mixed (food and cash crops). FGDs were also conducted with male and female community members (one per community) to gain insights into dietary practices and patterns in the communities and also to ensure that concerns of women are adequately represented. All FGDs were facilitated by two team members and discussions were recorded and detailed notes taken. A topic guide guided the discussion and provided sufficient flexibility to allow the participants to raise and discuss matters that they felt were relevant and important.

Initially the team had difficulties recruiting female smallholder farmers for the FGDs because women often faced multiple demands on their time given their responsibilities around farming, household duties and child care. In order to address this issue, the team offered alternative times during the day for conducting the FGDs (e.g. early in the morning, during a break from farm work, in the evening) to offer flexibility to the female farmers. Thanks to these changes they were able to conduct all-female farmer FGDs that revealed different challenges faced by men and women related to agricultural activities.

Development and pilot-testing of tools

The qualitative data collection was conducted by Participatory Development Associates (PDA) in Ghana in close collaboration with IDS. IDS drafted the data collection tools that were informed by the desk review (Barnett and Srivastava 2017) and the landscaping analysis (Barnett, Scott, Batchelor and Haddad 2016) conducted in the initial stages of the evaluation. The purpose of the desk review was to inform the evaluation design and the development of the data collection tools in Ghana. The review focused on the primary outcomes of the impact evaluation (i.e. to assess the impact of mNutrition on income, productivity and dietary diversity of smallholder farmers). The specific aims of the review were to summarise existing evidence on: 1) characteristics of smallholder agriculture in Ghana (with a specific focus on agriculture production and income); 2) determinants of dietary intake in rural Ghana; and 3) the use of mobile phones for agriculture in Ghana (with a specific focus on factors that may influence uptake of mobile phone-based information). The purpose of the landscaping analysis was to assist the evaluation team to understand the landscape it is operating in, so that it can choose a context-specific evaluation design that stands the greatest chance of finding answers rigorously. The landscaping review summarises what we know about behaviour change in nutrition and agriculture, explores evidence on the role of mobile phones in nutrition- and agriculture-related behaviour change, and surveys the wider mobile technology and m-development landscape.

The data collection topic guides and interview schedules were then extensively reviewed, discussed and refined during a two-day IDS/PDA training workshop with all field researchers in Accra on 18 and 19 October 2016. The workshop consisted of detailed discussions of every question and prompts and the sampling approach. Modification of and additions to questions and the order of questions were made with the team during the workshop. The team also tested the topic guides in role plays to gain experience with the guides prior to going to the field. This was followed by pilot-testing of the tools in a village in the Eastern Region of Ghana on 20 October, 2016. The tools were tested on female and male farmers who are part of the agricultural value chain improvement project. Following the pilot, the topic guides were further edited, and the

language simplified and translated into Twi and Dagaare from English by the IDS/PDA team. The final set of topic guides are attached as Annex D.

2.3 Data collection implementation

The data collection was conducted by two PDA teams working in parallel in the CR and UWR between 20 and 29 October. The teams spent approximately 2–3 days in each community including travel time. Each team consisted of three field researchers including a team leader. Each team included a female researcher to ensure that interviews with female farmers could be conducted with ease. There was also at least one researcher in each team who was native of the selected region and could speak the local language and was familiar with local customs. While interviews and FGDs in CR were conducted in Twi, in UWR Twi was mainly used for FGDs and occasionally Dagaare. This facilitated entry into the community and communication with community members. A detailed data collection manual was prepared by the IDS and PDA team to support the data collection, to ensure consistency and quality of the data collection process, and ensure that ethical standards were adequately met.

The field teams did community entry at two levels: district and community. Introductory letters about the evaluation were sent to district administration heads of the selected districts – district coordinating directors (DCDs). Through this initial approach, contact was then established with the agriculture extension officers of the relevant districts. Community entries were done primarily via the village chiefs/assembly members of the electoral areas within which the selected communities were located. These individuals also acted as the ‘focal person’ for community entry and facilitated the mobilisation of individuals for FGDs and IDIs. Once key informants and other interview participants had been mapped out with the assistance of the DCDs and focal person(s), and participants had been purposefully selected, the team leader from each district established direct contact either by phone or a household visit to introduce and discuss the evaluation aims with them.

Each team discussed their findings extensively in debriefing sessions that were organised each evening after the data collection. The lead researcher joined the debriefing sessions via telephone whenever possible. The lead researcher also visited each team during the data collection to discuss emerging findings and challenges and to ensure that all data collection tools and the data collection manual were being followed.

2.4 Sampling strategy

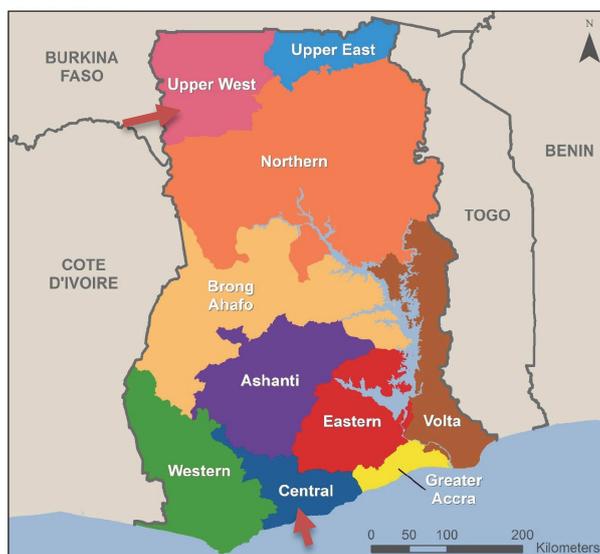
2.4.1 Community selection

Selection of sites for the evaluation

The sample selection for the initial exploratory qualitative study was purposive and closely linked to the quantitative sample selection. Since the overarching aim of the evaluation study is to assess the impact of VFC it was important that the evaluation sites had good Vodafone network

connectivity. Based on the list provided to the evaluation team by Vodafone-Ghana,⁵ UWR and CR (see Figure 2.1) were selected for the evaluation. As per the information provided by Vodafone, both these regions have low levels of marketing activities for VFC.

Figure 2.1: Regional Map of Ghana



Source: DHS et al. (2015)

District and community selection

The selection of districts for the qualitative exploratory study was a purposefully selected sub-sample of the quantitative sample selection.⁶ The selection was informed by key selection criteria including poverty rates, undernutrition prevalence and agriculture activities, and also discussed with local experts from CR and UWR. The aim was to get a diverse sample that would provide insights into multiple contexts within which the mNutrition product will be embedded, and which might be expected to affect the implementation and outcomes of the intervention. The sample is not designed to be representative of CR and UWR as a whole, and it is therefore impossible to draw generalisations or wider inferences from the qualitative evaluation stream alone.

Two districts and three communities within each district were purposefully selected to offer insights into a variety of different contexts and geographical settings (dry savannah vs rainforest, cocoa farming vs food crop subsistence farming). Based on both selection criteria, District 1 from CR (mainly cocoa farmers and mixed farming), where farmers have limited control over the land due to the existing land tenure system (see section 3), and District 2 from UWR (mainly food crop/subsistence farmers) were selected.

The purposive selection of the six communities (i.e. three communities in each district) was carried out jointly by the field research teams, the research leader and IDS based on the following criteria:

⁵ In CR: Abura/Asebu/Kwamankese; Agona East Municipality, Agona West, Ajumako/Enyan/Esiyam; Assin North; Assin South; Awutu/Senya; Cape Coast and Effutu Municipal. In UWR: Jirapa Lambussie, Lambussie-Karni, Lawra, Nadowli, Sawla/Tuna/Kalba, Sissala East, Sissala West, Wa East, Wa West and Bole.

⁶ At the time of the qualitative initial exploratory study the planning of the quantitative baseline, including the quantitative census, was still in progress. Nevertheless, the quantitative team had made some initial selections that were used to select the qualitative sites.

1. The community must be a farming community (i.e. the majority of inhabitants must be farmers);
2. The community must have a good Vodafone network reception (i.e. the network is largely available in most parts of the community), which was checked by the field researchers with a mobile phone; and
3. The community must not lie on the same stretch of road from the district capital as any of the other communities selected to ensure diversity across the three selected communities per region (e.g. with regards to access to services and markets).

As the quantitative baseline had to be delayed due to the start of the rainy season in November 2016, which would have made travelling to the quantitative communities logistically impossible, the qualitative sampling of communities and participant selection had to be done before the quantitative listing had been conducted and before the final survey sample was known. While the quantitative team had selected regions and districts for the quantitative data collection, communities had not been chosen yet. Therefore, the final sample included a combination of communities that were included in the survey and those that were not.⁷ This combination helped to reduce the burden on the quantitative communities, but will still allow us to gain insights into factors that may influence the up-take of VFC in the same context.. Table 2.3 below presents the six selected communities for the initial exploratory qualitative sampling.

Table 2.3: Villages selected for data collection for each region as per sampling criteria

Region/ district	Central Region District 1			Upper West Region District 2		
	Villages	Asara	Dolira	Solaba	Foli	Nzoro
Primary occupation	Farming (cash crops and food crops)	Farming (cash crops and food crops)	Farming (cash crops and food crops)	Farming (food and cash crops) and livestock-rearing	Farming (food crops) and livestock-rearing	Farming (food crops) and livestock-rearing
Mobile connectivity	Vodafone, MTN, Tigo and Airtel	Vodafone and MTN	Vodafone, MTN and Airtel	Vodafone, MTN and Airtel	Vodafone and MTN	Vodafone, MTN and Airtel
Access to services (roads and electricity)	Reasonable road connectivity and electricity access	Reasonable road connectivity and electricity access	Reasonable road connectivity and electricity access	Poor road connectivity and no electricity access	Poor road connectivity and no electricity access	Reasonable road connectivity but no electricity access

⁷ It should be noted that the qualitative sample communities for the qualitative midline and the explanatory follow-up data collection will be purposive selected from the quantitative sample. We do not plan a longitudinal qualitative evaluation.

The size of the qualitative sample (six communities) was based on judgement of the maximum coverage possible for the initial exploratory qualitative study, given the available time and budget for the qualitative evaluation.

2.4.2 Participant selection

At the community level participants were purposefully sampled to: (1) illustrate characteristics of different relevant sub-groups (i.e. male and female smallholder farmers, food crop subsistence farming only and pre-dominantly market oriented agriculture, farmers with different levels of education); (2) allow understanding of the contextual issues that may affect the products in different settings; and (3) ensure adequate representation of poor/subsistence farmers and voices of female farmers. The selection of the participants was informed by the initial community-mapping exercise that the field teams conducted for each community in collaboration with the DCDs and focal person(s).

In each of the six communities, two smallholder farmers (one male and one female) were recruited for in-depth interviews making 12 in-depth interviews in total. The farmers had to: (1) own or have access to a mobile phone; (2) have access to farmland or work on a family farm; and (3) have children or live with children in the same household. As noted above, it was impossible to purposefully select the participants based on the quantitative listing as it had not been carried out at the time as the qualitative data collection. Nevertheless, we are confident that the selected qualitative sample generated through community mapping with focal persons, presents a variety of experiences with smallholder farming and allows in-depth insights into contextual issues relevant for the uptake of the mNutrition intervention (see Table 2.4 below).

Table 2.4: In-depth interviews with smallholder farmers and characteristics

IDI number	Community	Characteristics of farmers
Central Region		
1	Soloba	Female, farmer, completed class 3 ^a , mainly subsistence, 4 children
2	Soloba	Male, farmer/construction worker, completed class 4, subsistence/market-oriented farming, 2 children
3	Asara	Female, farmer, completed primary school, subsistence/market-oriented farming, 2 children
4	Asara	Male, farmer, completed primary school, mainly market-oriented farming, 4 children
5	Dolira	Female, farmer/trader, completed primary school, mainly market-oriented farming, 5 children
6	Dolira	Male, farmer/village chief, middle school, subsistence/market-oriented farming, 2 children
Upper West Region		
1	Nzoro	Female, farmer, no education, mainly subsistence farming, 8 children
2	Nzoro	Male farmer, completed primary education, subsistence/market-oriented farming, 5 children
3	Foli	Female, farmer, no education, mainly subsistence farming, 6 children
4	Foli	Male, farmer, no education, mainly subsistence farming, 4 children
5	Tangoro	Female, farmer, completed primary school, mainly subsistence farming, 5 children
6	Tangoro	Male, farmer/carpenter, completed polytechnic school, mainly subsistence farming, 5 children

^a meaning three years of primary school have been completed.

Key informants are people presumed to have more specialist knowledge or authority on the issue being researched. Key informants were selected based on the objectives of the exploratory qualitative study and included village chiefs (or their representatives), prominent influential figures

in the community such as school heads, local health workers, agriculture extension officers and local mobile phone agents. In total, 15 local KIIs were conducted. Table 2.5 shows a summary of KIIs that were conducted and the communities.

Table 2.5: Local key informant interviews

KII number	Community	Characteristics of farmers
Central Region		
1	Asara	Agriculture extension officer
2	Asara	Health worker
3	Asara	Village chief
4	Dolira	Mobile phone agent
5	Dolira	Language teacher
6	Dolira	Agriculture extension worker
7	Soloba	Agriculture extension officer
8	Soloba	Representative of village chief
9	Soloba	Headteacher
Upper West Region		
1	Foli	Village chief
2	Foli	Female lead figure
3	Nzoro	Agriculture extension officer
4	Nzoro	Health worker
5	Tangoro	Health volunteer
6	Tangoro	Mobile agent

Also, two KIIs were conducted with representatives from the two leading MNOs (Vodafone and MTN) and three EIs with academics whose research focuses on agriculture and the agriculture-nutrition links in Ghana.

In each of the communities, one FGD with farmers who had access to a mobile phone was conducted. FGDs involved 7–11 homogeneous (with regards to gender and dominant farming system) smallholder farmers from the same community. FGDs were conducted separately for male and female farmers as challenges faced by each group were anticipated to differ (e.g. given the land tenure systems that make it difficult for women to own land) (Barnett and Srivastava 2017). In all, six FGDs (one in each community) were conducted.

Additionally, one FGD with community members was carried out in each community (five female-only FGDs and one male only). FGDs varied depending on the age of the participants, but most of them were involved in farming activities. This translated into six FGDs (one per community). In total, 12 FGDs) were conducted in the six communities (Table 2.6).

Table 2.6: Focus group discussions with farmers and community members and their characteristics

FGD number	Community	Characteristics of farmers
Central Region		
1	Asara	10 male farmers, mainly cocoa production, some subsistence farming, most are fathers, varied in age
2	Asara	8 female farmers, mainly subsistence farming, some do not have children yet, varied in age
3	Dolira	7 female farmers, subsistence/market-oriented agriculture, all are mothers, varied in age
4	Dolira	10 female farmers, mainly subsistence farming, all are mothers, varied in age
5	Soloba	10 male farmers, mainly cocoa production, some subsistence farming, most are fathers, varied in age
6	Soloba	7 female farmers, 4 female farmers/traders, mainly subsistence farming, all mothers, varied in age

Upper West Region		
1	Foli	10 male farmers, mainly subsistence farming, most are fathers, varied in age
2	Foli	10 female farmers, mainly subsistence farming, some do not have children yet, varied in age
3	Nzoro	11 male farmers, mainly subsistence farming, all are fathers, varied in age
4	Nzoro	7 female farmers, mainly subsistence farming, all mothers, varied in age
5	Tangoro	10 female farmers, subsistence farming, all are mothers, varied in age
6	Tangoro	10 male community members, all are farmers, mainly subsistence farming, all are fathers, varied in age

2.5 Data management and analysis

A debriefing workshop for the PDA qualitative field team was conducted immediately after the end of the data collection (30–31 October 2016 at PDA in Accra). The aim of the workshop was to discuss the data collection experience and challenges encountered, and to discuss and synthesise preliminary findings in relation to the four themes of the initial exploratory qualitative study. All interviews and discussions conducted during the data collection were transcribed by the field researcher using the audio-recordings and notes. All transcripts were cross-checked by the research lead and translated into English by a translator based in Accra.

Data analysis was conducted by the IDS qualitative team led by Principal Investigator Dr Inka Barnett in close collaboration and constant communication with the research lead of the PDA team. The qualitative data were analysed using a directed content analysis approach focused on the main qualitative evaluation questions (Patton 2008). Data analysis started with open coding of several interview transcripts using the qualitative data analysis software (NVivo). Open coding means that the transcripts were read several times and then initial codes were created to summarise and categorise the findings. Based on this an initial coding scheme that guided the coding of the remaining data was developed. To increase the rigour of the data analysis, coding was done by two researchers independently and coding schemes were then discussed and modified into a joint scheme (see Annex E for the coding scheme). While the coding scheme guided the coding, it was flexible enough to allow for unforeseen topics that emerged to be added at any point. After preliminary coding, transcripts were recoded for additional information and emerging themes. Initial analysis results as well as the final report were shared with the field team and lead researcher in Ghana to ensure the IDS team interpreted the findings correctly and to provide additional details that were necessary. For example, the PDA team provided additional information on the types of mobile phones farmers use, details on the purchase of mobile phone credit and poverty across the six communities.

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) which includes the processing and storage of any sensitive personal data and 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. In order to promote use and uptake of the evaluation findings and in line with DFID's Enhance and Open Access Policy, the evaluation team is committed to ensuring all major report outputs and associated data generated from this project are made publicly available in an accessible format.

2.6 Ethical considerations and approval

As an overall guiding principle, the research team sought to conduct itself in a professional and ethical manner throughout the data collection and analysis phase, with strict respect for principles of integrity, honesty, confidentiality, voluntary participation, impartiality and the avoidance of personal risk. These principles were informed by the OECD (2010) DAC Quality Standards for Development Evaluation and DFID's (2011) 'Ethics Principles for Research and Evaluation' which will be followed for the duration of the evaluation.

National-level ethical approval for the initial exploratory qualitative study was obtained from the Ethics Committee for the Humanities (ECH) of the Institute of Statistical, Social and Economic Research (ISSER) based at the University of Ghana in October 2016 (prior to the start of the data collection). Ethical approval was also sought from the IDS ethics board and was obtained in September 2016.

The research was perceived as low risk by both ethic committees because the content generated was not sensitive and did not include particularly vulnerable groups (e.g. children) and it was not intrusive (e.g. no anthropometry or blood sample collection).

Written and oral (where respondents could not read and write) informed consent was collected from all research participants prior to the start of the interview. All individuals were anonymised during the data analysis. The entire PDA field team was trained on ethical data collection and signed an ethical conduct form prior to the start of the data collection. Participants did not receive any reward or compensation for their participation in the interviews. Interviews were kept short and we do not believe that they were perceived as a burden by the participants that may have affected their responses.

For confidentiality, all identifying variables (such as village/community names, district capitals and other locations) have been replaced by pseudonyms.

All files with raw and analysed data are securely stored in password-protected databases. Access to the data is restricted to the evaluation team.

2.7 Limitations

There are several methodological limitations that need to be considered. First, the sampling of the districts, communities and participants was purposive and might have introduced some selection bias. For example, participants who agreed to be interviewed might have been more interested in mobile phone technology as a means of improving agricultural practices. In addition, help was enlisted from key community members who acted as gatekeepers for community entry. This may have led to selection bias. However, the team did its best to be as objective as possible during the sampling, using data available and conducting a comprehensive initial mapping of the community, to minimise selection bias, while capturing a variety of contextual settings that are likely to influence the uptake of the mNutrition intervention, and impressing upon the focal person the need to be as inclusive as possible.

Second, the aim of this initial exploratory qualitative study was to gain initial insights into contextual factors that may affect the uptake of the mNutrition intervention. Time and budget allocated to this initial qualitative data collection were relatively small. This made it necessary for the team to restrict the number of communities that could be visited and also influenced the approach chosen to select the participants (e.g. with the help of focal persons in the community). Naturally,

this limits the conclusions that can be drawn. However, the qualitative sample is not intended to be representative or allow for generalisable conclusions, but provide insights into multiple contextual factors. This limitation is also mitigated by the fact that the qualitative evaluation forms part of a wider mixed-methods evaluation that will continue to draw on the other evaluation components in order to triangulate and compare accuracy and completeness of data, and to help formulate the design of future data collection tools (both qualitative and quantitative) and analysis for the remainder of the evaluation. It should also be highlighted that this initial exploratory qualitative study is also very different from the in-depth qualitative work planned for the midline, which will use a larger sample that will be independently drawn from the quantitative sample.

Third, all interviews were conducted by a team of young educated field researchers who live in Accra. The characteristics of the field team might have affected the participants' comfort and ease when answering questions (e.g. introducing social desirability bias). However, both teams were very experienced, included team members who spoke local languages (Twi and Fante), were familiar with local customs and dressed according to local customs. All of these helped to make the participants feel at ease during interviews.

Fourth, as already highlighted above it was challenging for the field team to recruit female farmers for FGDs, the reason being that most rural women had extremely busy daily routines and could not find time to participate in the data collection. The team successfully addressed this challenge by offering alternative time slots for the data collection (e.g. very early in the morning) and also involved the community focal person to generate more interest among female farmers in the participation in the research. This is not expected to affect data quality.

Fifth, data collection was done before the onset of the rainy season in Ghana and seasonality is a strong factor that may affect the nature of responses from farmers (e.g. in terms of foods they consume, issues around food security, access to markets and services, and how farmers' information needs may vary according to the cropping season). This limitation is recognised and the midline and qualitative follow-up study (planned after the quantitative endline survey) will be designed to take into account seasonal differences. Moreover, since the quantitative survey was done after the exploratory qualitative study, some changes will be captured and cross-verified through that data for future data collection rounds.

3 Community profiles

This section provides a brief description of the six communities selected for the initial exploratory qualitative study. The description focuses on features and characteristics of each community that might be relevant with regards to the uptake and effectiveness of the mNutrition intervention. As highlighted in section 2, the communities were purposefully selected to allow insights into different geographical contexts within which the intervention will be embedded. The communities were selected on the basis of farming (mixed, market oriented or food crop subsistence) as well as different agro-climatic conditions (rain forest in CR and dry savannah in UWR). The community profiles were developed based on the observations and questions of the field teams and complemented by information from literature sources if available.

3.1 Communities in Central Region

Three farming communities were chosen in CR. Mixed farming is practised in most of the communities, as farmers grow cash crops (cocoa or rubber) alongside food crop subsistence farming. Vodafone and MTN network connections are available in all three communities. In CR, most farmers do not own their land and have no or limited control over what they plant due to existing land tenure systems.⁸ Community chiefs play an important role in these tenure arrangements and in some communities land is allocated through the chiefs. Though proceeds from cocoa cultivation need to be shared with the landowner, food crops are not necessarily shared with the owner.

3.1.1 Soloba

Soloba is about 50 minutes' drive from the district capital and has a population of about 600 people. There are three Christian denominations, namely Methodist, Pentecost and Charismatic. The inhabitants are mainly migrants from CR or Eastern Region who migrated to work on cocoa farms. Soloba has two rainy seasons per year – one from May to August and the other from September to October. Planting of crops is done in January and October.

Cocoa farming is the main occupation. Subsistence farming of food crops such as cassava, plantain, maize, cocoyam, tomatoes, pepper and a special type of yam called *cocoase bayire* is also practised in the community. The cocoa farms are mainly located about one and a half miles from the village centre. Other economic activities in the community are food vending and small-scale trading.

There are a primary school and junior high school in the community. Soloba has mobile network connections for MTN, Vodafone and Airtel, although the strength and stability of the connections varies.

⁸ There are two tenure systems: *Abusa* refers to the sharing of farm produce between the landlord and the tenant on equal basis. The land always remains the property of the landlord. It is the most common land tenure system in Ghana. In the *Abunu* system, the tenant cultivates a tract of land, usually planting cash crops. The farm is divided into three equal parts. One-third is given to the tenant.

3.1.2 Asara

Asara is about 30 minutes' drive from the district capital. The community, which has around 700 inhabitants, is ruled by a headman (*Odikro*) who serves as a link between the Kuntanese chief, the land owners and the settlers. The residents migrated from Gomoa and Ekumfi to farm the land, which belongs to the Kuntanese chief. The residents are mainly Christians, Muslims and Animists.

The main occupation of the people is farming and some women are also traders. The major crops grown are cocoa, cassava, plantain, cocoyam and maize. There are two rainy seasons, from May to August and from September to October, and two main farming seasons for food crops.

The community has a primary school and junior high school. Mobile network connections available are MTN, Vodafone, Tigo and Airtel, although the strengths and stability of connections vary.

3.1.3 Dolira

Dolira is a farming community with a population of about 550 people. The land is owned by the chief, but there is a headman (*Odikro*), who is the official caretaker of the community. Christianity and Islam are the predominant religions in the community.

The main crops that are cultivated in the community include cocoa, maize, cassava, tomatoes, pepper, coconut and palm plant. Farmers usually clear their lands in January and wait for the rains to begin planting food crops.

There is a primary school in the community. Mobile networks available are MTN and Vodafone.

3.2 Communities in Upper West Region

Three farming communities were purposefully selected in the UWR. 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.

3.2.1 Nzoro

Nzoro is a farming community and is about 40km from the district capital. There are about 5,000 people in the community; the main ethnic group is Dagaarti and the main language of the community is Dagaare. Christianity is the predominant religion of the region followed by Islam and the traditional religion. The chief, *Tendana*, is the supreme authority followed by sectional leaders who are family heads.

The main source of livelihood is agriculture. Farmers usually grow food crops, mostly grains, legumes and some vegetables. Most households also practice animal-rearing as an additional income source. Farmers practise rain-fed agriculture, but rainfall patterns are erratic, which creates challenges for agriculture and livestock-rearing (lack of fodder and onset of diseases).

The community has one school (up to junior high school) and a community health centre that also serves five adjoining communities. Predominant mobile networks are Vodafone and MTN.

3.2.2 Foli

Foli is about 41.5km from the district capital. It has a population of about 1,000 people. Dagaarti is the main ethnic group and the main language is Dagaare. Christianity is the predominant religion. The chief is the supreme authority in the community followed by elders and opinion leaders, among whom are women.

The main source of livelihood is agriculture and 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.

There is no public school in the community and children go to the school in the neighbouring community. Predominant mobile networks are Vodafone, MTN and Airtel.

3.2.3 Tangoro

Tangoro is located 42km from the district capital and has a population of about 1,000 people. The community comprises three sub-communities. Dagaarti is the main ethnic group and the main language is Dagaare. The predominant religion is Islam followed by traditional religion and then Christianity. The *Tendana* or chief is the supreme authority of the community

The main source of livelihood is agriculture and farmers cultivate food crops such as grains, legumes and tomatoes. Livestock-rearing for sale and consumption is common in the community. Illegal gold-mining, especially by young people, is prevalent within the community.

There is one primary school in the community. Available mobile networks are Vodafone, MTN and Airtel.

4 Findings

In the following sections, the thematic findings of the qualitative analysis will be presented structured around the four key aims of the initial exploratory qualitative study. Each sub-section will conclude with a discussion of the potential implications of the contextual findings on the uptake of the mNutrition intervention in Ghana.

4.1 Access to, use of and attitudes towards mobile phones

4.1.1 Access to mobile phones

Access to mobile phones was very good in all six communities and even poor farming households usually owned (at least one) active or working mobile phone. This observation echoes the finding of the literature review conducted by the team during the preparatory phase (see also Barnett and Srivastava 2017). The review suggests that 70 per cent of rural households own a mobile phone and that even very poor households are likely to have a mobile phone. Men were more likely to own a mobile phone than women (Ghana Statistical Service 2014). Farmers perceived different reasons for the gender difference in mobile phone ownership:

The women do not take delight in spending their money on phones, but the men who are the leaders of the household sometimes use their goat and sheep money to buy phone; the women will use their money for funeral or other things. The men feel that their wives can share phones with them, so it is unnecessary to go and buy another one unless they are well to do. (Male farmer, FGD, Nzoro)

Here, the men have more phones than the women. This [is] because, we the men are the ones who buy it for the women. (Male farmer, FGD, Asara)

While few women owned a mobile phone, many could gain access to the phone of their spouse or sons if needed (e.g. to make emergency calls). The practices of regular mobile phone-sharing between spouses, however, was uncommon. In fact, many male farmers were opposed to the idea of sharing their phone with their wives, as highlighted by the following two quotes that also summarise the concerns voiced by several farmers:

No [I don't share my mobile phone with my wife]. Even when I leave my phone and someone calls, my wife does not answer it. Unless I pick and the person wants to talk to her. (Male farmer, IDI, Asara)

No mobile-sharing, it will bring about problems, broken marriages, I know people whose marriage[s] have been destroyed because of mobile phones. But it is dependent on the relationship between the spouse or the individual character of the partners. (Male farmer, FGD, Dolira)

Opinions about whether younger farmers were more likely to own a mobile phone than older farmers varied and were related to costs and interests. Some interviewees were convinced that older farmers were more likely to own a phone '*because they are working and can afford a phone*'. Whereas, others believed that young farmers were more likely to have a phone because they were more interested in technology and the various features of a phone.

The majority of farmers owned simple mobile phones (often called ‘dumb phones’). Smartphones were very uncommon in all six villages. Perceived reasons for this were high purchasing costs, lack of 3G or 4G network coverage and low education levels among the communities.

4.1.1.1 Use of mobile phones

Mobile phones were mainly used in the context of making and receiving voice calls. Calls were made for social interaction (e.g. to stay in touch with friends and family in other villages or towns) and for work-related purposes (e.g. to ask for information about current market prices or specific farming practices, follow-up with people who owed them money). Most farmers said that they used their phones daily for calls, although calls were seldom longer than 2–10 minutes due to the call costs.

Other frequently reported uses of mobile phones included checking the time and listening to music (if this feature was available on the phone).

Many farmers noted that some people in their community used their phones for mobile money transfers, although very few of the farmers interviewed had ever used this service themselves. In an FGD one female farmer explained the reason for the reluctance of many of her fellow farmers to use mobile money as follows:

also with the mobile money withdrawal there is no merchant here to do so and we have to go all the way to the district (Nadowli) and you can be robbed. (Female farmer, FGD, Tangoro)

In another community, a farmer explained how he did all the mobile banking for his community via his phone as others in the community either did not own a phone or did not know how to do it:

My phone is like a communication centre for the village, people use it to receive money sent to them by their relatives outside via mobile money... The money sent [is] irregular, they send it anytime. (Male farmer, IDI, Nzoro)

4.1.2 Attitudes towards mobile phones and mobile network operators

Attitude towards mobile phones

The farmers were almost universally positive about the benefits that mobile phones had brought to their daily lives and their communities. They especially welcomed the fact that mobile phones allowed them to reduce time, effort and cost spent travelling (e.g. to run errands, get information, social interactions, business). This was perceived as important, as many male community members (who traditionally did most of the travelling) had left the village in search for work in the cities:⁹

It has help[ed] reduce travel cost and we can easily share information. (Female farmer, FGD, Asara)

⁹ For rural-to-urban migration, see also Barnett and Srivastava (2017).

When you need help you can call someone who is more knowledgeable or [the person] can bring fertiliser on time instead of going there with a car. This is important, as now the rainfall pattern is not good so most of the able-bodied men have moved to the cities. (Female farmer, FGD, Soloba)

In the past, they [my family] had to send someone from my village to come and deliver a message, but now I can only call or they call. With [a] phone, it is easy reaching people and locations. (Male farmer, FGD, Soloba)

In only one FGD in Dolira were male farmers concerned about the potential social impacts of mobile phone technology on their community. They voiced concerns about the negative consequences of the peer pressure to own a mobile phone, the dependency many people had developed on their mobile phone and the potential negative effects of mobile phones on human interactions:

Phones have become more important than human beings, you have not eaten but you buy credit to use on the phone (Male farmer, FGD, Dolira)

It also waste[s] people's time, when the person is supposed to be working, he might be on the phone. (Male farmer, FGD, Dolira)

Attitudes towards mobile network operators

Even though farmers' attitudes towards mobile phones were predominantly positive, opinions about MNOs were more cautious. While farmers appreciated that operators provided a welcome connection to a mobile network, most farmers complained about high calling charges and believed that the MNOs were mainly interested in making a profit:

Operators are concerned about their profit. No business person goes into business to lose but to make interest. (Male Farmer, FGD, Nzoro)

They are all the same because of the profit motive. (Male farmer, FGD, Nzoro)

We know they also want to make profit so sometimes they also squeeze us. (Male farmer, FGD, Soloba)

A few farmers were also convinced that their MNOs reduced their mobile credit unduly or too fast:

Sometimes when you buy call credits they [operators] deduct something or tax you on it. (Male farmer, FGD, Nzoro)

Some, it's because, when we use MTN they deduct us too much. Sometimes when you make a call... all you say is 'hello, hello' and they will deduct you. (Male farmer, 29, FGD, Asara)

Other farmers voiced doubts about the trustworthiness of MNOs, especially in relation to (poor) quality of network service provided and calling costs:

Similarly, the network operators are not truthful. Someone can be beside you, but when you call they say [their phone is] switch[ed] off. Though the world is full of lies, the network operators are teaching people to lie. (Male farmer, FGD, Dolira)

While many farmers were unsatisfied with their mobile phone charges (often combined with weak or fluctuating network coverage) and said that they would like to raise their concerns with their

mobile phone provider, they did not feel empowered and educated enough to actually do so, as the following quote highlights:

The deductions are too much. For example, they [MNO] deduct too much. If I knew how to read like I will call them and ask them. (Male farmer, FGD, Asara)

Factors that influence farmers’ network operator choices

Table 4.1: Frequency of farmers’ ownership of SIM cards from different network operators in the six qualitative communities (including ownership of two or more SIM cards)

Network operator	Central Region			Upper West			Total no. of SIM cards
	Soloba N=24	Asara N=24	Dolira N=20	Foli N=30	Tangoro N=20	Nzoro N=24	
Vodafone	18	13	6	28	15	12	92
MTN	10	8	16	13	11	16	74
Airtel	0	1	0	0	0	5	6
Tigo	3	1	1	0	0	0	5

Table 4.1 presents a summary of the SIM cards that farmers used from different networks in the six qualitative sites. The table includes farmers who owned SIM cards for two or more MNOs (see also the column on the total number of SIM cards). As can be seen, Vodafone was the most popular network operator among the respondents in the qualitative study sites, except in Dolira in CR and Nzoro in UWR where most farmers owned MTN SIM cards. Even in villages where use of Vodafone was predominant, MTN followed closely as the second most popular network. Tigo and Airtel were less popular.

Farmers highlighted different factors that influenced their choice for a particular MNO. Network coverage, stability and strength were generally described as the determining factors when choosing a network operator. A key informant from Soloba summarised the concerns of many interviewees as follows:

We are not looking at the charges [when choosing a network]. Of what good is it if the charge is good and we cannot get a network to make calls. So, we want a network that gives good reception to make calls...

If there are other mobile operators that offer better services like stable network and mobile money transfer, we would switch to that network. (Head teacher, IDI, Soloba)

Farmers explained that they considered promotions and bonuses offered by the MNOs and calling charges in their decision-making regarding the choice of network. However, network coverage and strength were usually perceived as more influential.

A few farmers described how they wanted to remain ‘loyal’ to the first network operator they had signed up with and said they were reluctant to change even if they would receive better service from a different operator, as this would be complicated and would require some effort (even if they received better service from a different operator) because it would be a tedious transfer process:

The MTN is the first chip I bought, so changing from it is challenging. That is the number all my contact people have. (Male Farmer, IDI, Soloba)

I use MTN. I use it because I have been using it for a very long time. (Female farmer, FGD, Dolira)

4.1.3 Potential implications for uptake of the mNutrition intervention

Table 4.2 presents the key findings on access, use and attitudes towards mobile phone technology among farmers in the two study regions and draws conclusions on the potential implications for the uptake of the mNutrition intervention. The last columns present recommendations for the quantitative encouragement design and/or quantitative survey design and aspects to follow up in subsequent qualitative data collection rounds (i.e. the qualitative midline and the qualitative follow-up at the endline).

Table 4.2: Qualitative key findings on access to, use of, attitude towards and acceptability of mobile phones in the six qualitative study communities

Key findings		Potential implications for the up-take of the mNutrition intervention	Recommendations for the quantitative encouragement design or survey design	Aspects to follow up in subsequent qualitative data collection
Access to mobile phones	Women are less likely to own a mobile phone and their access to a mobile phone might be irregular as the practice of mobile phone-sharing (e.g. with their spouse) is uncommon	Reaching female farmers with the mNutrition intervention could be challenging, including reaching them through their spouses' mobile phones	<p>Special attention should be paid to encourage female farmers to subscribe to mNutrition and/or share the information with other female farmers</p> <p>It cannot be assumed that male owners of mobile phones will share mNutrition content with female household members as the practice of mobile phone-sharing is uncommon. If female farmers are to be reached through mobile phones owned by male household members, special efforts to encourage regular content sharing should be made (including encouragement of female farmers to use the mNutrition helplines)</p> <p>Survey: Female ownership or regular access to a mobile phone</p>	<p>Explore whether mNutrition content is shared by male mobile phone owners with female household members on a regular basis and identify barriers to and facilitators of regular content-sharing</p> <p>Explore other potential pathways by which female farmers receive mNutrition content</p>
Use of mobile phones	Mobile phones are mainly used for making and receiving calls	As farmers are very familiar and comfortable with the call feature, uptake of mNutrition content via voice messages and use of the farmers' helpline to enquire about farming or nutrition may be good	<p>Voice calls could be a cost-effective approach to engage with farmers between the quantitative baseline and endline if needed (e.g. to deliver additional encouragement)</p> <p>Survey:</p>	Explore barriers to and facilitators of the uptake of voice messages and use of the helpline

			Use of mobile phone (calls, text messages, other)	
Attitude towards mobile phones	Positive attitude towards mobile phones and appreciation of the social and economic benefits they have brought to rural communities	Farmers' positive attitude and acceptance of mobile phones may have positive effects on uptake of and engagement with mNutrition	–	Explore farmers' experience with, barriers to and facilitators of the uptake of mNutrition messages
Attitude towards mobile network operators (MNOs)	Widely held belief that MNOs are mainly interested in making profits and related concerns about operators' trustworthiness (especially related to credit deductions and calling costs)	Farmers' attitude towards mNutrition and its uptake might be negatively affected by their critical attitude towards MNOs. This might especially apply if farmers believe that mNutrition is a service that helps mobile operators to increase their profit	Lack of trust towards MNOs and suspicions about their motives may be a barrier to uptake in the encouragement group. It is important to explain the purpose of mNutrition and related costs to the farmers. Survey: Subscriptions to different network operators and reason why	Explore whether farmers associate mNutrition with Vodafone, perceptions about Vodafone among farmers and the potential effects of this association on uptake
Factors that influence choice of MNO	Network strength and stability are the main determining factors for the choice of MNO, though promotion offers and bonus and call bundles may positively influence selection	In villages in which Vodafone does not provide a strong and stable network, farmers might be reluctant to sign up for or switch to the mNutrition service provided by Vodafone	Vodafone network coverage and strength need be considered when choosing quantitative encouragement sites Survey: Network strengths, in particular Vodafone	Explore barriers to and facilitators of signing up to Vodafone Farmers' Club (especially among farmers who are currently not Vodafone customers)

4.2 Potential barriers to and facilitators of the uptake of mobile phone based-messages

In this section, potential barriers to and facilitators of the uptake of mobile phone-based mNutrition messages are explored, both from a technology perspective (i.e. factors related to the mobile phone) and the farmers' perspective (e.g. perceived self-efficacy when using a mobile phone, perceived usefulness of mobile phone-based services).

4.2.1 Barriers and facilitators from a technological perspective

4.2.1.1 Poor network coverage and unstable network

Farmers and key informants in all six villages complained about patchy network coverage and regular fluctuations in mobile network strengths. They described how this made mobile communication difficult and at times impossible. Even within the same village, network strengths could vary considerably and several farmers explained that they did not have mobile phone connection when they took their phones to the fields for work.

I take my phone to the farm, but MTN does not work there, but maybe Airtel or Vodafone is working there, so I would have to buy this other network so that I use the phone when in the farm. (Male Farmer, FGD, Asara)

But the problem is the network. In the whole community, to get a strong network reception you have to go to the Soloba public park to access strong network. (Key informant, IDI, Andandan)

Some farmers interpreted the poor and often unreliable network coverage as a sign that network operators were not interested in improving the mobile network in rural villages, but rather focused their efforts on more profitable urban locations. An assembly member from Soloba summarised:

The people strongly feel there is the need for a telecom mast to be erected in the area, but the network operator is rather focused on erecting the mast in the cities. (Male assembly member, IDI, Soloba)

Complete network outages seldom occurred, but when they did happen they could cut off communication for up to two days, as described in the following quote:

Unless the network goes off. This doesn't happen very often, but sometime[s] it can go off for about two days. It can happen once a month and sometimes never happens for more than three [consecutive] months. (Male Farmer, FGD, Foli)

4.2.1.2 Access to electricity to charge the mobile phone could pose a challenge

Two villages in UWR (Nzoro, Tangoro) were not connected to the national electricity grid. Most farmers from these villages explained that they charged their phones in neighbouring villages for a charging fee. To save time and money for travelling, farmers often had to leave their phone in the neighbouring village to charge until their next planned trip there. During this time, they could not be reached via the phone.

A few farmers also used stand-alone solar energy panels to charge their phones; however, as panels were relatively expensive most farmers could not afford them.

Even the villages in UWR and CR that were connected to the national grid experienced occasional power cuts. One farmer explained the consequences of power outages on the mobile phone as follows:

When there is light off and you don't off [remove] the charger from the plug, it causes the charger to blow. (Male farmer, FGD, Soloba)

4.2.1.3 Economic and logistical barriers to access to mobile phone credit

The purchase of mobile phone credit was a challenge due to economic and logistical reasons for many farmers. Farmers described how they often struggled to find the budget to pay for mobile phone credit. Some said they frequently had to borrow credit on loan from their MNO, but that they had to pay a charge for this. Other farmers tried to save money in other areas of their lives (e.g. food expenditure) to pay for their mobile credit.

Based on interviews with MNOs, we know that a farmer can still receive telephone calls and messages if s/he runs out of call credit. Subscriptions to mobile phone-based packages (e.g. Vodafone, MTN) will be automatically deactivated if credit is not topped up within two weeks. Subscribers to VFC are put into a suspension state if their subscription is not renewed for three months and they have to re-subscribe to activate the service again. If credit is not bought after expiry, within a period of 90 days for Vodafone or six months for MTN, the SIM card will be deactivated automatically by the network operator. Similarly, if the phone remains switched off for the same length of time, the SIM card will be deactivated.

In the three communities in UWR it was impossible to buy credit and people had to travel to a nearby town to purchase credit from the vendor.

I always have to make sure there is credit on it, but there is no vendor in this town unless we go to [the] district centre, which is about 15–20 minutes' ride with a bicycle. (Male farmer, FGD, Asara)

Female farmers found it particularly challenging to get access to credit as they often did not earn or were not in control of their own money, but had to ask their husbands; and were also less mobile than men, due to social traditions and responsibilities in and around the house.

4.2.1.4 Hardware issues are rare and mobile phone repairs available

Hardware issues with the mobile phone were seldom reported by farmers. If they encountered a technical issue that could not be addressed by a family or community member, the farmers would bring the phone to the repairer in town the next time they were there for other errands:

I send the phone to repairers in town whenever I encounter problems with it. I don't go to town solely for the phone repairs. (Male Farmer, 39, IDI, Solaba)

Female farmers visited the nearby town less frequently than male farmers due to responsibilities on and around the farm. As farmers rarely had the time or money for immediate repairs, a broken phone could mean that a farmer was without a functioning phone for several days or even weeks.

As many farmers had used their phones for several years already, several of them experienced a gradual decline in the phone's battery life and had to recharge the battery more frequently, which could pose considerable challenges in the villages without electricity. Two farmers considered replacing the battery, but had difficulties in finding suitable replacements.

4.2.1.5 Multiple SIM card behaviour is common

If financially possible, farmers owned and used SIM cards from different network operators in parallel which allowed them to switch between networks flexibly and depending on the best network coverage for each location. For example:

Depends on the various sites where you stay, some networks are stronger at different points in the community and a different network is better. (Male Farmer, FGD, Nzoro)

Another reason for owning multiple SIM cards, from different operators or from the same operator with different tariff packages, was to use the cheapest calling tariffs depending on time of the day and the network of the person they wanted to reach. Calls within the same network were considerable cheaper than across networks, as highlighted in the following quote:

The networks are good when you are making calls on the same network – Vodafone to Vodafone or MTN to MTN. But when the calls are to different networks, it cost[s] more. I think some of the networks are sister[s] – thus they are affiliated, so making calls across such networks are relatively cheaper. E.g. Calls made from Vodafone to MTN are expensive but calls from Vodafone to Tigo are relatively cheaper. (Male farmer, IDI, Asara)

A few farmers used dual SIM card phones or 'China phones' (i.e. phones with slots for 2 SIM cards) because they were relatively cheap and often had longer battery life spans. Dual SIM card phones also allowed farmers to manage and switch between different active SIM cards easily and without missing communication sent through any of the cards. A mobile agent from Tangoro described the practice:

Yes, there are a lot of people like that, even me`, I use three SIM cards in one phone [sic]. I use two Vodafone SIMs and one MTN. I give all the numbers out to people depending on the number they use. For instance, if someone uses Vodafone I prefer to use my Vodafone to call that person and I do same with the MTN. If I am having a conversation on one line and someone calls on the other I will tell one to hold one and I will talk to one first. (Male mobile phone agent, Tangoro)

However, most farmers had single SIM card phones only. They had to manually exchange cards depending on their needs and might miss messages or calls as a consequence.

4.2.1.6 Mobile spam

Mobile spam – meaning unsolicited text messages, especially advertising – was common, but did not bother most farmers as they could not read text messages.

We receive a lot of text messages on our phones but since we can't read we pay less attention to it and just cut [delete]. (Mobile agent, Dolira)

Mobile spam could negatively interfere with the uptake of mNutrition voice messages, if farmers miss or disregard messages or message notifications, believing a message to be spam. Mobile spam might also fill up farmers' inboxes, making it impossible to receive new messages.

4.2.2 Barriers and facilitators from the farmers' perspective

4.2.2.1 Perceived self-efficacy in using mobile phones

Self-efficacy in using mobile phones has been shown to be an important determinant for perceived ease of use and, ultimately, adoption of new mobile phone-based services (Venkatesh 2000; Islam, Khan et al. 2011).

All farmers interviewed were used to making and receiving calls on their mobile phone; however, only a few were comfortable and experienced with using other functions of the phone such as voice and text messages. Most farmers, male and female, believed that they did not have enough technical knowledge to use other functions. The following quotes summarises what many farmers said:

There are many uses of phone but because we don't know inside, all we use it for is calls. (Male farmer, FGD, Soloba)

It is because, I don't know how to use it. I know the phone can do many things but I don't know how to do it. (Male farmer, IDI, Asara)

People press, press any key and lock their phones unintentionally and they then take it to the repairs and pay money for it be unlocked for them when it is not spoilt. (Female farmer, FGD, Dolira)

Hardly any of the interviewed farmers had ever sent a text messages, mainly because they could not write and did not know how to operate the text message function on their mobile.

Most of the farmers reported that they had received messages, but did not know how to open and/or read them. Therefore, most of them deleted the messages almost immediately (if they knew how to delete):

But the thing is some of [us] don't know how to read or even open the message so we can't access the text message. For me if messages come, I just 'cut it' [delete it] (Male farmer, FGD, Soloba)

While most farmers said that they would prefer voice messages to receiving information due to literacy issues, several farmers highlighted that listening to voice messages could pose another barrier:

The voice message will be more helpful [to receive information], because when you know the short code, you can dial it and listen to the message over and over again but the challenge is most people here don't know how to check their voice message. (Male farmer, FGD, Dolira)

Perceived ease of use of a new technology has been shown to be important to ensure its sustained use (Brown 2002; Wu and Wang 2005). To increase the likelihood that mNutrition messages are taken up and used effectively, basic instructions on how to open and replay voice messages would be beneficial for most farmers. In fact, one farmer suggested:

When we are taught how to use the phone and access text message through a workshop, it will motivate us to subscribe for such messages. (Male farmer, FGD, Dolira)

4.2.2.2 High level of illiteracy and preference for local language

Illiteracy or poor literacy was highlighted by the majority of farmers and all key informants as the main barrier to any written information on agriculture and nutrition, including information delivered through text messages. National statistics on Ghana currently state that 71 per cent of the population is literate (*ibid.*). However, there are disparities between male (82 per cent) and female (67 per cent) literacy levels (DHS *et al.* 2015), as well as huge urban rural disparities: 78 per cent of urban women are literate as opposed to 54 per cent of rural women; and 91 per cent urban men are literate as opposed to 72 per cent in rural areas (DHS *et al.* 2015).

One farmer said that he would ask a literate community member to read incoming messages for him as he did not want to miss important messages from his family:

Well, when the message comes, it [the mobile phone] notifies me, so I will give it to someone to read for me... It could be that important information is being sent to you by your child or relative or you have even won something and they are informing you. (Male farmer, Asara)

Due to the literacy issues, farmers preferred calls or voice messages with information. While a few farmers said that they would be comfortable with voice messages in English, the majority would prefer voice messages in their local language:

Yes, it will be helpful especially if it is in Twi or Fante so we can easily understand. (Male farmer, FGD, Asara)

While the majority of farmers said that they would prefer voice messages, farmers' understanding of what a voice message was varied. Some understood it as a recorded text messages, which is the format most mNutrition messages will take, whereas other believed a voice messages to be a call that enabled them to actively communicate with the caller, as seen in the following:

We would find such messages useful, but text messages will not be beneficial because we cannot read. We see the text messages as a bother. We would prefer a voice call, which will enable us talk to the person. (Female farmer, FGD, Dolira)

4.2.2.3 Perceived usefulness of mobile phone-based messages on agriculture and nutrition

Perceived usefulness (or the belief of the intended user that the mobile phone-based service will facilitate agricultural performance and improved dietary practices) has frequently been highlighted as a key determinant for uptake and sustained use of new technologies (Venkatesh and Davis 2000; López-Nicolás, Molina-Castillo *et al.* 2008; Venkatesh and Bala 2008). When asked whether they would find mobile phone-based messages on agriculture and nutrition useful, all farmers responded they would as long as the messages were delivered through voice rather than via text message, due to illiteracy. Farmers said that they would like to receive information through their mobile phones as access to agriculture extension workers was often difficult and required that they travelled to the agriculture office, which costs money and time:

Such information would be useful because it would relieve me of transportation cost to the agriculture office for information. If such [a] system exists I would like to receive information on food prices, preferably after 9am. (Male Farmer, IDI, Soloba)

Mobile phone-based messages were also perceived as potentially useful reminders that could provide timely information that farmers had not considered:

Sending the messages will be very useful because you forget some of the information the agri-worker gave. However, if they are sent as a message, we can always refer to it and remind ourselves of some of them. (Male farmer, IDI, Soloba)

That kind of message will be very helpful. This is because the farming business is very risky so if we have messages like these that can prompt us and draw our attention to certain things pertaining to the farming [it] will be very beneficial. (Male farmer, IDI, Nzoro)

Agriculture extension officers and community leaders in UWR and CR were convinced that a mobile phone-based information service could help to address existing gaps in current service delivery:

Yes, it would be useful... We need to continue giving more information to farmers but we are challenged with small staff numbers, so such a system would help. (Agriculture extension officer, IDI, Dolira)

We do not even have an agri-worker here [in the village] so if we get information on how to plant or [a] product that will be useful it would really help them [the farmers]. (Village chief, IDI, Mwanare)

Farmers, agriculture extension workers and other key informants all stressed that the uptake of messages would be most effective if messages were to be combined with an interactive component (e.g. a call centre, discussions about the content during a call or within the community). This was because interactive exchange would allow farmers to ask and discuss specific questions relevant to their households and current agricultural challenges in more depth.

It would be useful, but the text messages would make no sense to most of the farmers. Voice messages in the local language, Twi, is a better option. The creation of a call centre would also be very interactive and help. (Assembly member, IDI, Asara)

That one [a call centre] will be helpful because anyone who decides to call means the person is serious (Agriculture extension worker, IDI, Solaba)

Getting information on nutrition through the phone would be useful, if you are able to call me it would be best. (Male farmer, FGD, Nzoro)

The importance of interaction for effective health behaviour change communication has been highlighted repeatedly (Glanz, Rimer and Vswanath 2008, Briscoe and Aboud 2012; see also Barnett, Scott, Batchelor and Haddad 2016). Mobile phone technology and other communication technologies have been shown to have the potential to facilitate an interactive communication process, even in remote villages as shown in a recent review (Glanz *et al.* 2008; Free, Phillips Galli, Watson, Felix, Edwards and Patel 2013).

Others suggested that voice messages combined with other communication channels (e.g. visual aids) would be most useful for farmers:

I think the verbal way of sharing information with them is better, therefore voice message[s] are better. Even with that, if you don't include visual aids, they find it difficult to grasp and remember easily. (Health worker, IDI, Asara)

4.2.2.4 Timing of the messages within farmers' busy daily schedule

The timing of messages was perceived as important for many farmers. Most farmers preferred to receive messages in the late afternoon or early evening (between 4pm and 7pm) when they had just returned from the field. At this time, they could actively engage with messages and listen to voice messages as soon as they came in. Messages received during the day might be missed more easily.

Some farmers said they would like to receive food price information in the morning so that they could plan harvests and trips to the market accordingly.

4.2.3 Potential implications for the uptake of the mNutrition intervention

Table 4.3 shows the key findings on the potential barriers to and facilitators of the up-take of the mNutrition intervention. The last two columns present recommendations for the quantitative encouragement design and/or survey design and aspects to follow up in subsequent qualitative data collection rounds (i.e. the qualitative midline and the qualitative follow-up at the endline).

Table 4.2: Qualitative key findings on barriers to and facilitators of the uptake of the mNutrition intervention in the six qualitative study communities

Key findings		Potential implications for the uptake of the mNutrition intervention	Recommendations for the quantitative encouragement design or survey design	Aspects to follow up in subsequent qualitative data collection
Barriers and facilitators from a technical perspective	Patchy network coverage with fluctuating network signals was a challenge in all communities and made mobile phone-based communication often difficult	mNutrition messages may be delayed due to poor network signal (although the required bandwidth to receive messages is considerably smaller than what is necessary for voice conversations) The use of the Vodafone Farmers' Club (VFC) helpline might be difficult or impossible due to poor network quality	Frequency of fluctuations in network coverage	Explore whether network quality affected the reception of mNutrition messages and whether farmers perceived this as a barrier to uptake Explore whether network quality affected farmers' engagement with the VFC helpline
	No access to electricity in two villages in Upper West Region. Farmers charge their mobile phones in neighbouring villages (for a fee) or use solar panels (seldom)	mNutrition messages may be missed if the mobile phone runs out of battery and cannot be recharged within the next 24 hours. mNutrition messages may be missed if the mobile phone is being charged in the neighbouring village and absent from the beneficiary household	Access to electricity (where, how, costs)	Explore the potential impact of lack of electricity on reception of and experience with mNutrition messages
	Purchase of mobile phone credit can pose an economic challenge to poor farmers	Farmers who run out of credit may lose their subscription to VFC. Vodafone SIM cards will be deactivated within 90 days without top-up	Access to mobile phone credit and frequency and lengths of periods without credit	Explore the frequency with which farmers run out of credit and how this affects their participation in and experience with the mNutrition intervention
	Multi-SIM card use is common and allows farmers to use the best tariffs and network coverage	If SIM cards are exchanged manually, mNutrition messages might be missed during the times a different SIM card is in use If different SIM cards are used in parallel, using a dual SIM card phone, the likelihood that mNutrition messages are missed is reduced	Use of multiple SIM cards might delay uptake and activation of the Vodafone mNutrition SIM card as farmers do not perceive this to be an acute need. Also, they might be reluctant to replace their usual SIM card as they might miss calls to their usual number. Additional encouragement might be needed for farmers with multiple SIM cards	Explore whether the multi-SIM card behaviour has an impact on the reception of and experience with mNutrition messages and use of other services associated with mNutrition (e.g. use of the helpline)

			Survey: Multi-SIM card ownership Frequency and lengths of use of each SIM card	
	Mobile spam messages are common and are usually deleted immediately	Farmer might mistakenly disregard mNutrition messages or notification of messages as spam Farmers' inboxes might be filled up by spam messages and thus reception of new mNutrition messages will be impossible	Frequency of mobile spam	Explore the impact of spam messages on the uptake of mNutrition messages
Barriers and facilitators from the farmers' perspective	While most farmers perceive themselves as self-efficacious in using the mobile phone for calls, they lack confidence and necessary technical know-how to receive and listen to voice messages	Farmers' lack of technical confidence and knowledge may prevent them from receiving and repeatedly listening to mNutrition voice messages	To ensure effective uptake of mNutrition messages in the encouragement sites, the registration team should also provide basic training on how to listen to and repeat voice messages	Explore farmers' experiences of, and barriers to and facilitators of mNutrition voice messages; explore gender differences
	Most farmers are illiterate or almost illiterate	Information sent to farmers via text messages is unlikely to be read. This includes mNutrition content messages, but also any additional information about the mNutrition service	Any communication with the quantitative participants through text messages should be avoided and voice messages or calls should be the preferred channel to convey information Survey: Literacy level (including poor literacy)	Explore farmers' experiences with any written information about mNutrition
	Voice messages are the preferred channel for information, although there were some misperceptions about what voice messages are (e.g. voice messages are understood as	mNutrition voice messages may be well perceived by farmers as they are the preferred channel for communication, although misunderstandings of what voice messages are might lead to disappointment and may affect long-term sustained use of the service	To ensure sustained uptake and adherence in the encouragement sites, the team should clarify what voice messages are in the initial registration period and also encourage use of the free helpline	Explore farmers' experiences with and perceptions of mNutrition voice messages and interactive engagement with the farmers' club helpline

	interactive voice calls)			
	Information in local language(s) is preferred by most farmers due to lack of English language skills	mNutrition messages in local language(s) may be well received by farmers, whereas any messages in English are less likely to be taken up	Preferred language(s) Ability to understand advice in different languages	Explore farmers' experiences with and perceptions of mNutrition messages in the local languages Explore whether other mNutrition services (e.g. call centre) are delivered in local language and whether and how this affects uptake
	Farmers believe that mobile phone-based messages would be useful as they address existing gaps in agriculture extension services, can help to save time and budget for travelling to the agriculture office, and serve as refresher for existing information	mNutrition messages may be well-received by farmers	To ensure sufficient uptake in the encouragement sites the team should highlight the potential multiple benefits of the mNutrition services during its promotion (while managing expectations)	Explore the perceived usefulness of mNutrition services after roll-out
	Widespread perception that the uptake of mNutrition messages would be highest if the messages are combined with an interactive component	The farmer helpline and the cheaper call rates between Farmer club members are the main interactive components of the mNutrition intervention and may be essential to facilitate effective up-take and behaviour change	To ensure sufficient up-take in the encouragement sites the two interactive components of mNutrition should be emphasised when promoting the service	Explore farmers experience with the farmer helpline and the cheaper call rates to other Farmer club members
	mNutrition messages received in the late afternoon or early evening may be most effective as farmers have time to actively engage after the daily farm work is	mNutrition messages sent at other times are more likely to be missed or may not receive farmers' attention	Any communication with the participants in the encouragement site is most likely to be effective when delivered between 4pm and 7pm (e.g. calls to deliver additional encouragement)	Explore whether timing of the mNutrition messages has an effect on the uptake of the messages, explore differences in preferred timing of the messages among male and female farmers

	completed (except messages on prices that are requested in the morning)			
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4.3 Information needs and information-seeking behaviours related to agriculture and nutrition

The findings on farmers' current information needs and information-seeking patterns for agriculture and nutrition will be presented separately in this section. Potential implications of existing patterns on the uptake of the mNutrition intervention will be discussed at the end of this section.

4.3.1 Information needs and information-seeking related to agriculture

4.3.1.1 Information needs related to agriculture

Information needs can be recognised by the information seeker (i.e. the farmer) or by the information expert (e.g. agriculture extension worker, national agriculture expert) and these two need to work together to identify actual information needs (Kaniki 2001).

Information needs identified by farmers

When asked about their agricultural information needs, farmers identified a wide range of subjects that were ultimately concerned with ways of increasing agricultural yields. Farmers' main information needs were around finances and in particular how to get access to loans and credits for agricultural inputs, followed by the correct use of agrochemicals (i.e. fertilisers, insecticides and herbicides), the best time for harvesting and planting, spacing between crops, safe crop storage, choice of most productive crops, and how to combat plant diseases and livestock diseases (mainly diseases that affect chickens or goats).

Information needs changed throughout the year, depending on the planting and harvesting seasons, and also varied between farmers, depending on the crops they cultivated, level of experience in agriculture (less experienced farmers had more knowledge gaps) and agricultural problems encountered (e.g. rare plant diseases).

Information needs also varied slightly between the two regions, mainly because of different agricultural activities and availability of agriculture extension workers.

In CR, agriculture extension workers predominantly focused on providing knowledge on cocoa and rubber production, the two major cash crops produced in this area. Information on the production of food crops was often lacking, but needed by many farmers:

Farmer 1: The extension officers especially for cocoa and rubber assist us in our farming activities. For the food crops, the agric extension officers do not come here often. We mainly decide on the crops to cultivate ourselves. (Male farmer 1, FGD, Soloba)

Farmer 2: We don't have extension officers for the food crop farming so we lack information. We always have to rely on our own experiences. (Male farmer 2, FGD, Soloba)

In UWR, access to agricultural information was generally more difficult and time-consuming as farmers often had to travel to the agriculture office in the nearby town, which was often impossible for female farmers due to social traditions and responsibilities in and around the house. Consequently, farmers often expressed more pressing information needs than in CR.

It is not easy for us to get information because we don't get people to come and educate us on agric. No one comes to teach us about farming so if we don't get the information through the radio then that is it. (Male farmer, FGD, Tangoro)

Additional information needs identified by agriculture experts

In-depth interviews with agriculture extension workers (n=3) and national agriculture experts (n=3) identified additional information needs that had not been mentioned (or were only mentioned by very few) in interviews and FGDs with farmers.

According to national experts, farmers needed information on more profitable agricultural marketing strategies and up-to date market price information. Most farmers in CR described how they did not sell their products on the local markets, due to distance and low prices due to over-supply, but preferred to sell to traders from inside or outside the community. Farmers believed that traders paid better prices. However, as one agriculture expert pointed out:

The traders that come from outside the community offer relatively better prices. However, they usually have their own way of measurement which they call 'Accra rate' and 'Mankessim rate'. For instance, with the Accra rate, if the crop is cassava, they load or fill it into a sack to such an extent that the upper part of the load can fill two more sacks'. (Agriculture extension officer, IDI, Soloba)

Cocoa, which was the main cash crop produced in CR, had a fixed price set by the government and price information was therefore less important to farmers' decision to sell.

In UWR, farmers were more likely to sell their product at local markets; however, traders from inside and outside the community also existed. If farmers had access to storage facilities, they held their products back to sell later at a better price.

The need for accurate and timely weather forecasts to plan planting and harvesting was stressed by one of the interviewed national experts, but none of the farmers:

Of course, as a farmer you need information at different stages; production, marketing, meteorological, technology, skills. With regards to weather, rain, timing is important. It comes from two sources: local rain makers and other spiritual sources; and the government sources: radio, extension services. You have to be lucky if you have extension service. (National agriculture expert, IDI, Accra)

Two national experts also stressed that farmers needed more and better information on how to choose good-quality seeds to ensure improved production. One of the experts added that information on where to access better seeds was also needed and currently missing:

Second, availability of good-quality and variety of seeds; there is low awareness about the good germination rate. I think while there might be some degree of awareness among some farmers, they cannot access more information. Example: even if they know what is good for farming, they would need information on how and from where to access these inputs. (National agriculture expert, IDI, Accra)

Female farmers' urgent information needs and difficulties in accessing agriculture information and resources were also highlighted in the desk review on agriculture in Ghana conducted in the initial stage of this impact evaluation (Barnett and Srivastava 2017). One of the critical barriers was lack of access to land and one of the national agriculture experts said:

Women have less access to land and inputs, and thereby less access to services. As far as access to land is concerned, men access the land from the family or community as a matter of right. Female farmers will only get as much as is essential for her survival, not enough to make her rich. Women also do not take their own initiative [which they usually are not able to in rural patriarchal Ghana], but get land mostly through men. (National agriculture expert, IDI, Accra)

4.3.1.2 Farmers' current efforts to obtain agricultural information

Most farmers actively looked for ways to solve information-related problems. In the first instance, farmers often sought information from informal sources, mainly fellow farmers or neighbours. For example:

I do consult my colleagues most of the time. When I have a challenge on my farm or there is a new technique that I know a colleague has applied before, I consult them to share experiences. (Male farmer, IDI, Soloba)

The second contact point was usually formal sources, agriculture extension workers or the local agriculture office. If agriculture extension workers were unavailable, farmers frequently relied on radio programmes and their own experience only, as highlighted in the following quote:

You won't get anyone at the moment to help you so we rely on personal knowledge to help manage the situation (Male farmer, FGD, Asara)

Other less frequently consulted information sources were agrochemical suppliers, non-governmental organisations NGOs, farmers' associations, elders or village chiefs.

Only very few farmers (mainly in UWR) said that they had not looked for information to solve their problem, indicating that farmers were proactive and therefore might take advantage of mNutrition's services if these were appropriately provided:

For the crops, no one has ever come here to help us... We do nothing. You just have to stand and watch your produce being wasted away by diseases. (Male farmer, FGD, Foli)

4.3.1.3 Information providers farmers trust

The preferred and most trusted source of information for farmers in all six villages was agriculture extension workers. Farmers equally trusted agriculture extension workers from the government, NGOs and agriculture commodity companies (e.g. Cargill, which was frequently mentioned in CR). Agriculture workers were trusted because:

They are knowledgeable and are well trained (Male farmer, FGD, Dolira)

An agriculture officer explained further that:

They [farmers] consider the pedigree of the person; an agric officer telling them something they would value it. That is what they consider before buying into any advice or idea. (Agriculture extension worker, IDI, Nzoro)

While farmers perceived agriculture extension workers as the most trustworthy information source, this trust could be damaged easily (e.g. if the advice did not solve the problem or was perceived as

incorrect), especially in the CR where many farmers were better informed as highlighted by the following quote from an extension worker:

The thing is a lot of people come to us [the agriculture extension workers], but you need to be careful with what you teach them [the farmers] as they already have lots of knowledge on most things, so if you come to them (farmers/community) and you teach them something wrong... you will gradually lose their trust. (Agriculture extension worker, IDI, Asara)

The second most-trusted source of information were interpersonal relationships, mainly with fellow farmers, but also with elderly and family members. Female farmers, especially, frequently cited their fathers, husbands and sons as their main information source and hardly ever mentioned agriculture extension workers.

4.3.1.4 Preferred formats for agricultural information

Farmers relied more on interpersonal or face-to-face communication than on other sources of information (e.g. ICT-based information, printed information). Education levels of farmers also seemed to have an influence on the format of information farmers considered. More highly educated farmers – based on school grades completed – were more receptive to written information and were also more assertive and likely to contact agriculture extension workers via their mobile phones.

Practical demonstrations and experiments were highlighted by many male farmers as very influential for information uptake; for example:

Ideally, I have to trust the one who has applied some of the chemicals before because they may have the practical experience. (Male farmer, IDI, Soloba)

Male and female farmers in both regions also frequently mentioned previous and ongoing radio programmes that provided accessible information. One programme also encouraged farmers to call in and ask specific farming questions.

However, as pointed out by several farmers and an extension worker, radio programmes allowed farmers *'to only listen to the theoretical information and practice, but not to get feedback as they cannot go to the radio station'*.

Use of mobile phones to obtain agricultural information

A few male farmers explained that they used their mobile phones to call agriculture extension workers for advice, invite them to come to their farm and look at specific problems and to follow up on advice they had been given previously.

The requirement for contacting the agriculture extension worker was mentioned in case farmers had a telephone number for the agriculture worker allocated to their village. In UWR (in Tangoro and Nzoro) this posed a challenge, as most farmers did not have the telephone numbers of their extension worker.

Other agriculture-related activities farmers used their phones for were occasional calls to agricultural traders, fellow farmers to ask for advice and local markets to ask for price information.

Factors that influence whether farmers would subscribe to a mobile phone-based service

Farmers' willingness to subscribe to a mobile phone-based agriculture information service was mainly determined by the agricultural productivity benefits they expected of the service. Farmers were specifically interested in messages that would help boost their agricultural outputs (e.g. information on crop choices, fertiliser use, market prices). If the messages could achieve this, farmers said they would be willing to subscribe, even at a small cost.

Perceptions of and knowledge about the authority and trustworthiness of the sender of the messages was mentioned as another determining factor for whether farmers were willing to subscribe. In this context, none of the farmers said that they had heard of or were familiar with Esoko services, which is what was expected by the researchers given that Esoko has not offered its services in the two regions selected for this evaluation. The message had to come 'from people who learned' and there needed to be a clear 'link' to the sender.

Sometimes, they send you text message asking you to subscribe. We don't know where the message [comes] from. Some are from the extension officers who most at times when we call we don't even know them. So, important is a link that the messages are giving us. (Male farmer, FGD, Yizire)

I will give it to my son to check if it is from a trusted/appropriate source. After checking, if it comes from an appropriate source I would subscribe. If the source is appropriate I would be willing to even subscribe at a cost. (Female farmer, FGD, Nzoro)

A few farmers also said that they would like to see examples of the messages before they committed to subscribing:

I would like to try to see if the messages they send [are] helpful before I would subscribe. I would prefer the message via phone call since the text message would be difficult to read. (Male farmer, IDI, Soloba)

4.3.1.5 Barriers to accessing agricultural information

Farmers faced a number of external and internal barriers to accessing agricultural information. The most important external barrier was the unavailability or only very limited availability of agriculture extension workers. The main reason for this was staff shortages in both CR and UWR:

Each area in the district has an agric extension officer that is supposed to assist the farmers in using these agrochemicals. However, the agric extension officer in this district are very few (only 7) hence they are not able to cover all the areas. (Agriculture extension worker, IDI, Soloba)

Other reasons for the unavailability of agriculture extension workers in local communities in UWR were the lack of transport or resources for transport and bad roads, as explained in the following:

We don't have any means of transportation to the communities. We used to be given motorbike, maintenance and fuel allowance but all these have ceased. I have to use my salary to visit farmers (Agriculture extension worker, IDI, Foli)

The agriculture extension worker responsible for Foli and Yizire in UWR had been on leave for several months to attend his sick wife in Accra and no replacement had been sent.

Other external barriers to information included distance to the next agricultural office and lack of awareness of other potential information sources (e.g. through NGOs).

Barriers to accessing agricultural information for female farmers

Female farmers faced additional social and economic barriers to agricultural information, especially in UWR where women were unlikely to travel to the agricultural office for advice, as highlighted by a female farmer from Tangoro:

Sometimes the men go to the agric office. We don't know anything about this since it is our husbands who go there. We don't get any help from agric extension workers and NGOs. (Female farmer, FGDs, Foli)

A poor knowledge-sharing culture between male and female farmers was also highlighted by a female farmer from Tangoro:

We don't know about farming. When our husbands go [to the agriculture office] and return they don't teach us. (Female farmer, IDI, Yizire)

4.3.1.6 Utilisation of the information

Most male farmers explained that they mostly followed advice provided by agriculture extension workers as long as the advice did not involve huge additional expenditures for agricultural inputs that the farmers could not afford. Recommendations that required agricultural inputs were most likely to be practised if they were provided with the actual input (e.g. fertiliser).

A few farmers were reluctant to follow advice provided by agriculture extension workers without first scrutinising it and one explained:

Well, when agric workers come and teach, you have to think about it and also if you know an elderly person you speak to him before you adopt it. This is because, it is not all teachings that are right. (Male farmer, IDI, Asara)

Information provided by fellow farmers was most likely to be followed when the other farmer had successfully employed the suggested advice him-/herself and could present the results.

4.3.2 Current nutrition information-seeking behaviours of farmers

4.3.2.1 Information needs on nutrition

Information needs identified by farmers and community members

Information on nutrition was not perceived as a priority by farmers, whereas all farmers highlighted information needs related to their occupation and day-to-day survival. The few nutrition-related knowledge gaps that were mentioned were mainly concerned with food choices for themselves to stay healthy and strong enough to do farm labour and earn income. For example:

Health is wealth, if you are not healthy how can you eat [and] how can you work, if you don't eat well you are going to grow weak early. If it happens like that and we have majority of the population growing weak early it is going to affect our food security. (Male farmer, FGD, Nzoro)

Again, we all are farmers and we need to eat heavy food so we get energy to work on our farms. So, we will be glad if the information is on what we should eat before going to the farm. (Male farmer, FGD, Asara)

Men were generally less concerned with nutrition and food choices than women. This can probably be explained by the fact that women were responsible for meal planning, preparation and food shopping in most households, although the money for food purchases was mainly provided by men. While households, especially in UWR, relied heavily on food crops the household produced, most households purchased some foods (e.g. fresh vegetables, meat, tinned food, sugar, salt, tea).

Another nutrition-related concern that was raised by many farmers was eating times and in particular when the last meal of the day should take place. As highlighted by many farmers:

We would like to get information on the appropriate time to eat and why is not good to eat late (Female community member, FGD, Soloba)

In all six communities food choices were often shaped by environmental conditions (e.g. seasons) and/or the economic condition of the household (e.g. available budget to purchase food). Farmers expressed a need for information on how to make healthy food choices under these conditions, as noted in the following quotes:

We would love to eat a lot of things but during the dry season we don't get the food, especially the pumpkin leaves and other leaves. If they are able to teach us what we should eat as substitute we would appreciate it. (Female community member, FGD, Nzoro)

I want to know exactly what to buy with my small money to eat to stay healthy. (Male farmer, FGD, Foli)

A few farmers also voiced information needs with regards to food safety and, in particular, how to remove potential residues of fertilizers and pesticides from food. There was also the misperception among some farmers that food produced with the help of fertilisers had lower concentrations of various nutrients than traditionally produced food.

Additional information needs identified by health workers

Health workers interviewed in both CR (n=1) and UWR (n=2) were convinced that farmers mostly did not lack basic information about nutrition – mainly because information was provided to all women during antenatal and postnatal care – nor access to healthy food. However, they believed that more information on household food-processing and nutrient-preserving cooking practices was needed, as highlighted by a health worker from Nzoro:

The food stuffs they have here is healthy but as to how they cook it will determine how nutritious the food is. If you overcook some of the vegetables and leaves you will end up losing all the nutrients in it so we advise them on how to cook those stuffs to preserve the nutrients. (Health worker, IDI, Nzoro)

4.3.2.2 Farmers' active efforts to obtain nutrition information

Most female farmers had never actively looked for information about nutrition, but relied on informal sources such as older family members, mainly mothers and grandmothers, and formal

sources, mainly health workers during ante- and postnatal visits (86% of rural women attend at least one antenatal visit in Ghana (Ghana Statistical Service 2014a), occasional hospital visits to treat an illness and monthly community-based Baby Well Clinics.¹⁰

The only information we have is from our grandmothers, which was then passed to our mothers then us. The only time we get access to nutrition information from health workers is when we are sick and we go to the hospital or when pregnant women and mothers attend antenatal and postnatal and child welfare clinic. (Female community member, FGD, Wansabianga)

Information providers that farmers trust

Female farmers trusted nutrition information provided by health workers (e.g. community nurses) the most. Health workers could therefore provide advice in the health facility or during community visits (e.g. during Baby Well Clinics). A health worker described different reasons for why farmers valued her advice:

They [the female farmers] generally trust the information we [the health workers] give them. This is because they believe we have been trained in these areas. Also, they know when they do not follow what we tell them and they fall sick, they will end up in our facilities so they try to avoid this situation. (Health worker, IDI, Asara)

The second most-trusted source was informal networks (e.g. older female household members). Information provided was perceived as authentic and based on long experience. Many farmers believed that information had been transferred from one generation to the next and thus gained strength and wisdom.

Other information providers that were mentioned included radio, school children (from health education in school), agriculture extension officers and pharmaceutical drug sellers. Nutrition advice provided by drug sellers was perceived as less reliable as many farmers believed that the sellers' advice was influenced by their interest in selling drugs.

4.3.2.3 Preferred format of nutrition information

Most nutrition information that farmers had access to was provided orally and through face-to-face communication with health workers or family members. Several farmers and community members stressed that information in their local language was most accessible and that they liked food-preparation demonstrations where they prepared or observed the preparation of healthy meals using local foods. However, due to health centres' lack of resources and farmers' unwillingness to bring their own local produce, demonstrations hardly happened as a health worker from Nzoro explained:

The information is not the problem but we find it difficult to organise food demonstrations for them to really see what we are talking about. We tell them to bring food stuffs from their farms after harvest so that we can do it but they don't. (Health worker, IDI, Nzoro)

¹⁰ A monthly community-based health service clinic for preventive growth monitoring of all children aged below five years and health advice for parents of babies and young children.

Audio-visual, ICT-based or printed information on nutrition were not mentioned by any of the interviewees. The radio was mentioned frequently as a good information source.

4.3.2.4 Barriers to accessing nutrition information

Female farmers and female community members in all villages had access to nutrition information through health workers who visited communities on a monthly basis to conduct Baby Well Clinics and as part of outreach programmes, health facilities and informal networks. Formal nutrition information was mainly provided to women through ante-/postnatal clinics and Baby Well Clinics. Consequently, the available formal information mainly focused on nutrition practices during pregnancy and IYCF practices.

Unavailability of information on adult nutrition

Both male and female farmers highlighted lack of specific information (e.g. food choices to support strenuous farm labour and during different seasons). While they identified this information need, none of them had made any attempts to seek out this information, suggesting that it was not a priority.

Lack of perceived need

Most men did not perceive a need for nutrition information. Both men and women agreed that nutrition was the domain of women and that women were more knowledgeable about healthy food choices, meal planning and preparation, although men generally provided the money for food purchases. Many men said that they indirectly benefited from the nutrition education their wives had received, as the women would use what they learned to prepare food for the entire household.

Lack of time

Two health workers believed that lack of time and lack of perceived importance (of nutrition) was a barrier for many community members to accessing health workers with specific nutrition information needs:

Mostly they say there is no time. They spend almost the entire day in their farms. And sometimes it is laziness, they don't see they need to come here and ask some simple questions bothering them. (Health worker, IDI, Nzoro)

4.3.2.5 Perceptions about the delivery of nutrition information with agriculture information

Farmers perceived a natural link between nutrition and agriculture. Nutrition was seen as a requirement for good health, which in turn was necessary to do physically demanding farm work. As a farmer from Soloba stated:

If as a farmer [I] am not healthy, I cannot cultivate my farm and practice what I learned [about farming]. (Male farmer, IDI, Soloba)

Agriculture was also seen as the main provider of food and money to purchase food. Most farmers therefore said they would welcome nutrition information as part of a mobile phone-based agriculture programme, especially if the advice provided helped them to address their information needs (e.g. healthy food choices for difficult times, to support strenuous farm labour).

Several agriculture extension workers from CR said that they had already been trained on nutrition and provided nutrition advice to farmers as part of an Armajaro community development programme.¹¹

4.3.2.6 Utilisation of information

Both health workers and agriculture extension workers who provided nutrition advice said that farmer's actual utilisation and practical implementation of the information provided was limited. They saw many reasons for this, including lack of money to purchase nutritious food they had recommended, lack of time for travel and food preparation, and resistance to changing behaviours and taste preferences, especially among husbands and children.

Similarly, farmers described how they often struggled to use and practise nutrition advice. Their main reasons were lack of money, limited access to recommended foods and limited time (see next sub-section).

4.3.3 Potential implications for the uptake of the mNutrition intervention

Table 4.4 shows the key findings on farmers' information needs and information-seeking behaviours related to agriculture and nutrition. The third column presents suggestions for the mNutrition intervention design based on the qualitative findings. The last column highlights aspects to follow up in subsequent qualitative data collection rounds (i.e. the qualitative midline and the qualitative follow-up at the endline).

¹¹ Armajaro Ltd is the largest global buyer of cocoa beans produced in Ghana. The company delivers community development programmes in the major cocoa regions in Ghana. It also assists farmers through its various initiatives to boost their crop yields. The company works with Source Trust, a non-profit organisation established by Armajaro, which aims to improve farmers' yield through the delivery of projects to develop farmers business, knowledge and skills (Ghana 2011).

Table 4.3: Qualitative key findings on barriers to and facilitators of the uptake of the mNutrition intervention in the six qualitative study communities

Key findings		Potential implications for the uptake of the mNutrition intervention	Recommendations for the quantitative survey design	Suggestions for the mNutrition intervention design based on emerging qualitative findings	Aspects to follow up in subsequent qualitative data collection
Agriculture information-seeking and use					
Agriculture information needs	Farmers are mainly concerned with ways of increasing agricultural yields (e.g. through correct use of fertilisers, cropping techniques) and how to get access to loans and credits for agricultural inputs	The agricultural messages in mNutrition cover many of the priority information needs for farmers and might therefore be well received	Assess farmers' agricultural information needs	The addition of agricultural messages on access to credits and loans for agricultural inputs should be considered	Explore farmers' experiences with, uptake and utilisation of the different agricultural content in the messages
	Information needs change depending on season, characteristics and farmers' experiences and are location specific.	The more tailored the messages, the more likely would be mNutrition's successful uptake	Assess farmers' agricultural information needs throughout the year	Agricultural messages should be tailored to the individual characteristics, experiences, location and needs of each farmer	Explore how farmers perceive tailored messages (e.g. Are messages specific enough to address their individual needs? Why/why not?)
	Farmers in CR identified information needs on the production of food crops (currently available agriculture support in this region focuses mainly on cacao and rubber production)	Agricultural messages on nutritious food crops and their production might be well received in the CR as they address an existing information gap	Assess whether farmers' information needs vary by location	Agricultural messages should be tailored to food crops that farmers have selected for themselves and should include information on production and safe storage	Explore how farmers from CR experience and perceive mNutrition agricultural messages on food crops (e.g. Do farmers believe that the food crop messages help them? How? Why/why not? Is there any information that is missing?)
	Farmers in UWR have more pressing information needs on all agriculture-related activities, as access to agriculture extension services is more difficult in this region	Agricultural messages might be well received in UWR as they address an existing information gap	Assess whether farmers' information needs vary by location	Consider more frequent agricultural information messages given the scarcity of information in UWR	Explore how farmers from UWR experience and perceive mNutrition agricultural messages (e.g. Do farmers believe that the messages help them? How? Why/why not?)

					not? Is there any information that is missing?)
National experts identified information gaps on profitable agricultural marketing strategies and up-to-date market prices. In this context, region-specific sales strategies need to be considered, too. In CR farmers prefer to sell to traders from within or outside the community to save transport costs and for better prices. In UWR farmers are more likely to sell their products on local markets, but often hold products back for a better price	In CR, market price messages might help to strengthen farmers' negotiating power with local traders In UWR, market price messages might help farmers to choose the best time to sell their products for profit. Whether farmers benefit from price information depends on whether they have access to safe storage facilities	Assess whether farmers have information needs related to marketing	Agricultural messages in CR could include information on sales strategies to local traders (e.g. how to negotiate a good price).	Explore how farmers perceive and value market price information (e.g. Did the information help them? How? Why/why not?)	
National experts stressed that farmers need accurate weather information to select the best time for planting and harvesting	Currently, farmers receive weather information from several (more or less reliable) sources. More accurate and reliable information via messages might be well received	Assess whether farmers have information needs related to weather	–	Explore farmers' experience with the weather information messages. (e.g. did farmers value the messages? Why/why not?)	
Farmers' information needs are gender specific. Female farmers lack access to information in all areas (e.g. access to land, agricultural inputs and agriculture extension services)	Agriculture messages might help to address some of female farmers' information gaps. However, whether they can utilise the information depends on various social, economic and environmental factors	Assess female farmers' information needs	Gender-specific agricultural messages should be considered. Messages for females could include information on access to land, agricultural inputs and resources, while always taking women's social, economic and mobility barriers into consideration	Gain an understanding of female farmers' experiences with the agricultural messages (e.g. Did they perceive the messages as helpful? Why/why not? Did they face any barriers when attempting to utilise the information? What factors facilitated use of the information?)	

Seeking agricultural information	Most male farmers seek agricultural information actively from agriculture extension workers and both male and female farmers seek information from social networks	<p>Agriculture messages might be well received as long as they help farmers to address their specific information gaps</p> <p>As farmers potentially already have a lot of information (and experience), agriculture messages might not add anything new or might be perceived as non-specific or not tailored to their needs</p>	Assess and rank farmers preferred information sources	Agricultural messages should be tailored to the individual characteristics, existing knowledge and needs of each farmer. This can be done / improved upon when thorough farmer profiling takes place during the registration process	Explore farmers' experiences with the agricultural messages (e.g. How useful were the messages? Did the messages provide new information? Why/Why not?); explore gender differences
Trusted sources	Agriculture extension workers are the most trusted formal source for information	If farmers associate agricultural messages with agriculture extension services, they might be likely to trust and take up the messages	Assess and rank farmers' preferred information sources	Appropriate framing of the agricultural messages and the sender might be important for successful uptake. Involvement of agriculture extension services (e.g. as sender) might increase uptake	Explore how farmers perceive the mNutrition agricultural messages (e.g. did they trust the content of the messages? Why/why not?)
	Farmers' lose confidence in agriculture extension workers if they provide advice that is perceived as incorrect or does not solve a problem (especially the case in CR)	Farmers' interest and trust in and engagement with the agricultural messages might dwindle if messages are perceived as incorrect or inefficient	Assess farmers' perceptions of the quality of information they receive	To ensure sustained uptake and use of messages periodic checks with farmers to assess their perceptions about the usefulness of the messages is important. If necessary, content might need to be adapted/changed	Explore farmers' perceptions of the usefulness and correctness of the messages
	Agricultural information provided through interactive face-to-face communication is preferred (especially when combined with practical demonstrations) Written information is only valued by more educated, literate farmers	The majority of agricultural messages are delivered via voice messages which could encourage uptake among illiterate farmers. However, there is no interaction (except through the call centre) that might reduce uptake or lead to drop-outs	Assess which channels and media farmers prefer when receiving agricultural information	Promote active interaction about the content of the agricultural messages with other farmers in the community and through the call centre	Explore farmers' perception about voice messages and their experiences with the call centre (e.g. Do farmers miss an interactive component in regular agriculture messages? Why/why not?)

	Some (mainly more highly educated) farmers regularly use their mobile phones to get advice from agriculture extension workers and seek agricultural information (e.g. price information)	Farmers are familiar with using mobile phones for agriculture information-seeking and might therefore receive mobile phone-based agricultural messages well	Assess frequency of using mobile phones to contact agriculture extension workers	No recommendations	Explore farmers' perceptions of and experiences with receiving mobile phone-based agricultural advice messages
Farmers' willingness to subscribe	Farmers are willing to subscribe to mobile phone-based agriculture messages as long as the content of messages benefits their agricultural production and they perceive the sender as trustworthy	Sustained uptake of the mNutrition agricultural service depends on the perceived benefits of messages for agricultural production and trustworthiness of the sender	No recommendations	To ensure sustained uptake and use of messages, periodic checks with farmers to assess their perceptions about the usefulness of the messages is important. If necessary the content might need to be adapted/changed Involvement of trustworthy senders (e.g. agriculture extension services) might increase uptake	Explore farmers' experiences with messages and their perceptions about the sender (e.g. Explore whether they would be willing to pay for the service they received. Why/why not?)
Barriers to agricultural information	Unavailability of agriculture extension workers	Agricultural messages might help to address existing information gaps in agriculture extension services (with regards to provision of information)	Assess coverage of agriculture extension services	Check perceived availability of extension workers who might act as 'informal' agents to promote service.	Explore how farmers perceive and value mNutrition agricultural messages compared to 'traditional' agriculture extension services (e.g. Do farmers believe agricultural messages can complement or substitute agriculture extension services? Why/why not?)
	In UWR, long distances and poor transport links pose a barrier to access to agriculture extension services (especially for female farmers who have limited mobility due to	Agricultural messages may be particularly welcome in UWR where access to information is especially challenging	Assess accessibility of agriculture extension services		Explore how farmers, in particular female farmers, perceive and value mNutrition agricultural messages compared to 'traditional' agriculture extension services (e.g. Do farmers believe

	social and environmental factors)				agriculture messages can complement or substitute agriculture extension services? Why/why not?)
	A poor knowledge-sharing culture between spouses poses a barrier to accessing agricultural information	Agricultural messages delivered to female farmers' mobile phones might help to address information gaps Information from agricultural messages may not be shared between spouses	No recommendations	mNutrition could help to promote a better knowledge-sharing culture by encouraging farmers to share information	Explore female farmers' perceptions about the usefulness of the agriculture messages Explore whether mNutrition messages are shared between spouses or within households. Explore potential barriers to and facilitators of information-sharing
Utilisation of agriculture information	Farmers use agricultural information provided by trusted sources as long as the advice does not involve additional (large) expenses for inputs	Agricultural messages with advice that requires costly inputs (e.g. fertiliser) are less likely to be taken up	No recommendations	Agricultural messages should focus on low-cost, subsidised or free-of charge inputs and techniques as much as possible	Explore how farmers perceive and react to agricultural messages that require additional inputs and to messages that do not (e.g. Which type of messages do farmers prefer? Why? Do they act on messages that require additional inputs? Why/why not?)
Nutrition information-seeking behaviour and use					
Information needs	Information on nutrition is not perceived as a priority, although farmers are interested in learning more about food choices to promote health and support energy demands for physical/farm labour	As farmers do not perceive an acute need for nutrition information, nutrition messages may be less well received than agriculture messages, except messages that address information gaps identified (e.g. food choices for health and to support labour)	Assess farmers' information needs related to nutrition	Nutrition messages should include information on food choices that promote health and support energy demands during physical labour	Explore farmers' perceptions of the nutrition messages (e.g. did they perceive the messages as useful? Why/why not?)
	Knowledge levels on infant and young child feeding (IYCF) and nutrition during	Nutrition messages might not provide a lot of new information to female	Assess farmers' knowledge levels on nutrition	–	Explore how female farmers with and without children perceive

	pregnancy are good among female farmers due to the nutrition information provided to all women during antenatal care and monthly community-based Baby Well Clinics	farmers who have a child or children. However, they might act as a refresher for existing knowledge			messages (e.g. Do the messages provide new knowledge/refresh existing knowledge? How and why?)
	Men are less interested in information about nutrition due to their limited role in meal planning and food preparation	Men might be less interested in nutrition messages than women	No recommendations	Nutrition messages should aim to increase male farmers' interest in nutrition (e.g. by providing information about food choices to promote physical labour)	Explore male farmers' experiences with, barriers to and facilitators of uptake of and engagement with nutrition messages (e.g. What type of nutrition messages do they find useful/not useful? Why/Why not? How do they react to messages they find useful – e.g. sharing within the household, with other farmers)
	Farmers voice a need for information on healthy food choices across seasons, especially during dry seasons and times of economic hardship	Nutrition messages that are contextualised to farmers' environmental and economic conditions are likely to be well received Lack of contextualisation might reduce the likelihood of uptake	Assess farmers' information needs related to nutrition	mNutrition messages should include information on how to choose and if necessary substitute foods across seasons and in times of economic hardship	Explore whether farmers' perceptions and knowledge of food choices during different seasons and during economic hardships has changed due to the nutrition messages (e.g. How have meal times changed? Why/why not? Is there any information regarding meal times missing?)
	Information on nutrient-preserving cooking practices is needed, as highlighted by experts	Females may well perceive information on nutrient-preserving cooking practices as useful because they are responsible for food preparation, although no female farmer voiced a need for this information	Assess farmers' information needs related to nutrition	Nutrition messages should include information on nutrient-preserving cooking practices, especially messages targeted at female farmers	Explore whether farmers' perceptions and knowledge of cooking practices has changed due to nutrition messages

Information-seeking behaviour	Farmers do not actively seek information on nutrition as it is not perceived as a priority	The lack of active information-seeking on nutrition might result in a low uptake of nutrition messages	Assess whether or not farmers seek information on nutrition	Nutrition messages should try to arouse farmers' interest by specifically targeting identified nutrition information needs (e.g. healthy food choices during economic hardship, to support energy demands during physical labour)	Explore farmers' perceptions of messages and how it affects uptake (e.g. Were there any nutrition messages that farmers found particularly useful? Why/why not?)
Trusted sources	Health workers are the most trusted formal information source	If farmers associate nutrition messages with health services, they might be likely to trust and take up messages	Assess preferred information sources for nutrition	Appropriate framing of nutrition messages and the sender might be important for successful uptake. Involvement of health services (e.g. as sender) might increase uptake	Explore how farmers perceive mNutrition messages (e.g. Do they trust the content of the messages? Why/why not?)
	Nutrition information provided through interactive face-to-face communication and with practical demonstration is preferred	All nutrition messages are delivered via voice messages, which could encourage uptake among illiterate farmers. However, there is no interaction, except through the call centre, which might reduce uptake or lead to drop-outs	No recommendations	Promote active interaction about the content of nutrition messages within the household, the community and through the call centre	Explore farmers' perceptions about voice messages and their experiences with the call centre (e.g. Do farmers miss an interactive component in the nutrition messages? Why/why not?)
Barriers to nutrition information	Unavailability of information on adult nutrition. Most existing information focuses on IYCF and nutrition during pregnancy)	Nutrition messages might help to address existing knowledge gaps	No recommendations	–	Explore how farmers perceive the nutrition messages (e.g. Do they address existing knowledge gaps?)
	Lack of perceived need of nutrition information, especially among male farmers	Lack of perceived need for nutrition information might pose an important barrier to uptake	Assess perceived need for information on nutrition	Nutrition messages should try to arouse farmers' interest by specifically targeting identified nutrition information needs (e.g. healthy food choices during economic hardship, to support energy demands during physical labour)	Explore farmers' perceptions of nutrition messages (e.g. Do the messages arouse their interest? How and why?)

Perceptions about agriculture–nutrition link	Farmers perceive a natural link between agriculture and nutrition, mainly via the pathway that good nutrition promotes physical health that is a precondition for physical farm labour	Nutrition messages may be well received if they promote the health properties of good nutrition	No recommendations	Nutrition messages should stress the health properties of good nutrition	Explore farmers' perceptions about receiving both agricultural and nutrition messages (e.g. Do they think the messages complement each other? Why/why not? Was there any information missing?)
Utilisation of nutrition information	Several economic and social barriers to utilisation of nutrition information among farmers exist	Implementation of nutrition messages might be hampered by multiple barriers	Assess economic and social barriers	Nutrition messages need to be contextualised and take widespread social and economic barriers into consideration	Explore barriers and facilitators to utilisation of the nutrition messages

4.4 Social, economic and environmental factors that may influence behaviour change related to agriculture and nutrition

Changing established behaviours – whether they are related to agriculture or nutrition – is difficult (Barnett, Scott, Batchelor and Haddad 2016). Findings from this exploratory qualitative study provide valuable insights into various social, economic and environmental factors that may act as barriers to behaviour change in response to the mNutrition messages that farmers receive.

4.4.1 Reported barriers to improving agriculture practices

4.4.1.1 Poverty

Economic factors emerged as the potential main barrier to the change of agriculture practices and the adoption of new practices among farmers in both CR and UWR equally. A farmer from Asara explained what many other farmers said:

All the problems we face [are] dependent on money. For example, to get farming inputs such as cutlass, medicine (insecticides and weedicides), boots, etc. we require money but because we don't have money, we are not able to get these inputs so we farm on small scale... We are not able to save after taking care of all expenses which include buying books, paying fees and school uniform (Male farmer, FGD, Asara)

One of the national agriculture experts adds that inputs that are most effective are usually expensive:

good-quality inputs, especially fertilisers, are more expensive. Even if there is a subsidy [for fertiliser], it is not on the fertilisers that they would really want. (National agriculture expert, IDI, Accra)

Economic factors that were frequently mentioned as a potential barrier to change included costs for required agricultural inputs (e.g. fertiliser, seeds) and costs for temporary hired farm labour (e.g. for labour-intensive land preparation).

Some farmers also stated that they did not want to diversify from key staples when the risk of growing even their staple crops was high (e.g. due to uncertain weather conditions).

4.4.1.2 Social learning

Farmers in all six villages explained that they would wait until other farmers in the community had decided to adopt a new agriculture technique or practice before considering a change themselves. Farmers preferably wanted to see proofs of positive effects on yields before changing to ensure that the change was profitable. A farmer noted:

I would prefer to try and see the results before adopting new methods of farming. (Male farmer, FGD, Dolira)

4.4.1.3 Land tenure and ownership

Especially in CR, the existing land tenure system, long-term cocoa cultivation and conditions associated with it¹² could pose a challenge to a change in agricultural practices. As a key informant from CR stated:

Most of the farmers in this area [CR] are migrants. So, when they acquire [lease] lands, the land owners tell them what to cultivate and it is mostly cocoa... In situations where the farmer is interested in cultivating a different crop other than cocoa, he will have to seek the consent of the land owner. The farmer can only cultivate different crops when the land owner agrees. In most cases, it is only when the land is not suitable for cocoa that the farmers are allowed to cultivate different crops like oil palm. (Key informant, IDI, Soloba)

Nevertheless, most landowners allowed farmers to cultivate some food crops for own consumption and/or start home gardens on the leased land.

4.4.1.4 Unavailability of profitable markets for agricultural products

Access and availability to profitable markets for agricultural products posed a challenge for farmers in both CR and UWR. Apart from the remoteness and high transport costs to markets, farmers highlighted that oversupply of the same agricultural product during harvest season resulted in low prices and minimal profits only, as described by the chief farmer of Soloba:

The only market easily accessible to us is the district market but we don't like selling there. This is because the crops are always in abundance on the district market, hence the buyers offer very cheap prices for our produce. Also, because we don't have any stall to keep our crops, we are always forced to sell our produce cheap. (Chief farmer, IDI, Soloba)

In CR, there was a market with fixed prices for the main cash crops, cocoa and rubber, but no profitable market for other agricultural products, as illustrated by the quote of a head teacher and farmer from Soloba:

Markets are a challenge, I was given a land to cultivate and I grew cassava but because I could not consume all, I decided to sell some and I was shocked. A full sack of cassava can cost 20 or 30 Ghana cedi, a bunch of plantain for 5 Ghana cedi. After farming for a year, apart from the little you consume at home, all you get is 20 Ghana cedi so there is no market for the farmer's produce except for cocoa which the price is set by government. (Headteacher and farmer, IDI, Soloba)

Access to markets posed a particular challenge for female farmers, especially in UWR, due to their limited social mobility outside of their communities.

¹² See also Barnett and Srivastava (2017)

4.4.1.5 Limited access to necessary farm equipment to prepare the land

In UWR, small-scale farmers frequently hired tractors from large- or medium-scale farmers (Diao, Cossar, Houssou and Kolavalli 2014). The tractors were described as vital for the effective preparation of land for planting. As tractors were usually used by their owners first and then hired out to small-scale farmers across different villages, access was difficult and delayed. This delay often caused farmers to miss the best time for land preparation before or just at the start of the rainy season, making planting more challenging and could negatively affect yields;

When it is time for farming, we don't get tractor and even if it comes it will not come on time... The tractor comes from somewhere and it has to finish the work there before it comes here so by the time it gets here the land preparation season has elapsed. (Male farmer, FGD, Foli)

4.4.1.6 Additional barriers for female farmers

Intra-household decision-making

In UWR many female farmers explained that their husbands decided what crops the household would grow and that women usually could not influence his decisions.

Our husbands decide what to grow. We have no authority over our husbands. (Female farmer, FGD, Yizire)

Consequently, it might be impossible for female farmers to cultivate new crops or change cropping patterns if their spouses did not agree. In CR decisions on food crop production were often made by men and women together, whereas decisions related to the cash crop cultivation were made by the landowner.

Availability of farm labour

Female farmers who were widowed or whose spouse/sons had migrated in search of work often relied on hired labour to help with physically demanding work such as land clearing and preparation for planting and weeding. An agriculture extension officer from Nzoro explained:

For the women, their problem is the labour. The men are able to organise their colleagues to help them out but it is not so with the women, they have to get labour in, which is difficult. (Agriculture extension worker, IDI, Nzoro)

However, as described by several female farmers and also the desk review conducted previously by the impact evaluation team,¹³ high levels of rural-to-urban migration resulted in a dramatic loss of rural agricultural labour. Consequently, it had become increasingly difficult and expensive to find labourers, especially just before and at the beginning of the rainy season when there was a high need for additional help.

¹³ See *ibid.*

4.4.2 Reported barriers to improving dietary practices

4.4.2.1 Poverty

Poverty was stated as the main barrier to improving dietary practices by farmers and community members in all six villages, although it was mentioned more frequently in UWR. As also highlighted in the previous review, most farmers explained that while they consumed food produced on their own farm, they still had to buy in some food stuff especially in the dry season when farm production was low. Food purchased from the outside was perceived as more nutritious than home-grown food, as said by a farmer:

For us farmers, we are not lucky, we may get the food stuffs fresh but the ingredients that will make the food rich may be lacking because I may not be able to afford it. I may wish to add soya beans, fish or meat, garlic but all these may be lacking. These are foods that are rich and can make you strong but due to circumstances, you will be forced to add only kontomire [cocoyam leaves], pepper and salt. (Female farmer, FGD, Asara)

While the majority of farmers were aware that a good diet is a varied diet with staples, meat, dairy, egg and vegetables, most of them were simply unable to afford such a diet. They had to rely on the crops they produced themselves and small amounts of food bought in. One farmer noted:

With the foods, we eat all but because of money it is difficult... to eat and be happy or comfortable, you need money to buy the food. So mostly, if we get nutritious food, we will eat but there is no money so it [is] the cassava, plantain that is what we eat. Sometimes we eat with grinded hot pepper without fish. (Male farmer, FGD, Soloba)

Some farmers were frustrated that poverty prevented them from following the nutritional advice they had been given by health workers:

The doctors tell us to eat breakfast but we don't have money to provide the breakfast so I will prefer if they call and find out what I have and they advise us on what we should eat. (Male farmer, FGD, Asara)

In times of acute economic hardship (e.g. during droughts) or if money was required urgently (e.g. unexpected illness or death, to buy school books) farmers in UWR often sold most of the food crops dedicated for household consumption and thus reduced the quantity and diversity of the household's diet further.

4.4.2.2 Food insecurity

Limited food availability and in particular availability of fresh vegetables and food in local markets and difficult access (due to distance to local market, poor infrastructure and lack of money) were stressed as the main reasons for household food insecurity. As one female farmer noted:

No one sells meat in this community, so if you want to eat meat you have to travel to Breaman Asikuma (District Capital) to buy it. (Female farmer, FGD, Asara)

Access to fresh food also varied greatly between seasons and during the dry season, especially, the variety of foods in local markets was limited and farmers also lacked money to purchase these foods.

4.4.2.3 Time allocation conflicts

Female farmers repeatedly reported the substantial time burden farm work could place on them and how this could force them to condense household chores and in particular the time spent on food preparation and the purchase of fresh foods in distant local markets. One woman stated:

We do not have time to cook because we overwork in the farm and come home late so we have to prepare a quick fix meal which is mostly not healthy (Community woman, FGD, Soloba)

4.4.2.4 Limited female participation in decision-making regarding food choices

Female participation in intra-household decisions about food purchase and consumption has previously been shown to be an important determinant for dietary diversity of households' food consumption in Ghana. Based on the qualitative data, most women had at least some say in households' food choices and purchasing decisions. However, as men usually provided the budget for the food purchase and decided what food crops the household cultivated, they often made the final decision. Who brings in the money seemed to be the guiding factor for household decision-making, as highlighted by several women:

I ask my husband what I should cook, especially when he gives money for the food preparation, but when the money comes from me I use my discretion. (Female farmer, FGD, Nzoro)

The food to be eaten is mostly determined by our husbands but in instances when he does not tell me I use my own discretion. The latter happens mostly when he does not leave any housekeeping money to prepare food. (Community woman, FGD, Soloba)

In some households (especially in UWR), men decided what the household would consume without consulting the women.

4.4.2.5 Food preferences and traditions

Food preferences and taste emerged as important determinants of food choices in many households. The husbands', but in some cases also the children's, preferences influence what foods were purchased and prepared.

Especially in UWR, many women strictly complied with traditional practices related to serving and consuming food. Several women describe these traditions as follows:

The food is prepared it is served by the women in the old tradition, that is giving the best portion to the husband. (Community woman 1, FGD, Nzoro)

Some men want to share the meat themselves, which is not good. (Community woman 2, FGD, Nzoro)

Some men serve food in their household, but that is not our tradition or norm it is just bad attitude and greed. (Community woman 3, FGD, Nzoro)

As for me I won't even allow my husband to serve the food! Eeei! Me the woman I have prepared my food and you want to share the meat? It won't work. (Community woman 3, FGD, Nzoro)

This tradition might contribute to the low quality of food consumed by women and children.

4.4.2.6 Low diversity in agricultural production

Farmers usually did not cultivate a large diversity of food crops and meat production was rare and if done, animals were slaughtered infrequently. Livestock-rearing was practised for purposes of sale and income rather than meat consumption. The additional challenge was that the yields from the cultivated food crop were consistently low, as there was no budget to buy fertilizer and no irrigation. As a consequence, the diversity of foods available to the farming households from their own production was limited, especially with regards to fruits, vegetable and meat. During the dry season, dietary diversity often dropped further as agriculture production was limited and there was a lack of money to buy additional food stuffs from the outside.

4.4.3 Potential implications of the findings for behaviour change related to agriculture and nutrition

Table 4.5 shows the key findings on social, environmental and economic factors that may influence behaviour change related to agriculture and nutrition in response to the mNutrition messages. Column 3 presents suggestions for the quantitative survey, column 4 for the design of the mNutrition intervention and column 5 aspects to follow up in subsequent qualitative data collection rounds.

Table 4.4: Qualitative key findings on social, environmental and economic factors that may influence behaviour change related to agriculture and nutrition in the six qualitative study communities

Key findings		Potential implications for the uptake of the mNutrition intervention	Recommendations for the quantitative survey	Suggestions for the mNutrition intervention design based on emerging qualitative findings	Aspects to follow up in subsequent qualitative data collection
Barriers to improving agricultural practices					
Poverty	Low income poses a major barrier to change as farmers cannot afford required agricultural inputs (e.g. fertiliser, labour)	mNutrition agriculture messages that propose the use of additional bought-in agricultural inputs might not be successful	Poverty levels using different indicators Expenditures for agricultural inputs	Agricultural messages should only recommend the use of low-cost or free-of-charge inputs and perhaps crops that are low risk and less labour intensive	Explore whether farmers purchased new agricultural inputs to increase/diversify their yields in response to the messages (e.g. Why/why not?)
Social learning	Farmers are more comfortable changing practices in a group and after seeing visual proofs of the positive results of the change	Agricultural messages might be more successful in promoting change when discussed and shared with other farmers	Impact of farmer to farmer learning (frequency, issues, etc.)–	Agricultural messages should promote active interaction about the content of the messages with other farmers	Explore whether farmers discussed content of the messages with other farmers (e.g. Why? How did this influence their decision to change?)
Land tenure system	In CR, most farmers do not own their land and have no or limited control over what they plant	Landowners might oppose suggested change in crops cultivated on their land, although they usually allow cultivation of small amounts of food crops in addition to main cash crops	Land tenure, decision-making regarding crop cultivation	Agricultural messages should consider the existing land tenure system in CR and the restrictions this might pose for farmers	Explore whether farmers in CR changed the crops they cultivated in response to the messages (e.g. Why? Why not? Was the existing land tenure system a barrier to change?)
Unavailability of markets	Oversupply of agricultural products during	Agricultural messages that help farmers to increase their yields	Availability of safe storage facilities	Agricultural messages should include advice on how to store products safely for sale during	Explore the potential effect of increased agricultural production in response to the messages on

	harvest season (aggravated by the lack of safe storage facilities) results in low prices and low farm income	might promote further oversupply and associated price cuts if not combined with advice on storage		more profitable seasons (e.g. during the dry season when supply is low)	market prices. Explore whether farmers changed the timing for sale in response to the messages (e.g. How and why?)
	In CR, no profitable market for food crops exists, only markets for cash crops	Promotion of the cultivation of food crops for sale is unlikely to improve farming income significantly due to the absence of a profitable market	–	Messages should consider the existing lack of a profitable market for food crops in CR	Explore whether farmers in CR are more likely to attempt to sell food crops on local markets in response to the messages (e.g. What were their experiences?)
Intra-household decision-making	In UWR, male household members decide which crops the household grows and female farmers have limited or no influence on their decisions	Female farmers might not be able to follow suggestions for crops or cropping patterns in the messages due to limited participation in intra-household decision-making	Intra-household decision-making about crop production	Messages should consider female farmers' potential lack of participation in decisions regarding crops cultivated and patterns employed, especially in UWR	Explore whether female farmers in UWR changed cropping patterns in response to the messages (e.g. How and why? What barriers and facilitators did they encounter?)
Lack of farm labour for hire	Very limited availability of farm labour for hire, which especially affects female farmers who often depend on hired labour for physically demanding farm work	Farmers, in particular female farmers, might not be able to follow advice that required labour-intensive agricultural input due to lack of hired labour	–	Messages should consider the shortfall of hired labour and potential impact on labour intensive agricultural work	Explore whether lack of farm labour for hire posed a challenge when attempting to follow advice in messages (e.g. Why? How did farmers deal with this challenge?)

		Barriers to improving dietary practices			
Poverty	Due to low income farmers are unable to purchase nutritious, varied food stuffs from local markets and have to rely on (monotonous) own production. There is a misconception that nutritious food has to be purchased	Nutrition messages that promote a more varied diet based on farmers' own production might be very effective, as they save money and improve farmers' diet	Types of foods bought in Household's expenditure on food	Messages should include information on how to prepare varied, nutritious meals using farmers' own production and/or only limited, low-cost external foods	Explore how farmers experienced dietary advice provided by the messages (e.g. Was it helpful? Did it lead to a change in practices? Why/why not?)
Food insecurity	Access to and availability of fresh foods poses a challenge especially in UWR	Farmers might be unable to follow advice regarding consumption of fresh food (e.g. vegetables, meat) due to limited availability and access	Experience of food insecurity and coping strategies	Messages should consider challenges of access to and availability of fresh foods	Explore whether farming households changed the consumption of fresh foods in response to the messages (e.g. Why/why not?)
Time allocation conflicts	Farm work poses a substantial time burden for females and prevents them from travelling to local markets to purchase fresh foods and from preparing healthy meals	Messages that promote time-saving techniques for the preparation of healthy meals might be very effective	Female farmers' daily time allocation	Messages should consider the time demands on females and suggest quick and healthy meal options	Explore whether females perceive time as a barrier to following the nutrition messages (e.g. Why/why not? How do they deal with it?)
Limited female participation in food choices	Women's participation in food choice decisions was limited,	Women might not be able to follow advice regarding food choices given their limited participation in intra-	Intra-household decision-making regarding food consumption	Messages need to consider that women's contribution to decision-making regarding food choices is often limited	Explore whether women are able to follow advice regarding food choices (e.g. What barriers and facilitators do they experience?)

	especially as men usually provided the budget to purchase food	household decision-making			
Food preferences and traditions	Food preferences contribute to households' food choice decisions	Messages that are not contextualised to local food preferences might not be successful in changing dietary practices	–	Messages should consider local tastes and food preferences	Explore whether food preferences are a facilitator of or barrier to implementing the mNutrition messages
	Especially in Upper West, men receive the best and larger portion of the food during meals, whereas women and children consume the remaining portion	Messages might challenge the traditional practice leading to change or conflict	–	Messages should consider traditional meal-sharing patterns	Explore whether the mNutrition messages have an effect on traditional meal-sharing practices (e.g. How and why?)
Low diversity in agriculture production	Low diversity in agriculture production contributes to low dietary diversity	Messages that promote diversification of food crop production might contribute to higher dietary diversity	Diversity of agricultural production, including cash crops and subsistence food crops	Messages should promote diversification of food crop cultivation	Explore whether farmers have diversified their food crop cultivation in response to the messages and whether this has had an effect on dietary diversity

5 Summary of the main findings and potential implications for the uptake of mNutrition

The findings presented in this report have a number of potential implications for the uptake of the mNutrition messages, the effectiveness of the messages in triggering change in agricultural behaviours and dietary practices, and for the evaluation (and subsequent qualitative data collection rounds and the encouragement approach and survey used in the quantitative component). Detailed presentations of the findings and their potential implications have been presented at the end of each sub-section in section 4. Here we provide a summary of the key findings for each sub-section only.

5.1 Access to, use of and attitudes towards mobile phones

- The majority of farming households in CR and UWR have access to a mobile phone and attitudes towards mobile phone technology were positive overall. However, mobile phones were predominantly owned by men and female access was limited, as the practice of mobile phone-sharing was uncommon. Therefore, reaching female farmers with the mNutrition intervention could be challenging and might depend on intra-household sharing of information.
- Farmers are comfortable with the call function of mobile phones but less familiar with other functions including text messages (SMS) and voice messages. mNutrition voice messages might be an effective approach to inform farmers, as long as farmers know how to operate the voice message function on their mobile phone. Subsequent qualitative rounds of the evaluation need to explore barriers to and facilitators of the uptake of voice messages.
- Farmers frequently distrust MNOs, which might negatively affect the uptake of the mNutrition intervention if mNutrition is promoted as a Vodafone product.
- Mobile network strength and stability are the main determining factors for the choice of network operator and might negatively affect subscription to or activation of VFC SIM cards.

5.2 Potential barriers to and facilitators of the uptake of mNutrition messages

- Patchy network coverage, limited access to electricity (UWR) and power cuts could result in mNutrition messages being delayed or missed.
- Economic and logistical barriers to regular access to call credit for mobile phone top-ups could result in deactivation of the subscription to the mNutrition packages, if new credit is not purchased within two weeks.
- Multiple SIM card use was common to capture the best tariffs and network coverage. However, as dual SIM card phones were still rare most farmers had to manually exchange SIM cards and could therefore easily miss mNutrition messages.
- Limited technical skill in operating the voice message function could mean that farmers miss mNutrition voice messages and/or do not know how to repeatedly listen to them. The

interventions should include some basic training of subscribers on how to listen to voice messages.

- High levels of illiteracy pose a barrier to all text-based information. Voice-based mNutrition messages could enable more farmers to gain access to information.

5.3 Information needs and information-seeking behaviour

- Information on how to increase agricultural yields is a priority for poor farmers and mNutrition agriculture messages could address existing needs. On the other hand, farmers identified few information needs related to nutrition and uptake of nutrition messages might be less enthusiastic.
- In CR farmers identified a need for information on production of food crops, whereas any type of agricultural information was welcomed in UWR, where existing agriculture extension services are patchier.
- Information needs related to agricultural marketing strategies and market prices are highlighted by national experts, but are less of a priority for smallholder farmers as the context of the local markets allowed limited flexibility and room for manoeuvre (e.g. fixed prices, over-supply of agricultural products due to limited storage) and farmers had their own sources of information.
- Farmers' information needs are also gender-specific, with female farmers having less access to information, in addition to greater constraints on acting on this due to social, economic and environmental barriers. mNutrition might help to address some of the existing gaps (access to inputs, etc.).
- Agriculture extension services are the most trusted source for agricultural information; however, services can lose farmers' trust rapidly if the advice given does not yield the expected results or is perceived as incorrect. Appropriate framing of the mNutrition messages is important to build trust.
- Information delivery channels that encourage active interaction and communication are preferred for both agriculture and nutrition information. Uptake of one-way information delivery via mNutrition messages might be limited and the interactive components of the service need to be promoted (e.g. call centre).
- Access to agriculture extension services is limited due to staff shortages, long distances and poor transport links (UWR), social, economic and mobility barriers (for female farmers). mNutrition services might help to address the existing gaps.
- A poor knowledge-sharing culture among male and female farmers might limit access to mNutrition information by female farmers.
- Knowledge levels on IYCF practices are generally good, as information is delivered to all women within the context of antenatal care and monthly child growth monitoring. However, information needs around healthy food choices for adults, to support energy levels during physical labour, during times of economic hardship and the dry seasons are needed. mNutrition messages that address existing information gaps could be very effective.

- Health workers are the most trusted information source for nutrition information. Framing of the mNutrition nutrition messages is important to build trust. As most mNutrition messages are related to production and processing of farm products, agriculture extension workers are likely to be more trusted than health workers for the type of information provided.
- Farmers see a natural link between nutrition and agriculture via the pathway of good health. This perceived association might promote the uptake of the nutrition messages in mNutrition.

5.4 Social, economic and environmental factors that may influence behaviour change

- Household poverty and low income might pose a substantial barrier to change in both agricultural and dietary practices as farmers cannot afford to buy additional inputs or foods. mNutrition messages could potentially address this barrier if they focus on low- or no-cost inputs and foods.
- The existing land tenure system in CR could pose a barrier to agricultural change, as farmers rely on land owners' approval for any changes.
- The unavailability of profitable markets for agricultural products in both CR and UWR could pose a barrier to the improvement of agricultural incomes as agricultural products can only be sold at low or fixed prices.
- Limited availability of tractors (UWR) and hired farm labour, due to rural-to-urban migration, could pose barriers to the adoption of labour-intensive agriculture techniques for certain crops suggested by mNutrition.
- Food insecurity, limited time for food preparation, limited participation of women in household decisions regarding food choices, food preferences and traditions, and limited agricultural diversification may act as barriers to improvements in dietary diversity if not considered sufficiently in the mNutrition messages.

5.5 Guidance for the development of the qualitative midline

Findings from the initial qualitative study will inform the tool development and analysis of the qualitative midline studies (and qualitative follow-up studies at the endline). The summary tables at the end of each sub-section of this report summarise and highlight the most important potential barriers to and enablers of the successful up-take of VFC messages that emerged from the analysis of the initial qualitative study. In the midline, these factors and their potential interaction with VFC services will be explored further. For example, the initial qualitative study highlighted that female farmers are less likely to own or have regular access to a mobile phone. However, female farmers also have the greatest need for agricultural information as they often have only limited access to other information sources (e.g. agriculture extension services). The qualitative midline aims to gain in-depth understanding of female farmers' access to, perceptions of and up-take of VFC messages. These will also include a thorough investigation of gender-specific barriers to and enablers of the translation of the VFC messages into practice, which features of the VFC service women value most and why, which features are perceived as less beneficial and why, how VFC could be improved to address the specific needs of female farmers.

5.6 Comparison of the initial qualitative findings between Ghana and Tanzania

As stated in the introduction of this report, mNutrition is being evaluated in Ghana and Tanzania. A comparison of the key findings from the initial qualitative studies revealed several similarities but also differences between the two countries that may affect the uptake of the intervention in the two countries.

In both countries access to mobile phones seem to be relatively good, although women were generally less likely than men to own or have regular access to a mobile phone. Consequently, reaching women with the mNutrition messages may be challenging in both settings. In both countries, [multiple SIM card](#) use was common and may result in messages being missed. Formal information providers (i.e. health workers, agriculture workers) were the most trusted source of information, however, there were gaps in the service delivery (e.g. due to staff shortages) in both countries that may be addressed by mNutrition. Poverty, food insecurity, lack of time to prepare food and limited agriculture diversity were highlighted as barriers to a change in dietary and agricultural (Ghana only) practices.

Countries varied with [regards to](#) network coverage and access to electricity, with the evaluation sites in Tanzania being better supplied than the sites in Ghana. Additionally, many farmers in Ghana distrusted MNOs, whereas in Tanzania people's attitude towards MNOs was neutral. Technical capacities of the intended users of mNutrition also varied with people in Tanzania being comfortable with reading and receiving SMS text messages, whereas many farmers in Ghana were unsure of how to retrieve a voice message and illiteracy was high. In Tanzania, intended users highlighted that they would be interested in receiving information on nutrition via their mobile phones. In Ghana, intended users said they were interested in agriculture information but less in nutrition information.

Overall, Ghana seem to be a slightly more challenging context for the implementation of mNutrition with more contextual barriers that may affect the up-take of the intervention.

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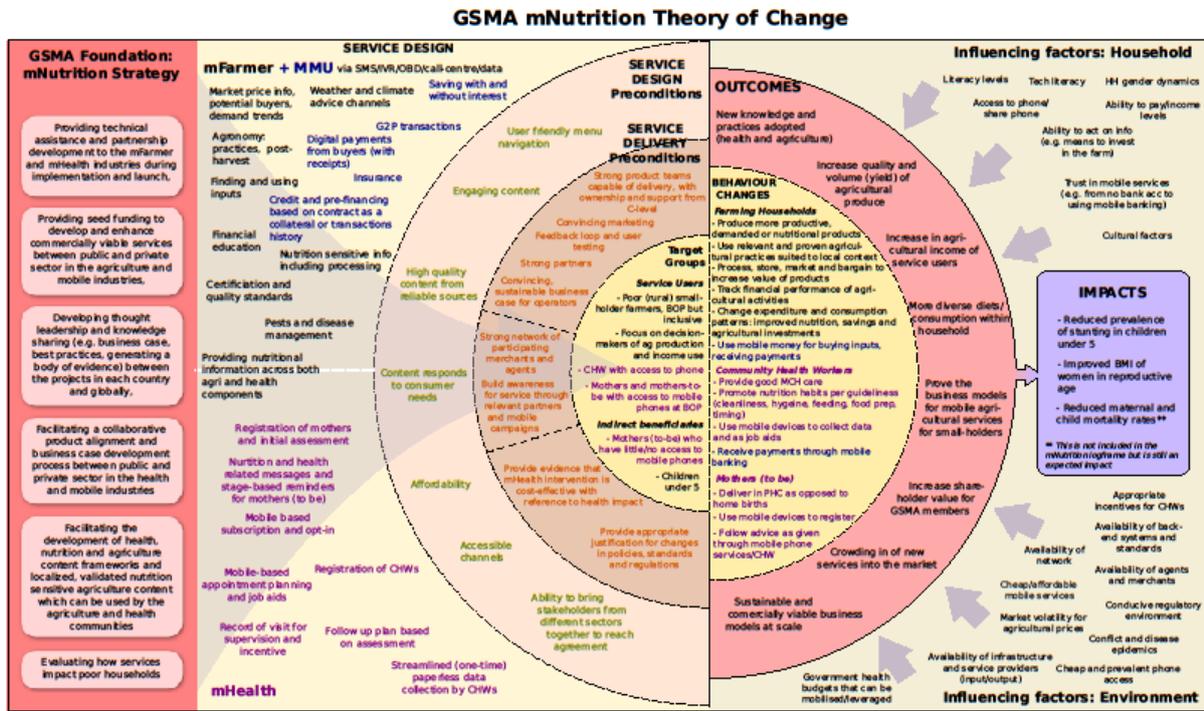
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Annex A GSMA's Theory of Change



Annex B Terms of References

Section 4, Annex A

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 protocols (Horvath, Azman, Kennedy and Rutherford 2012). 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 (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 populations (Alston, Wyatt, Pardey, Marra and Chan-Kang 2000; Anderson 2007; IFPRI 2010; Van den Berg and Jiggins 2007).

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 agricultural-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 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 outputs¹⁴:

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;

¹⁴ Exact timeframe of deliverables will be agreed on 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 Timeline of the impact evaluation

ACTIVITY	2016					2017					2018					2019																						
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D								
QUANTITATIVE COMPONENT																																						
Baseline survey																																						
Endline survey																																						
QUALITATIVE COMPONENT																																						
Baseline data collection																																						
Midline data collection																																						
Endline data collection																																						
BUSINESS MODEL & COST EFFECTIVENESS COMPONENT																																						
Phase 1 stakeholder interviews & data collection																																						
Phase 2 stakeholder interviews & data collection																																						
MIXED METHODS																																						
Mixed methods report																																						
Mixed methods final report																																						

Annex D Topic guides

1. Topic guide for in-depth interview with smallholder farmers (male and female)

Purpose:

- Explore acceptability of mobile phones
- Understand barriers to the use of mobile phones
- Barriers to the up-take of mobile phone messages
- Understand information seeking related to agriculture
- Understand information seeking behaviour related to nutrition

Sample: Smallholder farmers who own a mobile phone or have access to a mobile phone on a regular basis (female and male farmers)

Location: Household

Time for the interview: Approximately 45- 60 minutes

Name (just first name, so you can use their name during the interview)	Age (approximately)	Village	Primary source of income of household (get specifics e.g. ground nut farming)	Do you have other sources of income? What? (e.g. remittances)

Occupation of interviewee	<u>Crops interviewee grows</u> <u>Ask them to list and write down:</u> [Cereals (e.g. maize, rice, sorghum): Starchy crops (e.g. cassava, plantain, sweet potatoes): Legume (e.g. cowpea, ground nut, soya beans): Vegetable (e.g. pepper, tomato, eggplant): Tree crops (e.g. cashew, cocoa, citrus)]	Household size	Which mobile network(s) are you on (if respondent has mobile phone)	
Highest level of education completed		Number of children (<18 years) in the household	Date of interview	

No	Questions	Prompts
Warm up Questions		
	<i>Choose any of these</i> Have you always lived in this community? How is it living in this area? Have you always been a farmer?	

1. Information about farming <i>Say that you now would like to speak a little about their farming practices and where they usually get agricultural information from. (Please refer back to the crops the interviewee grows and that you have listed above)</i>		
1	How do you decide what crop/s you grow?	<ul style="list-style-type: none"> • How? Crops for sale or consumption? • Who? husband/other family members; agriculture extension workers, agricultural shops, FBOs; women's/men's savings groups; community chief/elderly or religious leader? • How often do you change the type of crops you grow?
2	Can you tell me what you do with the different crops you grow?	<ul style="list-style-type: none"> • consume them, sell them in the market <p><i>Ask which crops they sell/consume</i></p>
3	After harvest, how do you decide when is the best time to sell the crops to get the best price? (or whether it is better to store crops and sell 1 week later for a better price)	<ul style="list-style-type: none"> • Whom to sell the crop to, e.g. based on who offers the best price (it might be that they have no choice or and they need to sell it to the person who lent them money or similar reasons)? • Where to sell to? (which market) • Who influences your decision e.g. husband, other family members
4	What are the main problems you face when growing crops?	<ul style="list-style-type: none"> • Problems related to productivity; water access; soil; crop diseases and pests; agricultural inputs such as fertilizers, tools, machines, seeds • Different challenges for crops for sale or consumption
5	Do you use any fertilizer, insecticides or herbicides? Why? Why not?	<ul style="list-style-type: none"> • How and from whom they learn about them? • Whom did you ask for advice and why? <i>[Trust]</i> • Where purchased (agricultural shops)? • Problems in accessing them (e.g. shops are far away and/or difficult to reach; no money to buy agrochemicals; shops don't have the chemicals you need)?
6	When you have questions or concerns about your farming practices, what would you do? Can you give specific example	<ul style="list-style-type: none"> • Who: agriculture extension worker, farmer based organisation, NGO, shop for agricultural inputs, family, community elder, etc.

		<ul style="list-style-type: none"> • What: agricultural methods to improve yield; deal with crop diseases; storing crops; new farming practice • How could the advice be improved? • Whose advice do you trust more? Why or why not? • What factors would influence your decision to change your farming practice (who gives advice; peer pressure, profits)
<p>2. Acceptability, familiarity and use of mobile phone <i>Explain, that you would like to learn more about how they use their mobile phones (or their shared mobile phone).</i></p>		
7	Can you tell me for what you use your mobile phone in your every-day life?	<ul style="list-style-type: none"> • Use: voice call to friends, business contact, to get access to services; SMS; internet; camera • Frequency: everyday/what times; • Duration: how long
8	What functions of the mobile phone do you usually use? Why/Why not?	<ul style="list-style-type: none"> • Do you read SMS? Why/Why not? (e.g. readability, literacy, screen size; who reads the messages for you) • Have you ever received a voice message? • Do you access the internet with your phone? For what? <p><i>Specifically ask about use of Facebook/WhatsApp</i></p>
9	What do you do if you have a problem with your mobile phone (functionality or handset)?	<ul style="list-style-type: none"> • Who? Family member, mobile kiosk owner, others?
10	Are there any problems using your mobile phone?	<ul style="list-style-type: none"> • Access to electricity; money to top-up; access to network • Other family members sometimes restrict your access to the phone • How much of the time is your phone unavailable (for any or all of the reasons discussed above)? How often (frequency), and for how long (duration)?
11	What is your opinion of the mobile network you use?	<ul style="list-style-type: none"> • Why chosen? (e.g. cheapest, special offers, nearby agent)

12	Have you ever used the mobile phone for any farming-related purposes? Explain	<ul style="list-style-type: none"> • To contact agriculture extension workers, call other farmers to enquire about market prices for crops; • Agricultural practices (e.g. plant disease, what crops to grow), etc. • Other activities such as arranging transport, making money transfers, selling crops?
13	Does the mobile phone help you to get agricultural information for your every-day life? How? What information?	<ul style="list-style-type: none"> • Example: Voice calls with agricultural extension worker; SMS from FBO or m-agri services (Esoko) • For voice calls, have you ever called a helpline to get advice? Useful?
14	Have you ever received SMS messages with agricultural information?	<ul style="list-style-type: none"> • Useful? Even if they have not received any messages yet • Why useful? (sender, relevant to needs, time when sent) • Trust that the information is correct • SMS spam
15	What would motivate you to subscribe to a service with regular messages on agriculture?	<ul style="list-style-type: none"> • Costs • Relevant for your needs • Sender of information
16	Have you ever received SMS messages with other information (e.g. nutrition, health)?	<ul style="list-style-type: none"> • Useful, Why?
3. Information about nutrition <i>Say that now you would like to talk a little about healthy diet and food habits</i>		
16	In your opinion, what should people eat to be healthy?	<ul style="list-style-type: none"> • Meat, dairy, legumes (e.g. beans), vegetable and fruit? • Men/women/pregnant women and adults/children?
17	Would you describe your own/your household's diet as a healthy? Why? Why not?	<ul style="list-style-type: none"> • Barriers to a healthy diet (e.g. doesn't have money to buy food) • Who in the household decides what food is purchased?
18	Has anybody ever given you advice on how to eat well? Feed you children well? Explain	<ul style="list-style-type: none"> • Who: Health worker, 78 worker, family, community elder

		<ul style="list-style-type: none">• About: what types of food to eat for health (e.g. crops, vegetables, fruits); cooking healthy food?• How could the advice be improved?• What advice most useful
19	When you have any questions about healthy eating, what would you do? Specify	<ul style="list-style-type: none">• Whom ask for advice? Why?

2. Topic guide for focus group discussion with smallholder farmers

Purpose:

- Explore acceptability and use of mobile phones
- Understand information seeking related to agricultural
- Understand information seeking related to nutrition

Sample: Smallholder farmers (6 FGDs in total with 8-10 farmers each = 2 FGDs with female smallholder farmers+ 2 with subsistence farmers+ 2 with market-oriented farmers)

Time for FGD: Approximately 60-75 minutes

Date of the interview:					Village name			
Background information on participants :								
	Name	Gender	Age	Highest level education completed	Mobile phone ownership or regular access (yes/no)	Main income source of household	Crops grown (list)	Subsistence agriculture only (yes/no)
1								
2								
3								
4								

5								
6								
7								
8								
9								
10								

No	Questions	Prompts
	Warm up question	
	<i>Choose any of these:</i> How is it to live in this area? Are many people in this community farmers? What are the main agricultural crops that are produced in this area?	
	1. Information about agriculture <i>Say that you now would like to speak a little about their farming practices and where they usually get agricultural information from.</i>	
1	What crops do farmers in this area usually grow?	<ul style="list-style-type: none"> • Male and female farmers • Who decides what crops are grown? (e.g. village chief, each farmer decides him/herself, household heads) • What factors determine which crops are grown? (e.g. marketability, price, whether crop is for sale or for own consumption) • Male and female farmers
2	What are the main challenges that farmers in this area face when growing crops?	<ul style="list-style-type: none"> • Challenges related to agricultural yields; water; soil; crop diseases; fertilizers, tools, machines, seeds • Male and female • Crops for consumption or sale
3	<i>Now, we would like to ask you about the kind of agriculture information that is available to farmers in this community.</i> Where do farmers usually go if they have a question and want information related to crop farming?	<ul style="list-style-type: none"> • Why there? • Who: Agriculture extension worker, farmer based organisation, NGO, shop for agricultural inputs, peers, community elder, radio, newspaper etc.? • How they decide: What factors would you consider while approaching them/how do you choose between the sources? • What information (e.g. improve agricultural methods, plant diseases, store crops safely, prevent crop loss, choices of crops to grow)
4	How easy is it for farmers in this area to access information about agriculture?	<ul style="list-style-type: none"> • Barriers to access

5	In your opinion, can mobile phones help farmers in this area to get access to information about agriculture? How?	
6	Have you ever received a SMS/voice message with agriculture information?	<ul style="list-style-type: none"> • Useful • Trust
7	What would influence whether you would perceive SMS messages with agriculture information as useful?	<ul style="list-style-type: none"> • The sender (where information comes from), personalised to farming needs, frequency, best time to receive the message during the day, etc. • Barriers to the up-take of SMS messages with agricultural information (e.g. not useful, SMS spam prevents reading) • Factors that motivate you to subscribe to a service which provides regular SMS messages with agriculture information
8	Is there any information on agriculture that is missing in your area? Please give details.	
9	What would persuade farmers to adopt new farming practices and ideas?	<ul style="list-style-type: none"> • Social pressure • Peers
<p style="text-align: center;">2. Acceptability and use of mobile phones <i>Explain, that you would like to learn more about how they use their mobile phones (or their shared mobile phone).</i></p>		
10	Do many farmers in this community own a mobile phone?	<ul style="list-style-type: none"> • Men/more women; why? • Share a mobile phone? (e.g. husband and wife) Can you tell me how this works in practice? (e.g. when does the wife have access; when does the husband) • More than 1 SIM card for a mobile phone? Why? How?
11	What do people in this community use their mobile phones for in their every-day lives?	<ul style="list-style-type: none"> • Functions liked/not liked • Frequency of use
12	What are the common problems that people in this community have with their mobile phones?	<ul style="list-style-type: none"> • access to electricity; money to top-up or access recharge card; access to network • Technical problems with the phone handset or its functions? What do you do then?

		<ul style="list-style-type: none"> • Other family members sometimes restrict your access to the phone? • How much of the time is your phone unavailable (for any or all of the reasons discussed above)? How often (frequency), and for how long (duration)?
13	What is your opinion of mobile networks (e.g. Tigo, Airtel, MTN)?	<ul style="list-style-type: none"> • Why choose mobile operators? (e.g. cost, off-network tariffs (i.e. contacts are on the same network), special offers, voice call quality, quality of connection (getting cut off), incorrect charging, customer care) • Are mobile operator genuinely concerned about making life easy for their customers or just interested in making own profits? • Do you feel all mobile phone companies are the same? Why and how? • What would persuade people to change to a different operator promotion; quality of their service]
Information about nutrition <i>Say that now you would like to talk a little about healthy diet and food habits</i>		
14	What should people eat to be healthy?	<ul style="list-style-type: none"> • meat, dairy, legumes (e.g. beans), vegetable and fruit • Men/women/pregnant women and adults/children • Food taboo
15	Would you describe the diet of households in this area as good?	<ul style="list-style-type: none"> • Barriers
16	Where do people in this area usually go to get information about nutrition?	<ul style="list-style-type: none"> • What information available • Information about child feeding; food preparation; information about food for pregnant women

THANK YOU

3. Topic guide for in-depth interview with community leader/village chief

Purpose:

- Understand acceptability of mobile phones
- Understand agriculture practices in this area
- Understand information seeking related to agriculture

Sample: Village chief, community leader or other local key figure

Time for the interview: Approximately 45- 60 minutes

Name (just first name, so you can use their name during the interview)	Occupation	Village	Date of interview
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No	Questions	Prompts
	Warm up questions	
	<i>Choose any of these:</i> Have you always lived in this community? How long have you been the chief of this community? What are your responsibilities as the chief?	
	1. Agriculture practices and information <i>I would like to start by asking you about agriculture in this area.</i>	

1	How do people in this area earn their income?	<ul style="list-style-type: none"> • Role of agriculture • Men and women in agriculture
2	Can you tell me more about <u>men</u> who work in agriculture in this community?	<ul style="list-style-type: none"> • own/lease the land/work as agri labourers • What crops? • How decision about what crops? • Sale or consumption • Main challenges for agriculture (water, productivity, disease, low price) • Regular meetings of male farmers
3	Can you tell me more about <u>women</u> who work in agriculture in this community?	<ul style="list-style-type: none"> • Own/lease the land/work as agri labourers • What crops? • How decision about what crops? • Sale or consumption • Main challenges for agriculture (water, productivity, disease, low price) • Regular meetings of female farmers (e.g. saving groups)
4	Do male and female farmers face different challenges?	<ul style="list-style-type: none"> • Reasons
4	What kind of agriculture information is available to farmers in this community?	<ul style="list-style-type: none"> • Male and female farmers access to same information • What information (e.g. improving agricultural methods; diseases; storing crops) • Where they get information?
5	How easy is it for male farmers in this area to access information about agriculture?	<ul style="list-style-type: none"> • Male and female farmers • Barriers to access
6	Do you think advice on agriculture should also include advice on what to eat to stay healthy?	<ul style="list-style-type: none"> • Why/why not? • How would farmers feel about this?
2. Acceptability and use of mobile phones		
7	Do many people in this community own a mobile phone?	<ul style="list-style-type: none"> • Men and women? Difference? • Young and old people? Difference? • Sharing mobile phone? Common? How does it work?

8	What do people in this community use their mobile phones for in their every-day lives?	<ul style="list-style-type: none"> • Functions liked best? Why? (e.g. SMS, voice calls) • Frequently used functions? Why?
9	What agriculture-related activities do people use their phones for?	<ul style="list-style-type: none"> • Crop price enquiries, to contact agriculture extension workers, etc.
10	How useful would SMS message with agriculture information be for farmers in this area?	<ul style="list-style-type: none"> • Why useful? • Female and male farmers? • Barriers to usefulness
11	Do most of the people in this area use a particular mobile phone network?	<ul style="list-style-type: none"> • Feeling about mobile networks (e.g. make profit, help people) • Any examples of mobile networks working to improve the community?

4. Topic guide for in-depth interview with local mobile phone agent or mobile phone kiosk owner

Purpose:

- Understand use of mobile phones in the community
- Factors that might encourage uptake of the mNutrition product

Sample: Local mobile phone agent or mobile phone kiosk owner

Location: At the mobile phone kiosk or place of agent’s choice in the community

Time for the interview: Approximately 20-30 minutes

Name (just first name, so you can use their name during the interview)	Occupation	Village	Date of interview

No	Questions	Prompts
Warm-up questions		
	<p><i>Choose any of these:</i> How long have you been a mobile phone agent/own/work in a mobile phone kiosk? Can you tell me a little about your work please? What do you do?</p>	

1. Use of mobile phones in the community		
1	Do many people in this community own a mobile phone?	<ul style="list-style-type: none"> • Men and women? Difference • Young and old people? Difference • Sharing mobile phone common? How does this work in practice? • Owning several SIM cards common? How does this work in practice?
2	What do people in this community use their mobile phones for in their every-day lives?	<ul style="list-style-type: none"> • Functions liked best? Why? (e.g. SMS, voice calls) • Frequently used functions? Why?
3	What challenges do people in this community face when using their mobile phone?	<ul style="list-style-type: none"> • Access to electricity to charge the phone; Money to buy top-up; access to recharge cards regularly; access to network coverage • Technical problems with the phone handset and user functions • Family members do not want you to use the phone or others using the phone when they want to • Men and women same challenges?
4	How useful is SMS as a means of communicating with people?	<ul style="list-style-type: none"> • Read SMS (literacy)? • Prefer to use other functions? (Voice calls/internet)? • Is SMS spam problem?
5	Do you think people in this area value information (e.g. about agriculture, health) sent to them by SMS message?	<ul style="list-style-type: none"> • Why? • Know programmes that use SMS messages with information • Do you think people would be willing to subscribe (and pay a small fee) to receive SMS messages with information? • What factors do you think would motivate people to subscribe to such a programme?
6	What do people feel about mobile networks?	<ul style="list-style-type: none"> • Just interested in profit or help community? • How do they choose? (e.g. cost, family has same network and calls within same network are free, special offers, voice call quality, quality of connection) • How frequently do people switch network operators? Why?

7	Do you ever have promotional days, where you and a team from the network agents go to the communities and try to get people to sign up?	<ul style="list-style-type: none">• Does this work?• What is the best way to sign people up to a new network
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Thank you. Do you have any questions?

5. Topic guide for in-depth interview with agriculture extension worker or local agriculture expert

Purpose:

- Understand agriculture practices
- Understand information seeking related to agriculture

Sample: Agriculture extension worker or other local agriculture expert (e.g. NGO, FBO, private sector)

Time for the interview: Approximately 45- 60 minutes

Name (just first name, so you can use their name during the interview)	Highest level of education completed	Position (fill yourself)	Village	Date of interview
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No	Questions	Prompts
Warm up questions		
<i>Choose any of these:</i> How long have you been an agriculture extension worker? Have you always worked in this area? Are you a farmer yourself?		
1. Information about agriculture		
1	What crops do farmers usually grow in this area?	<ul style="list-style-type: none"> • Female and male farmers? Difference?

		<ul style="list-style-type: none"> • Who decides what crops are grown? (e.g. village chief, each farmer decides him/herself) • What factors determine which crops are grown? (e.g. marketability, price, whether crop is for sale or own consumption)
2	What do farmers do with the crops they grow?	<ul style="list-style-type: none"> • Sale or consumption • What crops consumed? What sold?
3	What are the main problems have when growing crops?	<ul style="list-style-type: none"> • Male and women farmers? Difference? • Problems for crops for consumption and sale different? • Problems related to agricultural productivity; water; soil; disease;
4	What do you recommend should be done to address these problems?	<ul style="list-style-type: none"> • Ask for details
5	Do many farmers in this area use fertilizer, insecticides, and herbicide)? Why? Why not?	<ul style="list-style-type: none"> • How and from whom do farmers learn about these • Where purchase? • Difficulties accessing? (e.g. shops are far away and/or difficult to reach; no money; shops do not have what they want)
6	What kind of information do farmers look for in this community?	<ul style="list-style-type: none"> • What? Plant disease, increase productivity, safe storage, where to sale
7	Where do farmers usually go if they want information related to crop farming?	<ul style="list-style-type: none"> • Sources: Extension worker, Radio, TV, peers • How decide between different information sources? • Information source they trust most? Why? • How do farmers 'test' advice or information they get (FBOs, chat, demonstration visits, phoning friends/family etc?)
8	How easy is it for farmers in this area to access information about agriculture?	<ul style="list-style-type: none"> • Barriers to access
9	What are your main problems as an agriculture extension worker in this area?	<ul style="list-style-type: none"> • Difficulties in reaching all farmers regularly • Farmers do not follow your advice, why?

10	Do you sometimes call your colleagues or boss for support if farmers ask you a difficult question?	<ul style="list-style-type: none">• Ask for examples• Would agri- helpline help them to do their job
11	Do you think advice on agriculture should also include advice on what to eat to stay healthy?	<ul style="list-style-type: none">• Why?• How would farmers feel if you also talk about nutrition

Thank you. Do you have any questions?

6. Topic guide for focus group discussion with community members

Purpose:

- Understand nutrition practices in the community
- Understand information seeking related to nutrition

Sample: Community members (FGDs with mothers with young children; FGDs with elderly women)

Time for FGD: Approximately 60 - 75 minutes

Date of the interview:			Village name		
Background information on participant:					
	Name	Gender	Age	Highest level of education completed	Occupation
1					
2					
3					
4					
5					
6					

No	Questions	Prompts
Warm up questions		
Can you share some of your experience of living in this community? Are many people in this community farmers?		
1. Information about nutrition		
1	What makes a healthy diet? Please explain why?	<ul style="list-style-type: none"> • Meat, dairy, legumes (e.g. beans), vegetable & fruit • Frequency of eating each day • Amount of food eaten per meal • Men/women/pregnant women and adults/children? • Food taboos
2	What do you think is important for children to stay healthy and grow well?	<ul style="list-style-type: none"> • For a baby in the first hours after birth? (ask about breastfeeding, when to start) • For a baby in the first 6 months after birth? (breastfeeding; whether they believe a baby needs other foods/drinks) • For a baby in the first year of life? (ask about the age at which the baby needs foods and drinks other than milk) • What foods/drinks do people give to children above 6 months of age in this area? Why?
3	Would you describe the diets of households in this area as healthy?	<ul style="list-style-type: none"> • Why/why not? • Barriers to healthy diet (e.g. access to food, (, availability of (fresh) foods; money to buy food)? • Barriers to the preparation of healthy food (e.g. lack of time, resources)?
4	Who in the household knows best about what foods are good for health?	<ul style="list-style-type: none"> • Foods that are good for children's health? • Foods that are good for women (especially pregnant women)? • Foods that are good for adolescent girls?

5	Who in the household determines what foods the household eats?	<ul style="list-style-type: none"> • Who purchases food? • Who prepares food? • Who determines how much food is eaten? • Who decides how much food each household member gets?
6	Do women and men in this area have different opinions about the types of food that should be eaten (e.g. by children, women, men)?	<ul style="list-style-type: none"> • Ask for details
7	Where do people in this area get information about how to eat well to stay healthy?	<ul style="list-style-type: none"> • Information sources (e.g. health worker) • What information (e.g. child feeding, food for pregnant)
8	How easy is it for people, in this area, to access information about nutrition?	<ul style="list-style-type: none"> • Barriers to access
9	What sources of information on healthy eating are most useful for people in this area?	<ul style="list-style-type: none"> • Trust • Health worker, peers • Context-specific information • Why?
10	Is there any information on healthy eating that is missing in your area?	<ul style="list-style-type: none"> • Ask for details • What information would they like

Thank you.

Annex E Coding scheme for data analysis

No.	Codes	Sub-codes	Description
Access, use and attitude towards mobile phone			
1	Mobile phone ownership	-Men -Women -Age	What proportion of men/women own phone in the community? (Include any reasons given for patterns of ownership along gender, age etc)
2	Female access to mobile phones	-Men's attitude towards female mobile phone use	Include information on men's attitudes towards female use of mobile phones (restrictions, control, unhappy to share, feel phone not required by women)
3	Attitude towards mobile phones	-Positive -Negative -Trust	Farmers find it helpful (communication, maintaining social ties, etc) Social challenges (Include any inference where farmers do not trust phones or feel that phones have led to problems)
4	Attitude towards mobile phone operators	-Loyalty -Complaints -Trust/mistrust -Reasons for choosing an operator	-What do people feel about network operators and reasons for preferring a particular network (include names of network, problems with network, complaints and positive/negative responses) -What are the factors that lead to choosing a particular network?
5	Mobile phone use	-Men use -Women use -Mobile use agriculture -Mobile use non-agriculture -Mobile use nutrition, if any	User behaviour - what purpose is the phone used for (business, family, etc)?; gender differences in use -Note specific uses mentioned for agriculture, nutrition etc
6	Phone sharing	-Frequency - Reasons for sharing --Barriers	How common is the practice of sharing phones and why? (include responses and attitudes from husbands sharing phones with partners/spouse; men/women sharing phones with family). What are the barriers to sharing (gender attitudes, money, etc)

7	Call vs SMS	-SMS popularity - Call popularity - Gender difference -Literacy - Age	What functions are liked more and why (record any inference to preferences and comfort level in using particular features) especially SMS; record any inference related to age, gender, literacy etc when mentioning these attitude)
Potential barriers to and facilitators of the up-take of mobile phone based messages			
1	Electricity	-Electricity availability -Phone charge -Credit to charge	Access and availability for charging phones (include duration of electricity availability and when it is available; where do people go to charge their phones, fee for charging)
2	Literacy	-Level of literacy -Attitude	Ease in reading or writing SMS, using functions of phone. How do they feel about it?
3	Mobile spam	-Attitude -Response	Received spam (yes/no); how do they feel about it (attitude and response)
4	Multiple SIM cards	-Reasons -how used	Reasons for multiple SIM use and what provider is used for different purposes
5	Network coverage	-Location -Attitude/response	Network access in different locations and at different times What do people do when network is not available (switch off phones, change sims/operator, wait, etc)
6	Phone hardware	-Problems with battery -Repair	Problems with hardware - what do people do when they have hardware problems; where do they go?;do they have particular beliefs about avoiding its use at particular times (night, raining, power outage); discharges too soon or charges slowly
7	Credit for top up	-Money -Mobile kiosk	Availability of money and mobile kiosk for buying vouchers; what do people do/not do when they run out of credit? (borrow, wait until get money, etc)
8	Attitude towards channels of communication	-SMS -Voice calls	What channel of communication is preferred and why (Include any quotes and inference regarding suitability of one against the other)
9	SMS on nutrition	-Liked/not liked - Men's perception on getting nutrition message -Women's perception on	-Positive/Negative responses about receiving nutrition messages and the reasons for it. -How do they feel about these messages and what do they do (tell others, delete)? - How do they feel about these messages and what do they do (tell others, delete)?

		getting nutrition message -Recommendations	-About type of information, who should send it, time of sending the messages, etc
9	Attitude towards subscription	-Willingness -Reluctance -Trust	-Reasons for subscribing/not subscribing to nutrition messages. -Do people trust/not trust these messages (record the reasons mentioned)
10	Problem with receiving the messages	- Overflowing inbox	
Information needs and information seeking behaviour for agriculture and nutrition			
1	Information needs agriculture	Male farmers Female farmers -Agri inputs -Agri marketing -Crops to grow	-What kinds of information do farmers look for? (market, weather, price, etc); record differences in information. smallholder farmers, subsistence farmers, cocoa farmers etc -Record differences in information needs of male and female farmers.
2	Information source- agriculture	-Farmers -Extension workers -Media/Radio -Others	Which sources do they obtain information from? (include any quotes and inferences to how they obtain this information and do they go to different sources for different kinds of information)
3	Information trust- agriculture	-Farmers -Extension workers -Radio -Others -Demonstration -Utilisation of advice	Which sources do farmers trust or not trust? (include any quotes and inferences to why they trust this information and do they go to different sources for different kinds of information/verify the information) How do they use the information received (follow it, wait until they see results, check with others)
4	Barriers to information- agriculture	-Availability of inputs -Extension workers -Money	Include any potential barriers mentioned such as money, lack of inputs etc and what are their responses
5	Extension workers perceptions	-Availability -their challenge	Include perception of farmers and extension workers regarding AO's work and any recommendations.
6	Information needs nutrition	-Men -Women	-Information on what constitutes healthy food, good diet.

		-Health worker -Others	-Women's needs regarding diet, care practices, vitamins, any other. - Any needs identified for training, knowledge about nutrition and care practices
7	Information source-nutrition	-Community -Extension workers -Media/Radio -Health worker	Which sources do they obtain information from? (include any quotes and inferences to how they obtain this information and do they go to different sources for different kinds of information)
8	Information trust-nutrition	-Farmers -Extension workers -Radio -Others -health workers	Which sources do respondents trust or not trust? (include any quotes and inferences to why they trust this information and do they go to different sources for different kinds of information/verify the information)
9	Perception of agri-nutrition link		What do respondents feel about it?(Link seen or not)
10	Preferred information format for agriculture	-SMS -Voice - Personal interaction -Practical demonstration	-Use of phone -Voice calls preferred and why -Meetings, seminars, personal interaction with agriculture officers -Demonstration of how to grow crops, use inputs or any other *note the format preferred for different kinds of information.
11	Preferred information format for nutrition	-SMS -Voice - Personal interaction -Practical demonstration	-Use of phone - Voice calls preferred and why -Meetings, seminars, personal interaction with health/agri worker -Demonstration of how to prepare food or any other *note the format preferred for different kinds of information.
12	Barrier to information seeking	-distance -lack of time -unavailable in the community -perceived capacity to uptake	-Travel to particular sources such as extension workers, companies, agro dealers, health workers -Busy schedule (household work; farm work or business) Information not available in the community (include inference to issues on which information is sought from community) -Inability to understand the information (include reasons – literacy, information too technical, etc)

Social, economic and environmental factors that may influence behaviour change related to agriculture and nutrition			
1	Barriers agri change	<ul style="list-style-type: none"> -Land tenure -Pests -Limited crop diversification -Market -Poverty 	<ul style="list-style-type: none"> -Include any inferences to land ownership and tenure (esp. for cocoa farmers) -Onset of diseases -Inability of farmers to grow different kinds of crops and the reasons for it (weather, lack of inputs such as labour, preferences, price, etc) -Inability of farmers to sell crops (include inferences on market access, pricing systems for different crops) -Inability of farmers to change agri pattern because of lack of money *include responses and attitudes of farmers in all instances and specifically if there are differences between male and female farmers
3	Barrier-food-	<ul style="list-style-type: none"> -Lack of money -Limited agricultural diversity - availability of food - Lack of nutritious-fresh food -Food access -Food preference -Decision-making regarding food -Traditional food beliefs 	<ul style="list-style-type: none"> -Inability to purchase food (include responses and what people do, household budget allocation, etc) -Information on what crops are grown in the area and what are the factors (price, market etc) What foods are mentioned? Reasons for non-availability (seasonality, money, distance, etc) What foods are mentioned? Reasons for non-availability (seasonality, money, distance, etc) -What foods are eaten in the household? Why are they preferred (easier to afford, general fondness, health, etc.) -Household decision making (who pays for the food/buys the food and who decides what would be cooked/eaten) -Include any information on foods that respondents think should be avoided or eaten at a particular time esp., during pregnancy or breastfeeding. Include any comments on why these foods should be avoided/eaten, any previous beliefs that are no longer practised
8	Other m-projects		Other mobile phone based services available such as mobile money, insurance, etc (include names of the programmes)

9	Other agriculture projects		Any other projects being run by government, donors or grassroots organisations (record details of the organisations, target recipients and what they do?)
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