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

Mobile phones, nutrition, and agriculture in Ghana: Business modelling endline report

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Disclaimer

This project is being led by the Institute of Development Studies (IDS) together with Gamos and the International Food Policy Research Institute (IFPRI) as part of the e-Pact consortium led by Oxford Policy Management (OPM) co-managed with Itad. The IDS project manager is Jessica Gordon [j.gordon@ids.ac.uk]. The report authors are Nigel Scott and Simon Batchelor. For further information contact j.gordon@ids.ac.uk.

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Executive summary

The mNutrition intervention in Ghana

mNutrition is a global initiative supported by FCDO, managed by GSMA, and implemented by in-country mobile network operators (MNOs) and third-party providers aimed at using mobile technology to improve the health and nutritional status of children and adults in low-income countries around the world. mNutrition is implemented through existing mAgri and mHealth initiatives in 12 countries throughout sub-Saharan Africa and South Asia. The nutrition content aims to promote behaviour change around key farming practices and around dietary and child feeding practices that are likely to result in improved nutritional health within a household.

Given the scale of the mNutrition service the decision was made to select two countries for inclusion in the evaluation: the mHealth service in Tanzania and the mAgri service in Ghana. The mNutrition service that is the focus of the evaluation in Ghana and this report is the VFC service. This was selected in consultation with GSMA and FCDO on the basis that it was one of the first of the mNutrition products to launch and had a strong partner with a proven platform. GSMA partnered with and funded the MNO Vodafone Ghana through the mNutrition challenge fund. Vodafone Ghana partnered with local provider Esoko to launch VFC, which was a rebranding of Esoko's existing service with additional content provided. The service was a 'bundled solution', offering both agricultural and nutrition information through mobile voice and SMS services, in addition to free calls to other VFC members. The objective of this Vodafone service is to create and scale commercially sustainable mobile services that enable smallholder farmers to improve the nutritional status of their households and increase their productivity. The VFC service was paused in January 2019, when Vodafone's contract with Esoko expired.

Evaluation design

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

In this report, we use the Osterwalder and Pigneur (O&P) canvas as a basis for the analysis. At the centre of the canvas is the value proposition (the product), which can then be divided into two: one half is customer facing (customer segments, channels, customer relationships, and revenue), while the other considers internal factors (partners, activities, resources, and investments). Given the changes that have taken place over time, this report focuses more on documenting the timeline and history of the product. The business model insights are intended to answer the key research question: 'How commercially viable are the different business models being employed at country level?' (They also aim to establish the models' contribution to cost-effectiveness and the importance of continued private sector engagement.)

The report is based on information collected from multiple sources, including qualitative interviews with stakeholders, commercial data provided by stakeholders, monitoring data, and alternative service providers. It also draws on data gathered by both the quantitative and qualitative evaluation components. The quantitative study implemented a randomised encouragement design to estimate

the causal impact of the VFC. The analysis highlights differences in outcomes across encouraged and comparison groups using data collected in the baseline and endline surveys.

Review of the business model

Value proposition – Despite high quality ratings levels, and high levels of self-reported behaviour change, the quantitative study found that use of VFC (at least once in 18 months) had minimal impact on the primary outcomes of household and women's dietary diversity, agriculture production, or nutrition or farming knowledge. The most common self-reported behaviour changes were negotiating better prices, improving soil fertility, and timing of farming activities. VFC is more than a VAS (Value-Added Service): it is a bundle or customer plan, as it provides users with discounted tariffs and free calls to other VFC members. Sales agents could, therefore, sell VFC as a low-cost airtime product rather than as an agricultural VAS, which left some consumers confused over the identity of the product, and unaware of all its features.

Customer segments – The lower uptake of the service by women may reflect gendered aspects of cultural and economic characteristics rather than any shortcomings in the design of the VFC bundle.

Channels – Study results suggest that voice messages in the local language represent a better platform than SMS in English for delivering content, but this is a substantially more expensive medium.

Customer relationships – Qualitative research indicates that people in rural areas with poor connectivity tend to feel 'trapped' in their choice of MNO by network coverage and signal availability. This suggests that there is little to be gained by investing in customer relationships, as this has little influence on customer retention.

Revenue streams – Vodafone report that the Average Revenue Per User (ARPU) for the VFC base is GHS 2.5 per month. However, the quantitative study found much higher levels of expenditure: GHS 11 per month among women and GHS 27 per month among men (N.B. this is their entire expenditure, which will be spread across multiple SIMs.) Vodafone's priorities have changed as it has shifted its priority from increasing its rural base to maximising the revenue generated by its rural base. It plans to do this by integrating a number of products based on different technologies.

Indirect benefits – The VFC offer led to significant increases in the stickiness of the Vodafone network: VFC users were more likely to use Vodafone as their main network provider (primary SIM); rates were 9% higher among of both women and men. Given that 20% of women and 22% of men in the comparison group used a Vodafone SIM as their main SIM, this represents an increase of roughly 43%.

Key resources – Vodafone found it difficult to justify allocating management resources to VFC. The VFC base was running at approximately 70,000 active subscribers, which represents less than 1% of a total of 7.9 million mass market customers.

Key activities – The last promotion undertaken by Vodafone was in autumn 2017.

Key partnerships – The partnership relationship between Vodafone and Esoko was based on negotiated contracts. Several parties reported that the nature of the relationship deteriorated over the course of the project.

Cost structure and investment – Because of the three distinct phases in the VFC journey, it did not make sense to conduct any financial analysis based on actual costs. Instead, financial data provided by Vodafone and GSMA has been used to create a financial model, which has been used to model the financial viability of each of the three iterations.

Exploring business models

The VFC journey was not linear, so the financial model was used to provide commentary on the sustainability of different phases of the business model. The model was based on cost data provided by Vodafone to GSMA supplemented by data gathered through interviews. The analysis is based on a growth profile that achieves a subscriber base of 270,000 after four years. Internal rate of return (IRR) is used as the key metric.

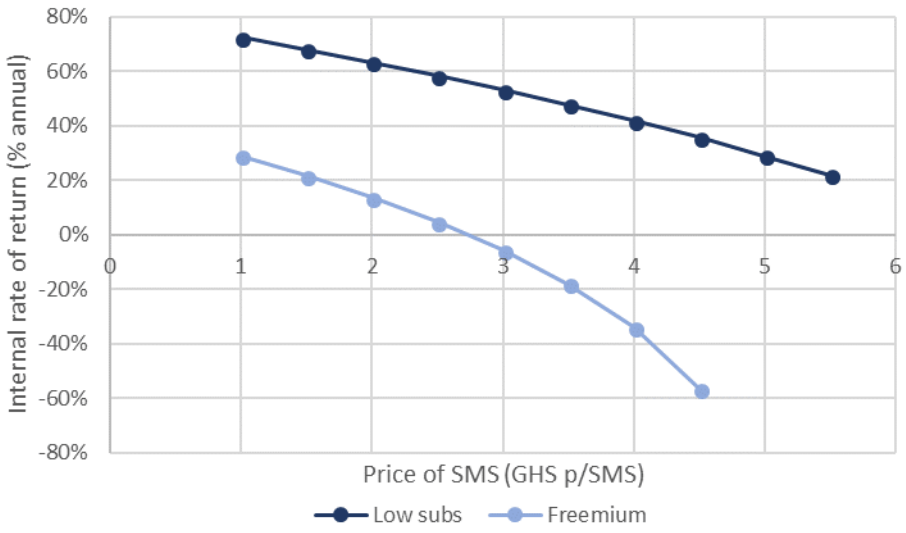
One of the premises of the mNutrition initiative was that the business models should be financially viable. This is often assumed to mean that farmers should pay for the service. For a while, VFC was offered as a free product. Financial modelling shows that this was not financially sustainable, at least not on the basis of the assumptions made about costs and the customer base. It also showed, for example, that financial performance was highly sensitive to ARPU, and could be attractive at rate of 3.5 GHS per subscriber per month (rather than 2.5 GHS).

For a subscription model, based on the original subscriber price of GHS 2 per subscriber per month, 44% of revenue can be generated from subscription fees, which could give an attractive 83% IRR on investment costs of £387,000. However, in practice Vodafone was not able to achieve these subscriber numbers at this subscription rate. At the reduced subscription rate of GHS 0.5 per subscriber per month, fee revenue drops to only 17%. Assuming that the amount passed on to the content provider was also GHS 0.5 per subscriber per month (i.e. 100% revenue share), the IRR on the investment drops to 29%. Given that revenue is dominated by ARPU, the financial performance is not highly sensitive to revenue share with the content provider. After reintroducing the subscription fee, the subscriber base fell to nearer 60,000, but the contribution margin[1] of VFC was 64% – well within Vodafone's target for the mass market segment (60–70%).

The cost of sending SMS messages is the largest single component of operating costs. The model assumed a retail price of GHS 0.055 per SMS. However, a bulk SMS price might be more realistic, and the real cost to an MNO is likely to be lower still. Figure 1 shows that if the real cost of SMS messages is discounted, even the freemium model can show a reasonable rate of return.

[1] Contribution margin is total revenues minus variable costs, often expressed as a percentage of the revenues (contribution margin ratio). It represents the contribution of the product to overall profit.

Figure 1: Sensitivity of IRR to SMS price (low subscription and freemium models)



Source: Authors' own.

As part of the baseline survey, the independent study team conducted a 'willingness to pay' (WTP) game, which has been used to estimate potential subscriber numbers at different prices. On this basis, modelling indicates that a subscription model could be financially viable at a fee rate of GHS 1 per month, reaching around 80% of the potential market, but also at a fee rate of GHS 2 per month, reaching only 50% of the potential market. This illustrates a potential for disconnect between commercial ways of working (aiming to maximise financial return) and donor ways of working (aiming to maximise social impact).

Conclusions and Lessons Learned

- VFC was offered under both subscription and freemium business models. Financial modelling shows that under certain circumstances, it is possible for both of these approaches to be financially viable. Key assumptions revolve around subscriber numbers, cost of SMS messages, and ARPU, each of which has implications for the sustainability of business models. In order to achieve subscriber numbers (of order 200,000) onboarding processes need to be addressed. Creating a simple product and a well-informed sales force are key.
- SMS costs are the largest single component of cost of sales. Including an MNO partner that can cover these costs can help to make mobile phone-based information services more commercially viable. It may, therefore, be easier to make a financial case for an agricultural advisory service hosted by an MNO rather than a third-party content provider, given that it is not clear that MNOs allocate real costs to SMS messages sent, whereas a content provider will buy bulk SMS at a real cost.
- Subscriber numbers for a mobile phone-based information service are crucial for commercial viability, but they have to be the right customers to maintain high retention rates. In a country the size of Ghana, the numbers required (of order 200,000) represents a large proportion of the potential rural market. Extensive marketing would be required to reach all of the potential market. More importantly, barriers to adoption of the service would need to be overcome, especially registration and profiling, and effective marketing by field agents trained and incentivised to sell the product and its features appropriately.
- Business models need to be reviewed regularly. The original VFC strategy of increasing the rural base of new mobile subscribers may have been appropriate at the inception of VFC (6

years ago), but was not in a maturing market. VAS business models based on increased ARPU and reduced churn will struggle in underserved areas where people have no choice of network.

- Although quality and satisfaction ratings were high among VFC users, as were self-reported levels of changed practices, the quantitative study found that changes were not significant enough to result in improvements in the primary outcomes. Nevertheless, farmers felt that mobile-based information on its own could still be useful.
- Mobile based agricultural advisory services offer the promise of improving agricultural practice among low income farmers at low cost. However, the study highlights a number of ways in which scaled up SMS-based systems are not a good fit with this target group:
  - Each information delivery channel (e.g. SMS, OBD, IVR) has advantages and disadvantages in terms of cost, literacy, timing, permanent record, and so on. Hybrid approaches would be ideal, but financial sustainability is highly sensitive to the price of messages, making it difficult to take advantage of expensive, voice-based technologies.
  - Substantial parts of sub-Saharan Africa remain underserved in terms of mobile coverage.
  - Farmers lack the financial resources to implement changes to their agricultural practices.
  - Low income farmers are risk averse, making them reluctant to implement new practices, and making it more difficult to convince them to subscribe, especially without face to face support.
  - The process of onboarding is crucial; it needs to be simple and immediate. Providing a local presence to assist (e.g. through well informed agents) is expensive.
  - VFC offers a complex bundle of services that customers struggled to understand, especially when agents had a poor understanding of the product, tending to sell it as a SIM rather than a VAS package.
  - Information alone is not enough to enable famers to make substantial changes to their agricultural practice.
  - Financial sustainability is most challenging when serving customers with the lowest ARPU.
- The mNutrition project provided an opportunity for companies such as Esoko to take a B2C model to scale by partnering with an MNO. The experience of VFC reveals some of the challenges encountered and the limited impact achieved (in terms of primary outcomes) with this approach. Further research is needed to find whether alternative B2B models (in which agricultural advisory companies partner with clients in the value chain) perform better.
- Contracting in VAS providers (e.g. as Vodafone did with Esoko) enables an MNO to set up a service quickly and with minimal up-front costs. The drawback is that the MNO might then lack market understanding and expertise, making the product vulnerable to the partnership relationship. Contractual relationships, for example, provide little incentive to innovate. Future programmes should take time to understand the nature of partnerships, and ensure that a strong product development team is effective.
- Mobile phone-based information services depend on multiple partnerships (including content and platform provider, and MNO). Effective partnerships depend on personalities. Partnerships must be agile in order to respond to changing markets. Support initiatives should include some form of future proofing to help mitigate changes that will occur over the duration of a programme.
- Emerging digital Agritech companies offering diversified services that integrate financial services and data capability are providing more comprehensive packages of support for farmers, which may well result in significant improvements. This is consistent with trends in the telecoms market of growth in data usage and mobile money. However, barriers to adoption of these data driven services are higher (in terms of digital literacy), so they risk widening digital divides and leaving the poorest behind.

- The report argues that an agricultural advisory service such as VFC could be financially sustainable under certain circumstances. This then raises questions over the ethics of spending public money on services that result in financial benefits for the private sector. There would, therefore, be value in the donor community engaging in discussion on how commercial returns can be used to reimburse expenditure from public funds.

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List of abbreviations

ALINe	Agricultural Learning and Impacts Network
ARPU	Average Revenue Per User
B2B	Business-to-Business
B2C	Business-to-Customer
CTA	Technical Centre for Agricultural and Rural Cooperation
CUG	Closed User Group
D4Ag	Digitalisation for Agriculture
DFID	Department for International Development
FCDO	Foreign, Commonwealth & Development Office
GAIN	Global Alliance for Improved Nutrition
GCP	Global Content Partnership
GHS	Ghanaian Cedi
GIFEC	Ghana Investment Fund for Electronic Communications
GSMA	Groupe Spéciale Mobile Association
HNI	Human Network International
ICT	Information and Communication Technology
IDS	Institute of Development Studies
IFPRI	International Food Policy Research Institute
IRR	Internal Rate of Return
IVR	Interactive Voice Response
KPI	Key Performance Indicator
LCP	Local Content Partners
M&E	Monitoring and Evaluation
MNO	Mobile Network Operator
NCA	National Communication Authority
NDA	Non-Disclosure Agreement
NGO	Non-Governmental Organisation
O&P	Osterwalder and Pigneur (Business Model)

OBD	Outbound Dialling
OPM	Oxford Policy Management
OTT	Over-the-Top
SIM	Subscriber Identity Module
SMS	Short Messaging Service
STK	SIM Application Toolkit
ToC	Theory of Change
TPB	Theory of Planned Behaviour
USAID	United States Agency for International Development
UX	User Experience
VAS	Value-Added Services
VFC	Vodafone Farmers Club
WTP	Willingness to Pay

1 Introduction

1.1 mNutrition

mNutrition was a global initiative supported by FCDO, managed by GSMA, and implemented by in-country MNOs and third-party providers; it aimed to use mobile technology to improve the health and nutritional status of children and adults in the developing world. The potential to utilise mobile technology to change attitudes, knowledge, behaviours, and practices around health and agriculture for improved nutritional status has been recognised for some time, but to date there have been no rigorous evaluations of m-services at scale. A consortium of researchers from Gamos, IDS, and IFPRI were contracted to conduct a rigorous mixed-methods evaluation to estimate the impact of mNutrition on children and adults, and to understand how the context and the components of the mNutrition intervention shape its impact.

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

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

- A **quantitative impact evaluation**, employing a randomised encouragement design to determine the causal effect of the programme on dietary diversity, agricultural income, and production. A baseline survey occurred before the start of the encouragement activities, and an endline survey occurred 18 months later.
- 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 an understanding of the context, underlying mechanisms of change, and the implementation process of mNutrition.
- A **business model and cost-effectiveness evaluation** employing stakeholder interviews, commercial and end-user data, document analysis, and evidence from the quantitative and qualitative evaluations to generate a business model framework and estimate the wider imputed benefits from the VAS for the range of stakeholders involved.

The mixed-method evaluation design will address the following research questions specified in the Terms of Reference (see Annex I):

1. What are the impacts and cost-effectiveness of mobile phone-based nutrition and agriculture services on nutrition, health, and livelihood outcomes, especially among women, children, and the extreme poor?

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

The primary target user of the evaluation results is FCDO, 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, and community-level health and agriculture extension workers. The reports from the evaluation will be made publicly available on the IFPRI and IDS websites.

1.2 Research questions of the business modelling component

mNutrition within the mAgri programme aimed to promote behaviour change around key farming decisions and practices by delivering nutrition information to farmers.[2] The objective of mNutrition and mAgri was to create and scale commercially sustainable mobile services that enabled smallholder farmers to improve the nutritional status of their household and increase their productivity (see Annex A for GSMA's theory of change of mAgri). The stated GSMA targets are the following (GSMA 2013):

- At least 20% of registered households that act on information and advice report consuming at least **four food groups** on a daily basis for at least nine months of the year as a result of more diverse agricultural output, increased income, and/or behaviour change in terms of nutrition.
- At least 50% of registered households that act on information and advice reporting a 25% increase in **agricultural productivity**.
- At least 50% of registered households that act on information and advice reporting increases in **agricultural income** of 20%.

In Ghana, mNutrition was implemented as part of the Vodafone mAgri mobile extension service called VFC. The service was a bundled solution offering agricultural and nutrition information via voice and SMS services in addition to free calls to other VFC members (details on the service are provided in Section 2).

The business model and cost-effectiveness component of the evaluation is designed to contribute evidence to help answer the first of the broad research questions specified in the Terms of Reference (Annex I):

- What are the impacts and cost-effectiveness of mobile phone-based nutrition services on nutrition, health, and livelihood outcomes, especially among women, children, and the extreme poor?

The mNutrition intervention was externally evaluated in two countries. In Ghana, the intervention was implemented via an mAgriculture programme in which nutrition information has been

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

integrated with crop information as part of a package of agriculture support services. The target group was low-income farmers in rural areas throughout the country. In Tanzania, the research consortium was evaluating mNutrition within a broader mHealth programme that promotes behaviour change around maternal and early childhood health and nutrition. The Terms of Reference refer to the impacts and effectiveness of mobile phone-based services, so the scope of the evaluation is the mobile phone-based service as deployed under the mNutrition programme, rather than the incremental impact of support provided through the mNutrition programme. We are therefore assessing the business model of the VFC delivered with the mNutrition content.

The intended audience for the business modelling endline report is FCDO, along with other organisations involved in mNutrition and mAgriculture programmes globally (including local MNOs and non-governmental organisations (NGOs) implementing mNutrition services), national governments, international agencies, and donors.

1.3 Purpose and scope of the business modelling endline report

This report is a milestone in the evaluation study; it documents the journey of the VFC project in Ghana supported by GSMA (and FCDO) over the duration of the evaluation. The report is one of four endline deliverables. This report should be read in conjunction with the baseline business modelling report (Batchelor *et al*., 2017), the endline cost-effectiveness report (Batchelor *et al*., 2019), and the quantitative endline report (Billings *et al*., forthcoming, 2020), which provide evidence of the impact of the access to the service on both primary and secondary outcomes. The qualitative endline report (Barnett *et al*., 2019)[3] gives additional insights into consumer priorities and behaviours and how the service was used. The baseline business modelling report covered the initial data gathering stage (up to March 2017). At this point, the GSMA grant was coming to an end, and Vodafone was taking the opportunity to renegotiate the contract with Esoko, the main content supplier.

1.4 Organisation of the report

Section 2 presents the background to the project. Section 3 discusses the evaluation design and in particular, the business modelling component. Section 4 describes the journey of the VFC, before these developments are mapped onto the business modelling canvas in Section 5. Section 6 presents a financial model that analyses the sensitivity of the commercial sustainability to various key costs and revenue options. Section 7 takes a wider view and considers the changing context of Ghana, telecoms, agriculture, and technology. Section 8 considers the VFC in the context of other GSMA mAgri mNutrition projects. Section 9 presents a discussion of the findings of the business modelling before some conclusions and learnings are presented in Section 10.

[3] This qualitative research report is commonly referred to simply as the ‘qualitative research’ throughout this report.

2 The mNutrition intervention in Ghana

2.1 Context

Nutrition: Ghana has achieved substantial progress in reducing malnutrition and is on course to achieve most of the World Health Assembly Global Nutrition Targets set for 2025 (Development Initiatives, 2018). Improvements have been seen in the reduction of stunting among children under five years of age, which fell from 28.1% in 2008 to 18.8% in 2014 (GSS *et al*., 2015). However, geographic disparities in nutritional status persist, with stunting prevalence at 22.2% in the Upper West region and 22% in the Central region – well above the national average and more than twice the rate in the Greater Accra region (GSS *et al*., 2015). Micronutrient deficiency is also a persistent challenge, with more than 35% of children under five years anaemic, and more than 20% vitamin A deficient (University of Ghana *et al*., 2017).

Literacy: Adult literacy rates in rural Ghana are quite low, with only 41.7% of adults able to read or write in English or any Ghanaian language (Ghana Living Standards Survey (GLSS) 6). Among rural women, rates are even lower (31.4%). These low literacy rates have implications for the design of the VFC service and its ability to change the behaviour of illiterate subscribers with text content delivered by SMS.

Mobile penetration: Use of mobile phones has increased dramatically in the last decade from 19% of households owning a mobile phone in 2005/06 to 94% in 2016/17 (GLSS 7). While there is still some heterogeneity in mobile phone ownership by geographic location and poverty status, these gaps are narrowing quickly with 86.4% of households in the lowest wealth quintile owning a mobile phone (GLSS 7). The market for mobile services in Ghana is dominated by three MNOs. MTN is the largest with 49.08% of market share for voice subscriptions and 59.74% of market share for mobile data subscriptions. Airtel/Tigo holds 25.14% and 23.21% of market share for voice and data subscriptions, respectively, while Vodafone holds 23.97% and 16.09% of market share for voice and data subscriptions, respectively. Glo, a fourth MNO, covers less than 2% of the market share (Ghana National Communications Authority, 2018).

Agriculture in Ghana: Agriculture accounts for 22.2% of national gross domestic product (GLSS 7). A little over half (51.5%) of households in Ghana own or operate a farm. Farming is predominantly a rural activity, with 82.5% of rural households involved in agriculture, compared to only 26.6% of urban households. The proportion of females involved in agriculture is 41.2%, and there is virtually no difference in the gender balance between urban and rural areas (GLSS 6).

Agriculture extension services are decentralised, but provision remains poor due to low capacity and limited funds (World Bank, 2017). In 2014 there were approximately 3,500 agriculture agents under the Ministry of Food and Agriculture (Dia *et al*., 2017). According to the Ghana Socioeconomic Panel Survey baseline report (2011), 51.7% of all households surveyed received agricultural advice from other households, and the proportion of households receiving agriculture extension advice through radio varied from 13.79% in the Northern region to 0.26% in the Greater Accra region.

mAgri services: The widespread penetration of mobile phone use in Ghana has come with a proliferation of tech start-ups, several with an explicit agricultural focus (for example, Anitrack, Complete Farmer, Ghalani, Qualitrace, and TroTro Tractor, many of which have started since 2014, when the project was conceptualised). The VFC, introduced in 2015, is one such mAgri service, described in greater detail in Section 2.2 of this report. Farmerline is a social enterprise company that develops information and communication technology (ICT) for rural famers. In 2013,

Farmerline launched the 399 Service in partnership with MTN, which connects farmers to financial services, information, and agricultural inputs. Agrocenta facilitates smallholder farmer trade with AgroTrade (a platform for farmer registrations, inventory management, logistics, and tracking) and provides financial services with AgroPay (a platform for digital payments, micro-lending, and crop insurance). Mobile services for livestock farmers include Cowtribe, which enables subscribers to schedule and receive veterinary treatment for livestock and track the health statistics of each animal, and Agro Innova, with software for poultry farmers including AkokoTakra for production management and AkokoMarket for connecting farmers to markets. A few services aim to support logistics, including Ghalani, a platform for farmers to organise group deliveries, and Truckr which allows farmers to book a truck on a mobile app to take products to market. Viamo, a global social enterprise with origins in Ghana, developed the 3-2-1 services, a mass communication tool used for the delivery of information-based services (including mHealth services) in a number of developing countries. In Ghana, the 3-2-1 Service was launched in April 2016 and delivers a range of services on the Vodafone network.

More recently, large MNO companies are starting to roll out business-to-person services, whereby agribusinesses pay farmers via mobile money for the product or services rendered (Loukos and Javed, 2018). There is also a growing interest in apps that enable the urban population to invest in agriculture, either through the provision of finance and information services to farmers or by coordinating labour for urban landowners.

2.2 The VFC service

The VFC was a mobile extension service delivering agricultural and nutrition information to farmers via recorded voice and SMS messaging and providing access to a call centre for agricultural advice. The objective of Vodafone's mNutrition programme was to create and scale commercially sustainable mobile services that enable smallholder farmers to improve the nutritional status of their households and increase their productivity. Smallholder farmers with access to mobile telecommunications were the primary target for VFC enrolment. The service included access to a call centre for expert advice without airtime charges, free calls and SMS messaging to other VFC subscribers, and discounted calls and SMS messages to non-VFC subscribers, in addition to the following information-based services:

Table 1: VFC information services

	Delivery mode	Frequency	Language
Local weather information	SMS	3 messages per week	English
Local market price information	SMS	1 message per week	English
Agricultural tips for selected crop	Recorded voice message	3 per month	Local language
Nutrition tips (for selected crop and general)	Recorded voice message	3 per month[4]	Local language

Source: Authors' own

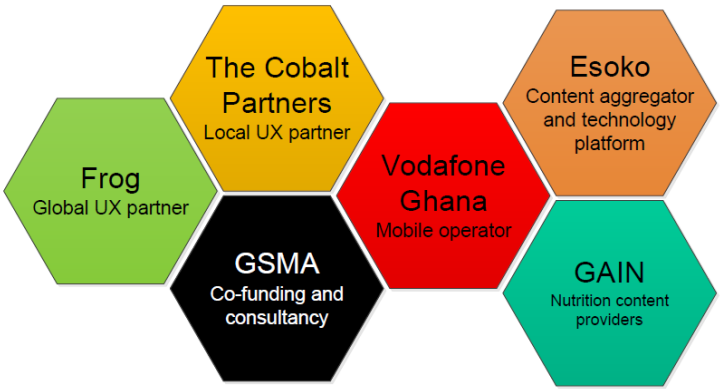
Key organisations involved in the VFC partnership are illustrated in Figure 2. The primary roles of each are:

[4] Initially, the VFC service sent one nutrition message per month, but this was increased to three nutrition messages per month in July 2017.

- Vodafone Ghana – lead partner, funding, marketing, and billing;
- Esoko – main partner, content, platform, and helpline;
- Cobalt – local UX design research;
- Frog – global UX partner;
- GSMA – co-funder, business intelligence, monitoring and evaluation (M&E) (provided via contract with the Agricultural Learning and Impacts Network [ALINe]), and consultancy; and
- GAIN – global content partner.

The contribution of the key partners to principal business activities are summarised in Table 2.

Figure 2: Partners and other key players



Source: GSMA (2016a). Reproduced with permission.

Table 2: Summary of activities conducted by key VFC partners

	Vodafone	Esoko	GSMA / GAIN
Platform/network	Operate network Billing customers	Operate Esoko platform (distribute content)	Product feedback from users
Production		Create content Aggregate and localise content continuously (weather and market prices) Update advisory and nutritional content Maintain call centre	Create content
Marketing	Customer acquisition Customer retention	Customer profiling	Feedback from users

Source: Authors' own

Esoko Ghana, a mobile phone-based rural information service, curated the message content and operated the platform to send tailored SMS and recorded voice messages to member farmers and also operated the Farmer Helpline call centre. Esoko developed the content for the crop-specific agricultural tips for 24 widely cultivated crops in Ghana. These tips covered recommended planting time and information on best practices for cultivation and harvest. Messages were sent according to planting cycles for specific crops and agro-climactic zones based on farmer profile information. Nutrition message content was developed by GAIN in 2015. GAIN created 312 crop-specific messages (13 messages per crop for the 24 Esoko-supported crops) with nutrition information on topics including food preparation, food hygiene, safety and storage, and processing. In 2017, the Grameen Foundation developed 26 additional nutrition messages focused on animal-sourced foods including eggs, dairy, fish, and meat. VFC subscribers received both general nutrition tips and crop-specific nutrition tips according to their profiled crop. Vodafone invested in the VFC

service with the aim of increasing penetration in rural Ghana through new subscriber acquisitions. The VFC service was launched in June 2015 promoted by Vodafone agents with a dedicated VFC SIM card. The monthly subscription fee for VFC was initially GHS 2 (US$ 0.45). However, the agent-led model resulted in slow acquisitions and difficulty retaining active usership of the service. By November 2016 there were approximately 130,000 registered members, but fewer than 20% were active (GSMA, 2017). In December 2016 Vodafone added existing rural Vodafone customers to the service, thus increasing the VFC subscription rate to over 200,000. In addition, Vodafone made a strong push to increase acquisitions by temporarily dropping the monthly subscription fee from October 2016 to June 2017. In June 2017, the monthly service fee was reinstated at GHS 0.5. Monthly fees are automatically deducted from the subscriber's airtime balance when the balance is at least GHS 0.5.

The VFC service was designed to offer customised 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 VFC 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 programme member base in late 2016, it was no longer feasible for Esoko to follow up with each new VFC member individually. Instead, new members were given default profile options based on their district of residence, receiving agri and nutrition tips on the crop most widely grown in that district and in the language most widely spoken. Farmers were able to request modifications to the profile options through the call centre, but this was not widely publicised. As a result, new members were less likely to have customised options and may therefore have received agricultural and nutrition tips for crops they did not cultivate.

Due to the challenges in building and maintaining a wide subscription base for VFC, Vodafone designed a new service to better meet the needs of rural famers called the *Connected Farmer*, which includes financial services delivered through the Vodafone Cash platform such as a savings package, a crop insurance offer, and a platform for connecting farmers to agribusiness services, in addition to market information services available through VFC. This new offer was designed based on findings from market research conducted in 2018 that indicated that farmers are most interested in services with immediate financial benefits (e.g. access to finance) and far less interested in information-based services, even if the information is also intended to ultimately boost production and income. However, Vodafone planned to continue offering the VFC services to *Connected Farmer* members with the aim of building greater demand for such information over time. The *Connected Farmer* was supposed to be rolled out in August 2018, and Vodafone planned to migrate existing VFC members to the new *Connected Farmer* service when it was launched, although study farmers would continue receiving the basic VFC service to maintain consistency in the mNutrition evaluation intervention. However, the launch was delayed, and the *Connected Farmer* had not yet been initiated at the time this report was written.

In January 2019, Vodafone discontinued their contract with Esoko to deliver recorded voice content for VFC, although they continued to operate the VFC helpline. IFPRI contracted Esoko directly to continue sending the content to study farmers from January through March 2019. There was a small interruption in the voice message service before Esoko resumed sending content to study farmers in the third week of January under the IFPRI contract.

3 Evaluation design

3.1 Study design

This report is constructed from interviews with key stakeholders and a review of secondary data. A list of contacts made during the baseline collection can be found in Annex B.

The study has used the O&P canvas for structuring insights into the business model (Osterwalder and Pigneur, 2010). Few business models in the 21st century are straightforward and simple. Production of a product, sales of the product, and revenue from that product are only a small section of the overall model. Revenues are often made on associated advertising, or on the value the product adds to the brand. The landscape report published as part of this study details some of the possibilities for MNOs (Barnett *et al*., 2016).

In this report, we use the O&P canvas as a basis for the analysis. An introduction to the framework is given in Annex C. While this generally works well, we acknowledge that the canvas is good for taking a snapshot of a business model but in this report indicate that also documenting the timeline and history of the product is important. These business model insights are intended to answer the key research question: 'How commercially viable are the different business models being employed at country level?' (They also aim to establish the models' contribution to cost-effectiveness and the importance of continued private sector engagement.)

In a development sector where public funds are increasingly under scrutiny for value for money, the roll-out of a public good via a private sector commercially sustainable mechanism is very attractive. The heart of the question is predicated on assuring that future actions taken by donors and private sector actors regarding similar products are informed and lessons are learned, in order to increase the chances of sustainability. Hence, while we try to use the O&P framework in an applied manner, there are times when we need to document the 'backstory' that led up to certain decisions.

The aim of the baseline report was, therefore, to provide a detailed description of each of the building blocks of the business model canvas as at the beginning of the independent study. It also provided a review of operating experience since the beginning of the mNutrition project that may provide context for changes that have already taken place in the product design. This endline report builds on the baseline, bringing the canvas up to date.

3.2 Data collection methods

Business models traditionally describe how a business is going to make a profit from a product or service, and identify the direct relationship between the two. They consider who the customers of the business are, why they will buy the product or service (the value proposition), and how the company is going to provide the product or service. On the financial side, a business model considers both revenues (and pricing) and costs. The role of VAS within MNOs is not always straightforward. There are imputed benefits, and these are recognised as important within the FCDO logframe for the whole GSMA programme. The challenge here, then, is to identify the broad business model, including the non-monetary benefits of the service to each stakeholder.

Given the complexity of the partnerships involved in the mNutrition projects, Osterwalder and Pigneur's (2010) inductive approach to business model generation has been used as a framework for the research.

This endline report is based on information collected from multiple sources:

- qualitative interviews conducted with stakeholders and MNOs in Ghana;
- commercial data provided by stakeholders and MNOs (or brokered by GSMA);
- monitoring data gathered by ALINe (the M&E provider for the GSMA mAgri Programme);
- data available in published literature;
- government stakeholders and alternative service providers as a source of additional, unpublished information on costs and business models;
- the quantitative component of the study, led by IFPRI (Billings *et al*., forthcoming, 2020); and
- the qualitative component that focused on consumer perceptions, led by IDS (Barnett *et al*., 2019).

This component draws on data gathered by both the quantitative and qualitative evaluation components described in Section 1. The qualitative research employed multiple data collection tools to explore four thematic areas:

1. Access, use, and attitudes toward and acceptability of mobile phone technology by male and female small-scale farmers.
2. Barriers to and facilitators of the uptake of mobile phone-based messages by female and male small-scale farmers.
3. Small-scale 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.

Data collection tools included semi-structured in-depth interviews with farmers, key informant interviews, expert interviews and community member interviews, and focus group discussions. Field work was carried out in two clusters of three villages selected from two different regions – Upper West and Central Region. Details of the sampling strategy, participant numbers, and composition are described in Barnett *et al*., (2017). Findings from each of the qualitative research areas have contributed to the various building blocks described in Section 5. Findings relating to information needs, current sources of information, and barriers to uptake all affect the perceived value of the service. Patterns of handset ownership and access, poor network coverage, and literacy levels all inform the viability of the service, and SMS as a medium, in reaching target farmers.

This report draws heavily on data analysis presented in Billings *et al*., (forthcoming, 2020). This analysis highlights differences in outcomes across encouraged and comparison groups using data collected in the baseline and endline surveys. Full details of the sampling design and the analytical approach can be found in the quantitative endline report, but it is important to understand what the two groups represent.

To estimate the causal impact of the VFC product, IFPRI implemented a randomised encouragement design. The encouragement design does not restrict access to the VFC service (as with a control group in a randomised control trial), but instead works by randomly assigning some communities or households to receive additional marketing and promotion of the programme. Because the encouragement is randomly assigned, the variation in take-up of the service created by the encouragement is used to measure the causal impact of the programme as the difference in outcomes between encouraged and comparison communities at endline. The random assignment means that average differences in outcomes across the groups after the

intervention can be interpreted as being truly caused by, rather than simply correlated with, the interventions.

The additional marketing and promotion to encourage take-up and continued use was informed by the qualitative study and includes a combination of price discounts and door-to-door marketing to households in selected communities throughout the evaluation period. During the door-to-door marketing, the product was promoted using a short advertisement script. Households in communities were randomly assigned to receive the encouragement. The experimental design included two refinements:

- using 'sales' scripts that focused on the agriculture content of the product (Vodafone's current script), or scripts that augmented the agriculture focus with additional information on nutrition; and
- either a male or a female from the household was targeted to receive the advertisement scripts and a free subscription to VFC.

Processing information

Evaluation activities carried out by Gamos to inform the endline reports include:

- Country visits to establish and maintain relationships with key stakeholders. Interviews conducted with key representatives of stakeholder institutions to gather additional data to populate the O&P framework. Ongoing communication and country visits undertaken to monitor developments in services and to track the commercial justification for changes.
- Populating the O&P canvas with information gleaned from reports previously published under the mNutrition programmes (e.g. UX testing, case studies, rapid feedback surveys, etc.), as well as grey literature.
- Working with IDS and IFPRI to contribute to the design of both qualitative and quantitative instruments (both baseline and endline) to incorporate indicators relating to non-financial attitudes of customers to services, and to MNOs in particular, such as customer satisfaction and brand loyalty. These instruments also explore attitudes toward alternative services offered by other providers, e.g. media, face-to-face extension, etc.
- Interviews with alternative service providers to explore other business models (among alternative mobile services).
- Analysing financial data with a view to creating a financial model to test key cost sensitivities.

The process of enquiry and information collection was flexible and responsive to events on the ground, given that the partners and the service offerings were constantly evolving. Particularly portentous times occurred following the end of GSMA mNutrition grant contracts. Other times coincided with the publication of significant outputs from the research project that informed product review decisions. This component of the evaluation is based on opportunistic data gathering from key individuals such as representatives of the core partners and other partners to the project.

3.3 Ethical considerations and approval

As an overall guiding principle, the research team sought to conduct themselves in a professional and ethical manner throughout the baseline phase of work, with strict respect for principles of integrity, honesty, confidentiality, voluntary participation, impartiality, and the avoidance of personal risk. These principles were informed by the Organisation for Economic Co-operation and Development (2010) Development Assistance Committee's Quality Standards for Development

Evaluation and FCDO's 'Ethics Principles for Research and Evaluation', which will be followed for the duration of the evaluation.

Overall, this component will draw on the qualitative and quantitative data collected in the other two components of the evaluation. Other data sources were stakeholder interviews with MNOs and data collection (commercial and monitoring data) from MNOs and other relevant organisations.

Although most research participants were familiar with the mNutrition programme, and the principle of an independent evaluation, this component sought the informed consent of participants. This was achieved by emails and briefing documents describing the research. In particular, we described the relationship between the consortium, FCDO, and GSMA, in order to avoid any possibility of deception. Research activities with participants involved interviews only; there were no observational activities.

While this evaluation component did not involve any primary data collection from human subjects at community/household level, ethical considerations are still considered important for all work carried out under this component. In particular, GSMA remains highly aware of the commercial sensitivities of their partner MNOs, so the issue of commercial confidentiality is very important for this area of work, given that it relies on the sharing of sensitive commercial data. Therefore, the Gamos team has paid specific attention to this issue as part of our ongoing work.

The Gamos team is currently operating under the Non-Disclosure Agreement (NDA) signed by GSMA and OPM during the inception phase of the project. Where relevant, stakeholder respondents were informed that an NDA with their trade association has been signed, and that the interview is bound by it. All the data being gathered fell within the scope of this agreement (e.g. development, business plans, marketing, operations, and finances), although there is a provision that such information should be designated as proprietary or confidential.[5]

For the avoidance of doubt, all internal reports shared by Gamos were marked as confidential and were not to be circulated outside the evaluation team. Any outside reporting will not contain any detail that could be construed as proprietary or confidential information.

All external reports were and will be shared with key research participants in early draft form in order to establish principles of trust and reciprocity. This has been done in order to ensure that participants will have an opportunity to confirm that their views have been reported accurately, and that publications do not breach their confidentiality requirements.

As this component draws on qualitative and quantitative data collected through the other two workstreams, appropriate measures were taken to ensure that the shared data is anonymised and there is no risk of confidentiality breach. For the quantitative data, a unique household ID has been assigned to each household. This allows for following up with respondents as necessary without providing access to any personal information in the datasets that are made available for analysis. Similarly, all qualitative transcripts are anonymised, pseudonyms given, and any information that can lead to personal identification has been removed.

3.4 Limitations

The methodology relied on the willingness of key stakeholders to share their data and their thoughts. In a commercial environment this is not always forthcoming, and a limitation of the report

[5] The agreement permits Gamos to share confidential information among the team if: (i) they need to know; (ii) they have entered into a confidentiality agreement; and (iii) they are not a competitor.

is that it relies on this shared data. Risks associated with this transfer of data have been mitigated as much as possible by clear communication and follow-up with stakeholders. The degree of engagement to date with stakeholders is reflected in the insights and level of data presented in the report. Changes in relationships and personnel (among all stakeholders) were the principal threats to the mitigation strategy.

The risks associated with the evolving nature of the business model have been mitigated as much as possible by setting milestone data points, and the subsequent phases have informed the changes between baseline and endline.

4 Developments in the VFC

4.1 Vodafone Farmers Club (VFC)

The VFC service was paused in January 2019, when Vodafone's contract with Esoko expired. Prior to this there had been a series of changes to the VFC product, followed by a period of searching for ways to revise the farmers' product.

Default profiling was introduced in early 2017 as a means of providing a simplified registration process. Farmers were profiled based on the location where theywere registered (district level) and then received messages for crops that were dominant in that location. Farmers could then contact the call centre to provide more accurate profile details, but Esoko reported that a negligible number of subscribers had done so. If they were automatically profiled, they did not receive weather information. The system allocated them to a district on the basis of the cell tower through which they were registered onto VFC. The district is too large an area for weather, as weather in one part of the district may well be different to that in other parts of the district, so it was felt that supplying farmers with inaccurate information would be counterproductive. Market price information was still sent because this comprised prices from the main markets within the district. This meant that the majority of new subscribers were not receiving weather information.

Farmers were entered into VFC in a two-stage process. First, Vodafone compiled a file of all subscribers both new and re-subscribed with basic registration information. Second, the file was sent to Esoko, which entered the subscriber details into its system. The files were previously sent to Esoko daily, but this was changed to a weekly transaction. This meant that new subscribers could wait up to a week before getting onto the Esoko system and receiving any information.

Esoko research found that awareness of the product among users was poor, and some did not even want to be on the plan. This highlights shortcomings in the marketing of the product. No VFC field agents had been commissioned since the initial launch phase. This leaft the product to be sold by freelancers, who had minimal training on VFC and may have simply sold a VFC SIM because other SIMs were in short supply. In this case, members did not even learn about the package they are signed up for. The promotions ended in early 2017, partly as a consequence of these problems with freelancers.

When it was clear that the original target of 400,000 subscribers would not be met, a revised target of 200,000 was negotiated with GSMA at the end of 2016. Among a range of measures taken to achieve this, the subscription fee of 2 GHS/month was temporarily dropped. When the subscription fee was reintroduced at a reduced rate of GHS 0.50 per month, VFC lost two-thirds of its subscribers, demonstrating a low level of WTP. Following this, and changes in management, Vodafone has been considering ways of improving the VFC product. Given that VFC has not increased the rural base as originally intended, priorities have changed toward improving the revenue potential of the rural base.

Due to the challenges in building and maintaining a wide subscription base for VFC, Vodafone decided to bring one of its global services to Ghana to better meet the needs of rural famers. This is called the *Connected Farmer*, and it includes financial services delivered through the Vodafone Cash platform such as a savings package, a crop insurance offer, and a platform for connecting farmers to agribusiness services. This new offer was selected based on findings from market research conducted in 2018 that indicated farmers are most interested in services with immediate financial benefits (e.g. access to finance) and far less interested in information-based services, even if the information is also intended to ultimately boost production and income. However,

Vodafone planned to continue offering the VFC services to *Connected Farmer* members with the aim of building greater demand for such information over time. The *Connected Farmer* was supposed to be rolled out in 2018, and Vodafone planned to migrate existing VFC members to the new *Connected Farmer* service when it was launched, although study farmers would continue receiving the basic VFC service to maintain consistency in the mNutrition evaluation intervention. However, the launch was delayed, and the *Connected Farmer* had not yet been initiated at the time this report was written.

The latest thinking was that value could be generated by bringing together a range of different services, currently hosted in different parts of the organisation:

- 3-2-1 (run by Vodafone Foundation through Viamo);
- Farmerline (run by Vodafone Business);
- Fisherfolk (run by Vodafone Cash); and
- VFC.

There may be merit in each of these products retaining their own identify, so the main attraction is in merging the backend systems. This would also enable the upselling of products such as Easy Pension (run by People Pensions Trust), while the 3-2-1 service could be made free to VFC members. The ideas were discussed in March 2018, but even then Vodafone noted that the merger had been delayed due to staff shortages. The revised package, offering mobile money, savings, and insurance in addition to information services, call centre, and discounted calls, was scheduled for launch in August 2018. It was planned to organise major awareness-raising activities to coincide with Farmers' Day in December 2018. Around March 2018, GSMA secured an assurance from Vodafone that VFC would be preserved as part of the revised agricultural market offering.

However, at the end of 2018, plans for the *Connected Farmer* service were delayed further, and Vodafone was looking to the beginning of the next financial year – April 2019. It still had not confirmed if Esoko would be the content provider for the new service. One of the options being considered was to contract Esoko to manage the entire system. This would eliminate the need for parallel subscriber lists, which causes delays in registration and profiling, and results in a long lapse between farmers registering and receiving their first information message. However, after further staff changes in Vodafone, such plans appear to have been dropped.

Note that Viamo, Farmerline, and Esoko all operate in the same space, offering similar services. This inevitably led to tensions in negotiating Esoko's continued position as VFC content provider when Vodafone was at the same time negotiating with other providers.

The VFC partners were keen to take up GSMA's suggestion of commissioning a consultancy visit from Telenor Pakistan (the most successful of the projects supported under mNutrition) to stimulate ideas on ways in which VFC could be improved and adoption rates increased. Both Esoko and Vodafone were willing to share the costs, and the longer-term vision was to create a VFC 2.0. However, the visit did not take place, partly because changes in personnel at Vodafone meant that nobody pursued the idea.

Esoko reported that VFC has reached a total of 350,000 subscribers, i.e. farmers who subscribed to VFC at some point in time. As at early March 2019, they reported only about 33,000 active subscribers, defined as those who are currently in a 30-day bundle (a mix of new subscribers and re-subscribers). Vodafone reported nearer 60,000 subscribers at the same time. The discrepancy is reported to be due to a large proportion of new subscribers who sign up (are added to Vodafone numbers), but then unsubscribe within a short period of time and are then absent from the Esoko numbers.

4.2 Vodafone

Vodafone Ghana has been through major changes over the duration of the study. At the very top, Yoland Cuba took over from Haris Broumidis as CEO in March 2016, and was then succeeded by Patricia Obo-Nai in April 2019. Vodafone Ghana has struggled with unprofitability since it acquired Ghana Telecom in 2008.

Agnes Emefa Essah was appointed as Chief Marketing Officer in July 2014 and stepped down in March 2018. She was responsible for innovation, which includes VFC. The Commercial and Marketing Executive who originally supported VFC through the mNutrition programme processes reported to her, and he also moved on. He was replaced by the Value Segment Manager, who later passed on responsibility for VFC to the Product Manager.

At the product level, the original Product Manager, who had previously worked at Esoko and was instrumental in brokering the partnership, left early on in the history of VFC. When the next Product Manager went on maternity leave, her replacement was not familiar with the procedures or history of the project, which caused further communication difficulties.

Having established a relationship with Vodafone Ghana through the mNutrition programme, GSMA entered into exploratory discussions about engagement in forthcoming mAgri programmes. Early in 2018, GSMA was conducting early-stage research into using mobile technology to digitise agricultural value chains and using data to create digital identities, which has since evolved into the AgriTech programme.[6] Vodafone was involved in a short programme of field research that led to the eventual publication of a case study (Wasunna and Ngumi, 2019). The aspiration to digitise agricultural value chains aligned closely with emerging thinking on revising VFC. Internally, Vodafone even used the name *Connected Farmer* to refer to the revised VFC product, which was planned but never implemented. In sum, despite early enthusiasm from Vodafone, after key personnel moved on dialogue waned and ideas were not pursued.

4.3 Esoko

Esoko was split into two companies in 2017. The baseline report described the Fasiba/Tulaa savings and loans platform, which held the promise of matching the most pressing needs among farmers identified by qualitative research. This was launched as Tulaa in Ghana in November 2016. Around the same time as Tulaa was being developed, the team at Esoko realised that there was a commercial application for the platform that they had developed for farmer profiling as part of their longstanding market information service. This was developed as a survey application, and eventually launched under the Insyt brand.

The two parts of the company separated in July 2017 when Tulaa was spun off as a separate entity, taking many of the Esoko staff with it. Miller-Wise (the ex-CEO) justified this on the basis of the two products having different customers and different business models: ‘The survey business is a pipeline business, while the m-commerce business is a platform model’.[7] Later, she launched Tulaa in Kenya, where it has attracted funding and equity investment. However, the Tulaa operation in Ghana folded. At the time of writing the baseline report, Esoko and Vodafone were discussing ways of improving the VFC product and were excited about integrating the Tulaa savings and loans platform. These negotiations, however, faltered for a number of reasons.

[6] www.gsma.com/mobilefordevelopment/agritech/
[7] https://nextbillion.net/why-we-broke-up-the-company-a-former-ceo-of-m-agri-pioneer-esoko-explains/

The company in Ghana retained the Esoko trading identity and continues to offer the survey product under the Insyt brand. They also continue to offer the market information system, bundled into other products.

5 Review of the business model

This section summarises key observations made in the baseline report, supplemented with additional findings from the intervening period, as well as findings from both the qualitative and quantitative studies. An introduction to the canvas and a more detailed description of VFC, as it relates to the framework, are provided in Annex C.

5.1 Customer segments

The primary target for VFC was articulated as 5 million smallholder farmers in Ghana, who account for 77% of the entire agricultural base in the country (GSMA, 2014). Three key segments were described, which are not mutually exclusive:

- female farmers – estimated at 2.8 million (56% of the agricultural labour force);
- semi-literate and illiterate smallholder farmers – estimated at 3.3 million (30% of the entire agricultural base is estimated to be illiterate), who also lack numerical skills; and
- rural residents without access to mobile phones – estimated at 3.2 million.

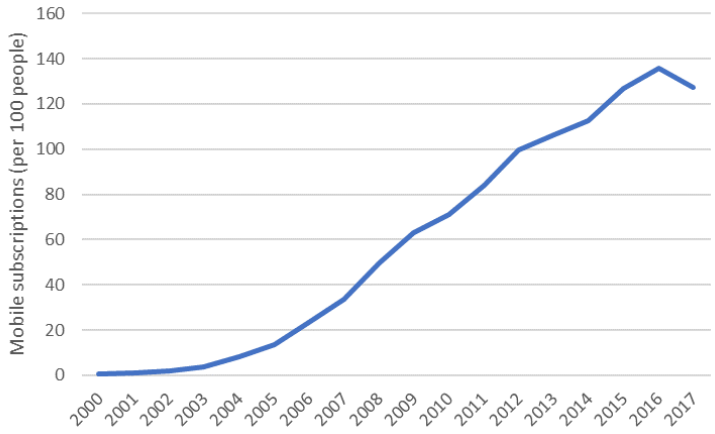
Migrating base customers (on other plans) onto VFC in late 2016 enabled Vodafone to reach the key performance indicators (KPIs). Initially this introduced a mix of non-farmer customers into the VFC base, which were then weeded out.

Although the product was inclusive of women farmers, a number of factors make this difficult to achieve in practice. Mobile phone ownership is lower among women, men are more likely to adopt innovations, and literacy rates tend to be lower among women. Women were less likely to have used the service than men: 63% of men had used the service in the last 18 months compared with 43% of women. This may reflect gendered aspects of cultural and economic characteristics rather than any shortcomings in the design of the VFC bundle. For example, women were more likely to have had no access to a phone (32% of women who did not use the service, and 12% of men).

Sharing of information between genders was uncommon. This implies that where women have no access to a phone, even if their husband signs up to VFC, they are not likely to access information. The study found that men usually shared with men while women shared with women, which is due to the cultural norm that adults who are married should not interact with the opposite sex. Women were more likely than men not to read the weather or market price information because they cannot read, and not to listen to voice messages because they do not have access to phones.

Targeting rural residents without access to mobile phones assumes that there remains a potential customer base that still aspire to mobile ownership. However, the market in Ghana may be approaching saturation (Figure 3), and the qualitative research identified some resistance to mobile phone ownership, especially among the poor, who may feel subject to peer pressure yet can ill afford to pay for airtime (Barnett *et al*., 2017).

Figure 3: Mobile subscription rates per 100 people (Ghana)[8]



Source: Authors' own (updated 2019).

5.2 Value proposition

The VFC bundle included the following components:

- **Weather information**: three SMS messages in English with local weather information per week. ALINe (2016b) found weather to be the second most commonly used type of information.
- **Market price information**: one SMS message in English with local market price information per week for a selected crop and selected market. ALINe found market prices to be the most commonly used type of information (ALINe, 2016b).
- **Agri and nutrition tips**: one weekly recorded voice message in the selected local language with seasonal agricultural or nutrition tips (three agri tips and one nutrition tip per month) for the selected crop. Agri tips had limited appeal.
- **Access to Farmer Helpline call centre**: free access to a call centre with advice available from an agricultural expert. Users mostly called the helpline for farming tips, and information from the call centre was felt to be most actionable.
- **Free community calling**: free calls to other VFC users.
- **Discounted SMS and calls**: to non-VFC members.

Innovative features in the application distinguishing this from competitor services were:

- a platform for peer-to-peer sharing and learning – free community calling; and
- a more active engagement than just receiving voice and SMS calls – helpline, free calling to other farmers, mobile money transactions, and content tailored to crops/livestock and to location.

Subscribers were, however, not fully aware of the features available within the VFC bundle. Different agencies marketed the VFC product differently, e.g. OSJ agency customers were more likely to be aware of the content elements of the product, whereas those signed up by Vodafone's

[8] World Bank data.

below-the-line efforts were more likely to be aware of free and discounted calls. Many customers were unaware of any of the benefits of VFC.

Surveys indicate that the most commonly **reported behaviour change** among users was negotiating a better price at markets. Other commonly reported changes included changing the way they keep their soil fertile and using weather information to change the timing of farming activities.

Esoko identified that VFC was experiencing a high number of hang-ups of voice calls. A phone survey in November 2017 showed that most subscribers did not know about VFC and they did not want to be on the product. They also found that Vodafone's deactivation code (9090) was not working.

The quantitative study showed that making calls and texts to friends or family was by far the most frequently used function, with 24.6% of households using it every day. Note that it is not clear if these calls were made on the Closed User Group (CUG) or if they used airtime; however, the low airtime expenditure figures suggest intensive calling is likely to be on the CUG. Among the information-related push-type services, the agriculture and nutrition tips were most popular:

- 73% listened to the agriculture and nutrition voice messages always or often;
- 55.4% read the weather messages always or very often;
- 54.2% read the market price messages always or often; and
- 36.2% had used the call centre to speak with an agricultural expert.

The main reasons for not listening to the tips (by outbound dialling (OBD) in local languages) were weak service and not having access to a phone. The main reason for not reading weather and market price information (by SMS in English) was not being able to read English. The main reason for not using the call centre was not knowing that it was available. Overall, these results suggest that voice messages in the local language was a better platform than SMS in English for delivering content. However, this is a substantially more expensive medium.

Among those respondents who used each of the information services offered under VFC, the call centre was the most highly regarded. Tips on agriculture and nutrition were the next most popular, while weather and market prices were least valued (see Table 3). Even though farmers who used the call centre found the information to be very useful, among *all* users it was regarded as the least useful aspect of the service, and agriculture tips were most useful (see Table 4). The relatively low rankings given to weather, market prices, and nutrition tips suggest that farmers already have access to weather and market prices, and they are not interested in nutrition tips. Overall quality scores for all aspects of the services were good (Figure 4).

Table 3: Perceived value of information services

Information service	n	Value of information	Trust in information+
Call centre	234	96%**	94%
Agriculture and nutrition tips	582	72%*	81%
Weather	594	57%*	69%
Market prices	576	51%*	64%

* Always or very often found the information useful.
** Found advice from the agriculture expert useful.
+ Agrees that they trust and feel confident in information provided by VFC.

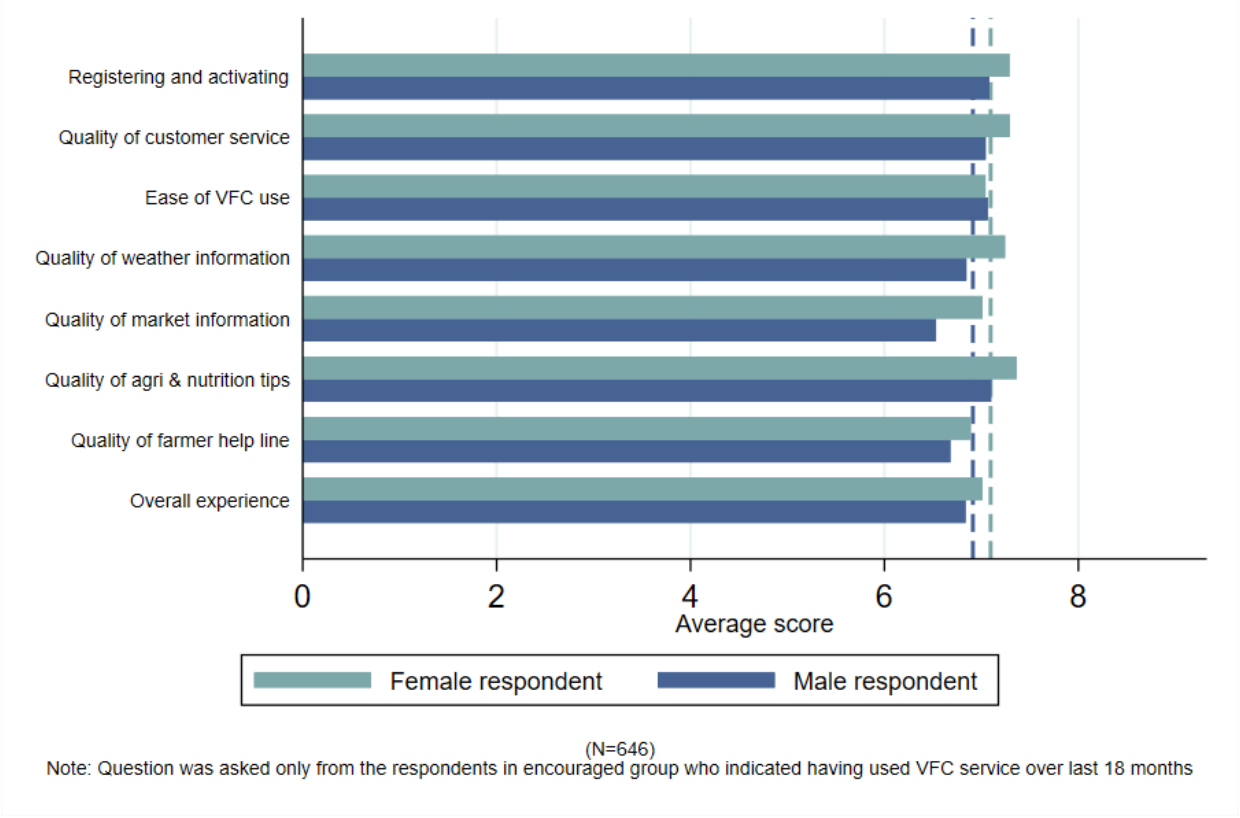
Source: Authors' own, based on Billings *et al.* (forthcoming, 2020)

Table 4: Most useful aspects of the VFC service (n=646)

VFC feature	Proportion who found it most useful
Agriculture tips	55%
Weather information	12%
Market prices	10%
Nutritional tips	8%
Free calls	3%
Discounted calls	3%
Call centre	2%
Other	8%
Total	100%

Source: Authors' own, based on Billings *et al.* (forthcoming, 2020)

Figure 4: Reported quality scores[9], by gender



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

The key metric used by the mNutrition M&E was behaviour change: did farmers change their behaviour as a result of receiving information through VFC? According to ALINe (2016b) found 97% of users reported some kind of behaviour change. The figures obtained by the quantitative study are also high, but not quite so optimistic (e.g. 75% of respondents reported changed behaviour related to agriculture and nutrition tips). This can be explained by differences in the sample selection between the two survey techniques.

[9] On a scale from 1 (very low) to 10 (very high).

Respondents to the qualitative study felt VFC had helped them to increase their yields and improve their food storage and land preparation practices. However, the quantitative study found that use of VFC (at least once in 18 months) had minimal impact on the primary outcomes of household and women's dietary diversity, agriculture production, or nutrition or farming knowledge. Findings from Barnett *et al.,*'s (2018) study confirm that information on agricultural tips, weather, and market prices was all regarded as useful, but actual benefits were aspirational: 'they continue to use the VFC services with the hope that they can increase yields and reduce postharvest losses'.

All of these positive metrics are at odds with the weak WTP for the service, which was evident when the subscription fee was reintroduced, and two-thirds of users left the service. It is likely that shifting prices confused customers, who had come to expect the service to be free after the subscription fee was temporarily dropped.

5.3 Channels

The main channels through which customers come into contact with Vodafone are as follows:

- **Customer acquisition** – enrolling in the club (SIM registration). There were originally three channels through which Vodafone acquired VFC members:
  - Agents – two agents were employed (one in the north, one in the south) to promote VFC by moving from village to village.
  - Freelancers – Vodafone employ around 3,000 individuals to go out into communities and promote Vodafone products in general, rather than only VFC. They represent the 'business as usual' acquisition vehicle.
  - There are also 'retailers' – these are stationary (e.g. a table at a market). There are 30,000 of them, but most are in urban areas, so only relatively few in rural areas have been trained and equipped to sell VFC.

  The highest number of acquisitions were achieved by agents, followed by freelancers – few were brought on by retailers. The cost per acquisition is also highest for agents.
- **Registration or profiling** – once enrolled, farmers need to enter details of their farming practice in order for the Esoko system to send them information tailored to their needs. VFC has struggled with the onboarding and profiling of farmers. Field agents did a poor job because incentives were based on the number of farmers signed up. Then an automated profiling process allocated a 'typical' profile based on the geographical location. Detailed profiling could then be done by farmers calling the call centre, Esoko calling farmers, or by the agents, but each of these had shortcomings.
- **Helpline** – free access to agricultural experts in Esoko's call centre. Farmers appreciated being able to speak to a real person. The qualitative research found that by the time of the endline study most were aware of the call centre, even though few actually used it.
- **Payment** – airtime vendors and automated billing systems. VFC struggled with devising an effective payment mechanism. Initially, farmers had to make a payment each month (manual renewal), but dropout rates were high, and farmers did not understand the system well. An autorenewal service was introduced in late 2015, but again farmers did not understand the system and further tweaks were made. Farmers struggled to pay GHS 2 per month, not necessarily because it was too expensive but because they were not accustomed to the concept of paying a monthly subscription for a service (reinforced by the fact that 98% use prepaid mobiles).
- The **automated services** themselves (voice and SMS messages). There are strong indications from the qualitative research that farmers prefer voice messages, preferably in local languages.

As most farmers are illiterate, information sent to the farmers via SMS text messages is unlikely to be read.

The qualitative research found that farmers engage well with OBD voice messages in local dialect and that these were the most used feature of the VFC bundle. However, Esoko found that farmers were not listening to these messages. When conducting research to understand why not, they found that there were two groups of users:

- Those who were not farmers – they found rural agents were simply giving customers VFC SIMs without checking they were farmers, or explaining the full features of the VFC bundle.
- Farmers who wanted the information but for whom the timing was wrong, e.g. messages came through when they were out in the fields.

The reach of the SMS-based services (weather and market prices) is limited as most farmers indicated that they cannot read or understand English. Those who do make use of the SMS services mostly depend on friends and family who are literate in English. Within a context of declining access to traditional sources of information such as government extension workers and radio, respondents to the qualitative study felt that mobile-based information on its own can still be useful. Note that even if text messaging is not regarded as the most important source of information, it can still play a part in behaviour change by reinforcing messages from other sources and providing supplementary information.

The quantitative study found that only 50% of participants who had registered for the VFC service reported that someone in the household had actually used the service in the last 18 months.[10] The main reason given for not using the services was losing or not using the SIM, followed by not having access to a phone. Other reasons included faulty phones and poor network connectivity.

5.4 Customer relationships

The call centre facility offered a means of establishing personal relationships with customers. However, the endline quantitative study found that only 26% of VFC members called the call centre. Initial ideas of fostering personal relationships through local ambassadors did not materialise. Moreover, agents were transient and present only during the launch phase of the product, leaving freelancers and retailers, neither of whom were fully engaged with the VFC product.

From early on in the VFC journey, Vodafone was aware that payment mechanisms were a problem. For example, in 2015 ALINe showed that most people who tried VFC but failed to re-subscribe either did not know how to re-subscribe or were simply unaware of the need to do so (ALINe, 2015). An autorenewal system introduced in 2015 met with some success but research from 2016 showed that most users (62%) still did not know how to pay for the service (ALINe, 2016a).

Qualitative research indicates that people in rural areas with poor connectivity tend to feel ‘trapped’ in their choice of MNO by network coverage and signal availability. This suggests that there is little point in Vodafone investing in improving the customer relationship as it has little influence on customer retention. Despite this, the quantitative study found that VFC users were more likely to

[10] Under the encouragement design process, 91.5% of treatment households agreed to be registered and were given a VFC SIM. Uptake among this passively registered group will not be representative of the wider base of VFC customers.

use Vodafone as their main network provider (primary SIM) – an increase of 9% (for both women and men).

5.5 Revenue streams

The original business model was built on generating direct revenue from both airtime and subscription fees. During the life of VFC, pricing models have changed. In October 2016, the subscription fee of GHS 2 per month was dropped to meet subscriber number targets. Then a subscription charge was reintroduced in June 2017, albeit at a much lower rate (GHS 0.50 per month).

A WTP experiment was carried out as part of the baseline quantitative research (Billings *et al*., 2017). This suggests that most farmers (over 85%) are willing to pay a small subscription fee (up to 1 GHS/month), but that demand drops dramatically at prices beyond 1 GHS/month, such that only 50% were willing to pay 2 GHS/month. Although these may seem like low subscription rates, they should be considered in the context of an ARPU for VFC users of only 2.5 GHS/month.

Vodafone report ARPU for the VFC base as GHS 2.5 per month. However, the quantitative study found much higher levels of expenditure: GHS 11 per month among women and GHS 27 per month among men. Note that this is their entire expenditure, which will be spread across multiple SIMs.

5.6 Indirect benefits

The primary aim of Vodafone was to increase its rural customer base by offering a low-cost, high-value product to smallholder farmers who were not yet signed up with a mobile operator. The quantitative study does not provide any evidence that this strategy has been successful within the communities sampled.

Nonetheless, the VFC offer led to significant increases in the stickiness of the Vodafone network:

- VFC users were more likely to use Vodafone as their main network provider (primary SIM) – an increase of 9% (for both women and men). Given that 20% of women and 22% of men in the comparison group used a Vodafone SIM as their main SIM, this represents an increase of roughly 43%.
- The proportion of phone numbers owned by an individual on the Vodafone network increased by 9.6 and 11.4 percentage points for women and men respectively. Given that the proportions of phone numbers on the Vodafone network were 20% among women and 22% among men in the comparison group, this represents an increase of roughly 50%.

However, there is no evidence that SIM turnover is lower among VFC users: 77% of women and 89% of men in the comparison group have had their SIM for over a year, and rates were similar among the encouragement group. The qualitative research confirmed that the majority of farmers own multiple SIMs, and deciding which SIM to use was based mostly on network availability.

There is no evidence that the VFC led to any increase in ARPU. The VFC service did not increase usage in terms of making or receiving calls, sending or receiving text messages, or total amount spent on airtime.

Levels of customer satisfaction were generally high: 83% of women and 91% of men said that they were likely to recommend their main network provider to their friends or family. However, being offered the VFC service had no impact on this customer satisfaction metric among women, but significantly decreased satisfaction ratings among men.

In terms of branding, the qualitative study found that notwithstanding complaints about poor network quality, users largely expressed positive sentiments concerning the Vodafone network, describing it as the one that cared for the needs of farmers and asserting that VFC has been beneficial to farmers.

5.7 Key resources

The resources contributed to the product by each of the partners are summarised in Table 5.

Table 5: Summary of resources brought by key VFC partners

	Vodafone	Esoko	GSMA / GAIN and partners
Physical	Network infrastructure Billing systems	Call centre Software platform	
Intellectual	Brand Customer base	Agricultural content database Experience of working with agri VAS Experienced staff	Nutrition content Quality control processes
Human	Product development Experienced staff Marketing	Expert network Software developers Network of market enumerators	UX researchers Business intelligence Monitoring, evaluation, and learning Business consultancy

Source: Authors' own

The VFC partnership offered Esoko a route to scale because Vodafone offers nationwide reach (infrastructure), can push services to existing customers (customer base), and has systems that deal with billing, micro-payments and marketing (a network of 3,000 regional freelancers and up to 30,000 point-of-sale agents; see Section 4).

Esoko had a long track record of working with agri VAS, having set up Tradenet in Ghana over 10 years ago. It provided the technology platform and a database of agricultural content as well as staff to manage the localisation of agriculture and nutrition tips. Esoko's Expert Network proved to be a particularly valuable resource for quality control. Esoko also had a network of enumerators providing data on market prices from markets across Ghana.

Vodafone found it difficult to justify allocating management resources to VFC. The VFC base was running at around 70,000 active subscribers, which represents less than 1% of a total of 7.9 million mass market customers. This made it impossible to justify a marketing budget, and with a team of five staff members, the manager could not justify allocating meaningful staff time to VFC.

5.8 Key activities

Key activities carried out by each of the partners are summarised in Table 6.

Table 6: Summary of activities conducted by key VFC partners

	Vodafone	Esoko	GSMA / GAIN
Platform/network	Operate network Billing customers	Operate Esoko platform (distribute content)	Continuous product feedback from users
Production		Create content Aggregate and localise content continuously (weather and market prices) Update advisory and nutritional content Maintain call centre	Create content
Marketing	Customer acquisition Customer retention	Customer profiling	Continuous feedback from users

Source: Authors' own

Vodafone deals with customer acquisition and registering new SIMs. The Esoko platform requires farmers to be profiled. Data suggest that up to one-third of SIMs were not successfully registered. Then only one-third of VFC customers were successfully profiled by Esoko, which appears to be due to the two-stage (manual) process of porting numbers from Vodafone into the Esoko platform. Consumers also complain of poor network quality.

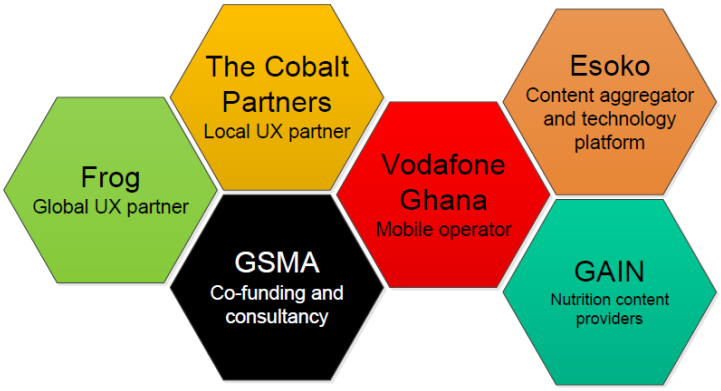
Research highlighted a need for ongoing customer education, e.g. customers were not aware of how to pay their fees, nor of the functionalities available in the VFC bundle.

Content creation (agriculture and nutrition tips) has been managed by GAIN in a two-part process of global and local content generation, with Esoko responsible for local content generation. CABI has pointed out that content cannot be regarded as a static commodity because, as local conditions change, it will go out of date. It will therefore be necessary to continually update content to address new challenges, changes in policy, advances in knowledge and technology, and so on.

5.9 Key partnerships

Parties to the partnership model are illustrated in Figure 5. The nature of the relationships between different sets of partners are summarised in Table 7.

Figure 5: Partners and other key players



Source: GSMA (2016a). Reproduced with permission.

Table 7: What parties give and get from partnership relationships

Partnership	Contribution of parties		Type
	First set of partners	Second set of partners	
Vodafone – Esoko	Vodafone: Reach, marketing (customer acquisition), billing	Esoko: Agricultural expertise and database (content), content platform, content management	Symbiotic, acquisition of resources; Vodafone want VAS, Esoko want scale
Vodafone – GSMA	Vodafone: project lead	GSMA: funding, technical assistance	Symbiotic: reduces risk to Vodafone of new product; VFC contributes to GSMA development strategy
GSMA – GAIN	GSMA: funding, project management	GAIN: agricultural content expertise	Symbiotic: open-access database fits GAIN mandate, and adds value to mNutrition project
Esoko – Expert Network	Esoko: financial compensation	Network members: refine product (reduce risk), credibility	Symbiotic: VFC contributes to members' mandate to improve agriculture
GSMA – Frog	GSMA: funding	Frog: design resources	Contractual
Vodafone – Cobalt	Vodafone: funding	Cobalt: design resources	Contractual
Vodafone – Agents	Vodafone: funding	Agents: marketing resources	Contractual

Source: Authors' own

When VFC was launched, Esoko entered into a two-year contract with Vodafone. This was followed by a one year contract, which was then extended twice into early 2019. The contract was then not renewed, so the product was paused in January 2019.

The partnership relationship between Vodafone and Esoko was a contractual one and was reported to have deteriorated over the course of the project, mainly due to personnel issues.

Esoko has continued to deploy its core market information system in collaboration with other programmes in parallel with VFC. For example, the multi-donor-funded Agricultural Development and Value Chain Enhancement Project commissioned Esoko to disseminate market and weather information and agriculture tips to 20,000 farmers in Ghana.

5.10 Cost structure

Vodafone has shared the final financial report that was submitted to GSMA under their grant agreement. This has been used as a source of much of the cost data for the financial model described in Section 6.

Voice messages sent out to farmers were well received (Barnett *et al*., 2018), but they are expensive. MNO charges are roughly GHS 1 per minute for voice messages, compared with GHS 0.05 per SMS (i.e. 20 times the cost). All of these costs were covered by Vodafone. The cost of developing text for messages was covered by funding from GSMA through GAIN, but Esoko covered the cost of recordings for OBD messaging.

The value of SMS messages delivered was the largest single cost component, when SMS messages were priced at the prevailing market rate for individual customers (GHS 0.055 per text). Even if bulk purchasing prices were used and these costs halved, they would still represent the largest single cost component.

Esoko originally received GHS 1.50 per subscriber, but under the new contract this was reduced to GHS 0.40. There is a tiered payment structure, but these figures are rough averages. Vodafone considered various ways of making VFC more profitable, such as moving to an alternative content provider at lower cost, and recreating the mNutrition database internally.

5.11 Investment

In addition to those costs directly associated with VFC (both operating and capital), FCDO and GSMA have invested in wider programmatic costs that have stimulated and supported this action.

It is worth noting too that Esoko has a history of investments made over the years by the founder, equity investors, programme partners, and various donors.

6 Financial viability of business models

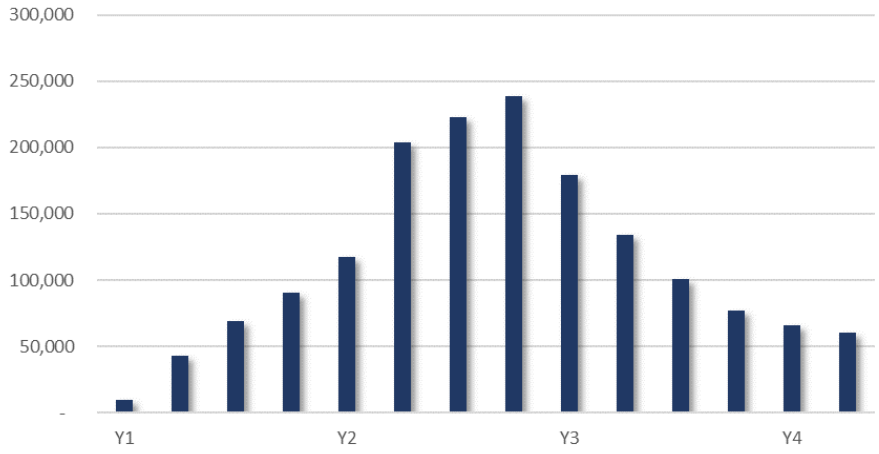
6.1 The VFC journey

It can be argued that although VFC went through three pricing structure iterations, these represented only two distinct models. When first launched, the monthly subscription rate was relatively high at GHS 2 per month, and this revenue was shared more or less equally with Esoko, the content provider, under the sub-contract agreement. Toward the end of 2016, when the subscriber numbers were substantially short of the initial target of 400,000, negotiations with GSMA resulted in a revised target of 200,000 subscribers, which was achieved (among other measures) by eliminating the subscription fee altogether. A much-reduced subscription fee of GHS 0.5 per month was then introduced, but under a revised contract agreement with Esoko in which almost all of this revenue was passed on to the content provider.

The first and third iterations represent subscription models, with differing degrees of revenue share between the MNO and the content provider. The second iteration represents a freemium type model: customers were able to access the VFC features for free, but then had to pay for additional mobile phone services, i.e. airtime, which represents the revenue stream for Vodafone.

These three distinct phases in the VFC journey resulted in an unusual profile of subscriber numbers[11] (see Figure 6). A financial analysis based on actual costs has been carried out on each phase. Financial data provided by Vodafone and GSMA has been used to create a financial model, which has been used to model the financial viability of each of the three iterations.

Figure 6: Estimated profile of subscriber numbers (quarter 3, 2015 to quarter 4, 2018)



Source: Authors' own.

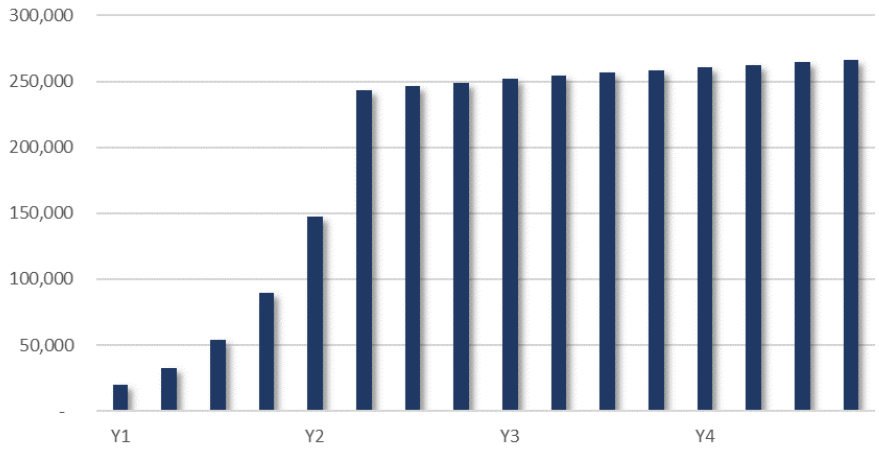
[11] This profile has been generated to reflect subscriber numbers reported by Vodafone at different points in time over the duration of the evaluation project.

6.2 The financial model

The model calculates two key metrics: net present value of investment in the product and the IRR. It is based on the cost structure and cost data provided by Vodafone to GSMA in the final financial return,[12] supplemented by data gathered through interviews.

Key to the model is the estimated profile of subscriber numbers. An analysis of subscriber number profiles among all agricultural projects within the mNutrition programme is presented in Section 8. This suggests that expenditure on customer acquisition activities during the early stages of product launch can achieve exponential growth during a rapid growth period. Thereafter, growth continues on a straight-line basis as the product enters a more mature phase. The following analysis is based on the profile presented in Figure 7, which results in a subscriber base of 270,000 after a four-year period.

Figure 7: Estimated subscriber numbers profile for four-year period



Source: Authors' own.

Cash flow is calculated from estimates of revenues and variable costs, which depend on the customer numbers profile, as well as fixed costs. Details of cost components and estimates based on financial records from VFC are presented in Annex D.

Cash flow (Operating profit) = Revenue – Cost of sales – Fixed costs

Revenue:

- Subscription fees
- Airtime expenditure

Cost of sales:

- Cost of SMS – nominal value to MNO of text messages sent to customers
- Taxes and fees – any product is expected to contribute to group taxes
- Content provider – revenue share of subscription fees with content provider
- Call centre – contribution to cover cost of call centre operator (third party)
- Cost of scratch cards – branded airtime scratch cards

[12] Internal document.

- Sales commission – paid to agents

Fixed costs:

- Product development – in-house UX design, M&E, and content curation
- Marketing expenses – merchandising and field presence
- Administration expenses – project management, support staff, and training

This analysis considers the viability of the agricultural information product to the MNO. Therefore, it considers investment costs incurred in developing the product for roll-out in a specific country. The following investment costs have been included in the model (see Annex D):

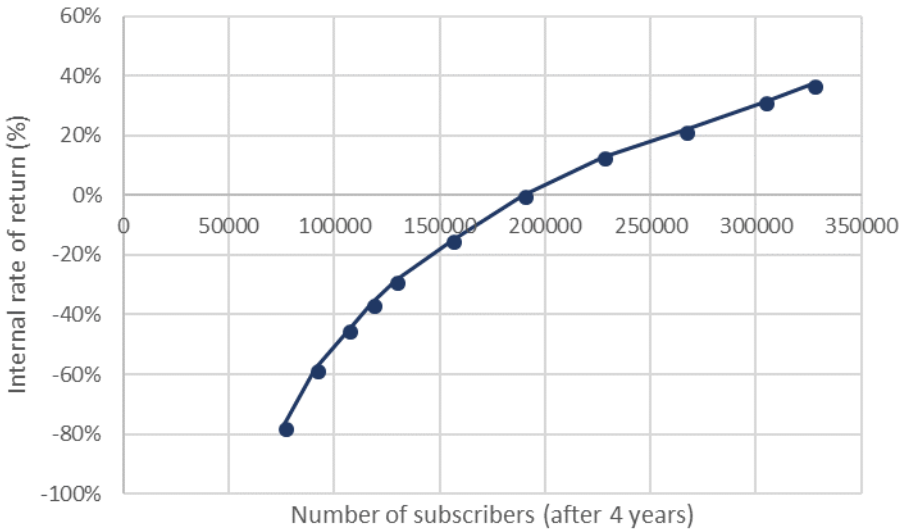
- technology – integration of content provider into operator network and SIM Application Toolkit (STK) set-up;
- localisation of content – e.g. developing appropriate messages and seeking necessary approvals; and
- support service provided by the mNutrition programme – e.g. formative evaluation and UX consultants.

6.3 Subscription model

The country-specific investment costs outlined above total £387,000. Based on the original subscriber price of GHS 2 per subscriber per month, this gives a total projected revenue over a four-year product lifetime of £7.8 million, with 56% from airtime and 44% from subscription fees. The IRR on this investment would be an attractive 80%, but in practice Vodafone was not able to achieve these subscriber numbers at this subscription rate.

At the reduced subscription rate of GHS 0.5 per subscriber per month, revenue drops to £5.2 million, with only 17% raised from subscriptions. Assuming that the amount passed on to the content provider was also GHS 0.5 per subscriber per month (i.e. 100% revenue share), then the IRR on the investment drops to 22%. Given that revenue is dominated by ARPU, the financial performance is not highly sensitive to revenue share with the content provider. If the revenue share was 30%, for example, the IRR would increase only to 44%. However, this is valid only if a subscriber base of 270,000 can be achieved after four years. Since reintroducing the subscription fee, and reducing the amount paid to Esoko, the subscriber base has fallen to nearer 60,000. After the launch period, this level of demand demonstrates a positive contribution margin but has a negative cash flow over the four-year period, i.e. it is not sustainable. Figure 8 indicates that charging the reduced subscription rate (and paying 0.5 GHS per subscriber per month to Esoko) starts to become financially viable only if subscriber numbers of over 200,000 can be achieved.

Figure 8: Sensitivity of IRR to subscriber numbers (low subscription rate)



Source: Authors' own.

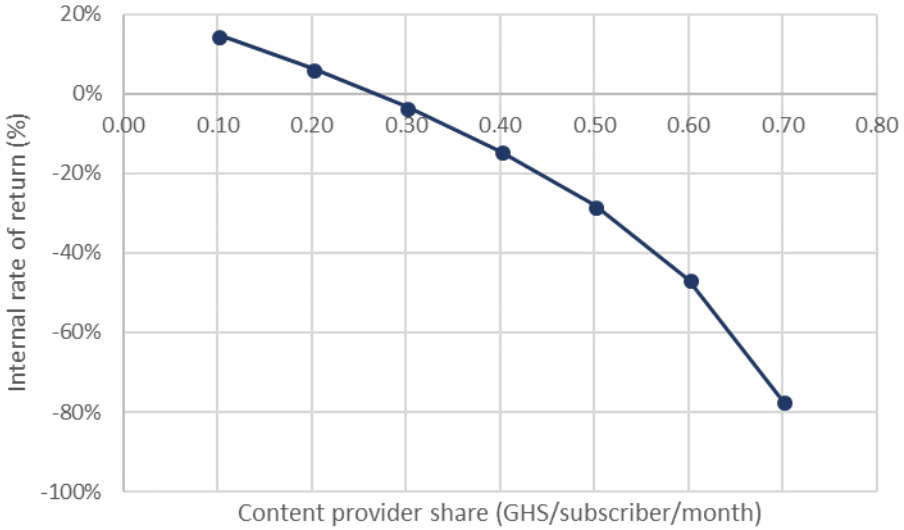
Note that at the end of 2018, with a reduced subscriber base of approximately 60,000, Vodafone reckoned that the contribution margin of VFC was 64%, which is well within the target range normally expected for the mass market segment (60–70%). Entering these assumptions into the model gives a contribution margin lower than that reported by Vodafone, indicating that the model is somewhat conservative.

6.4 Freemium model

The country-specific investment remains at £387,000. With no subscription revenue, the airtime revenue drops to £4.3 million, resulting in an operating loss over a four-year lifetime. This appears to confirm that Vodafone was right to say that the content provider costs were not sustainable (based on the original contract price of GHS 0.85 per subscriber per month).

The sensitivity analysis presented in Figure 9 suggests that if the revenue share to the content provider were reduced to around GHS 0.2 per subscriber per month, the investment might start to look attractive, given an assumed subscriber base of 270,000.

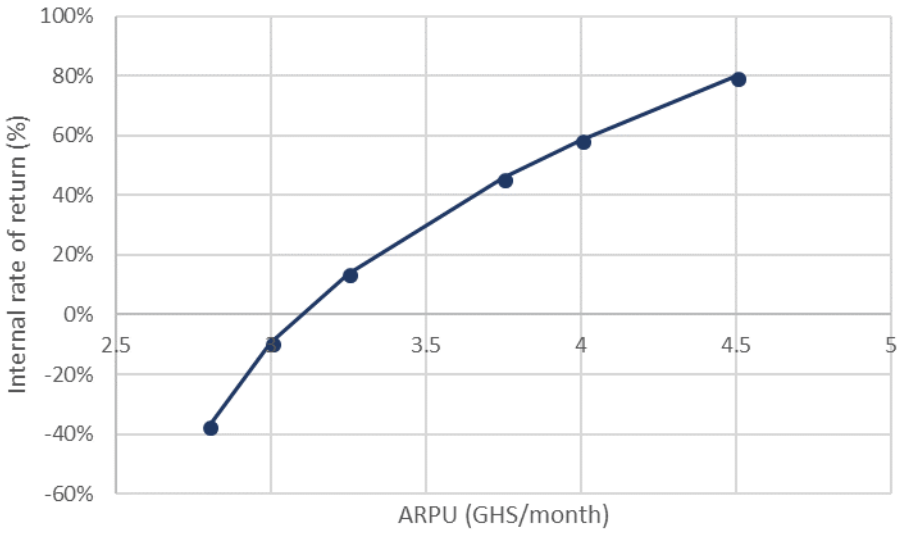
Figure 9: Sensitivity of IRR to revenue share with content provider



Source: Authors' own.

A freemium model is driven by revenue generated from additional services, which is expenditure on airtime in this instance. The figures above are based on the reported ARPU of GHS 2.5 per month. However, this is for a particularly low-income segment of mass market customers. Figure 10 suggests that financial viability is highly sensitive to ARPU, so if the product could attract a slightly higher status market segment with an ARPU of GHS 3.5 per month, this would be enough to make even a freemium model financially attractive.

Figure 10: Sensitivity of IRR to ARPU (freemium model)

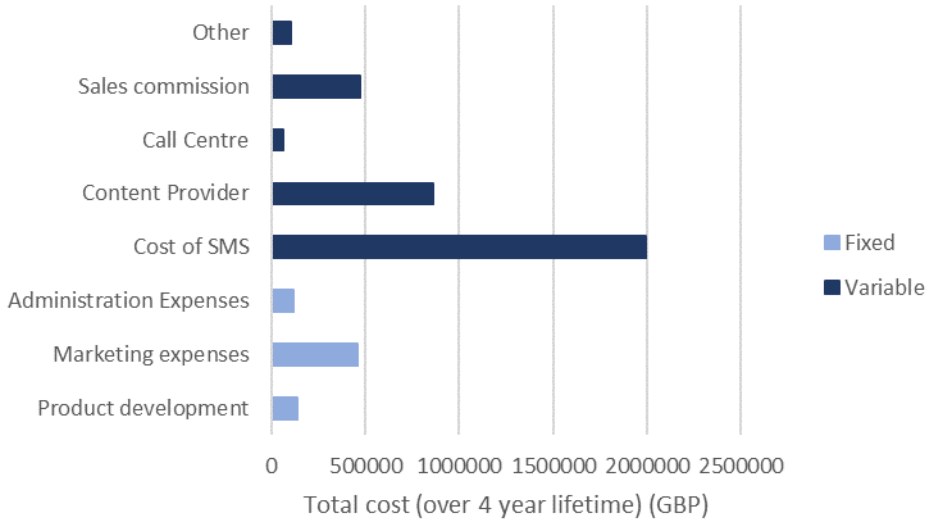


Source: Authors' own.

6.5 Sensitivity to cost of sales

The relative weights of different components of operational expenditure are illustrated in Figure 11. These figures are based on assumptions representing the low subscription rate model, and show how operational expenditures are dominated by the cost to the MNO of sending SMS messages to subscribers.

Figure 11: Operational expenditures (summed over four-year lifetime)



Source: Authors' own.

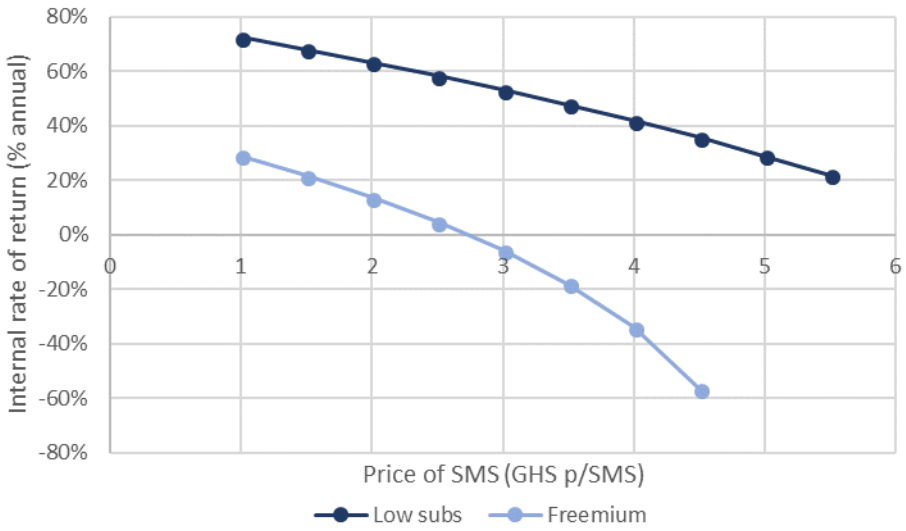
What is the real cost of sending an SMS? In a study on the impact of consumer consumption of network services (voice, SMS, and data) on network profitability, Blackburn *et al*., (2013) highlight a trend toward flat-rate pricing (as opposed to pay-as-you-go). They point out that one feature that makes this attractive to operators is that the cost of delivery is a small fraction of the retail price. Keshav (2009) concluded that the cost of sending an SMS message was likely to be less than 0.003 USD/SMS, or 2% of the per unit price charged to pay-as-you-go customers. Lack of clarity on the true cost of sending an SMS message continues to plague development cost modelling. For example, in a study of an mHealth intervention in Tanzania, Mangaone *et al*., (2016) modelled scenarios using standard SMS charge rates (0.03 USD/SMS) along with reduced rates (0.02 USD/SMS and 0.01 USD/SMS) representing negotiated bulk purchasing agreements.

The analysis up to this point has been based on a figure of GHS 0.055 per SMS, which is the price that an individual customer would pay to send an SMS and is quoted by the MNO on their website; it can be interpreted as representing the opportunity cost to the MNO. However, given that the MNO is sending out messages to thousands of subscribers, it could be argued that a bulk SMS price would be more realistic: a figure of GHS 0.03 per SMS was quoted in the baseline report. Figure 12 shows how returns on the investment look much more attractive at this level of SMS price.

Where an intervention purchases SMS messages, through a negotiated bulk purchase agreement, for example, the cost represents a real cost to the implementing agency. This is not the case with VFC, where the messages are sent by the mobile operator. The fact that Vodafone omitted the cost of sending SMS messages from its financial report to GSMA indicates that this action does not incur a real cost, which highlights the difficulty in attributing a meaningful cost to an operator of sending messages. If the real cost of SMS messages is discounted still further, even the freemium

model (with GHS 0.85 per subscriber per month paid to the content provider) can show a reasonable rate of return – see Figure 12.

Figure 12: Sensitivity of IRR to SMS price (low subscription and freemium models)



Source: Authors' own.

6.6 Understanding subscribers

When the VFC product was first conceived, it was clearly targeted at low-income, small-scale farmers, inclusive of women. The product was intended as a vehicle for attracting the last remaining consumers without phones (the so-called 'laggards') to subscribe to the Vodafone network. The revenue generated by each new customer therefore represents additional revenue to Vodafone.

When Vodafone revised the product in order to boost subscriber numbers toward the end of 2016, it not only removed the subscription fee (temporarily) but also relaxed the eligibility criteria. Eligibility was revised to include low-value customers from the existing Vodafone customer base. Near-dormant SIM cards received a blast SMS inviting these existing customers to change to the VFC product. However, it became apparent that many of these new subscribers were urban-based and data suggested they had signed up mainly to take advantage of the CUG free voice calls. From their behaviour, Vodafone concluded there were few farmers signing up to benefit from the content. It then improved the subscriber base by moving non-farmers to another more relevant tariff, and refined the criteria used to send invitations to existing users, which were made on a stronger geographical basis.

This illustrates a potential threat to revenue by migrating existing customers from one product to another. If the new service offers additional features that are sufficiently attractive to command higher charges, then migrating customers to the new service would generate positive marginal revenue. However, if the charges associated with the new service are **lower** than those originally charged, then migrating customers will result in a negative marginal revenue. This is likely to have been the case when Vodafone invited existing customers to sign up for VFC because the VFC bundle included free group calls as well as discounted tariffs outside the group. This appears to be

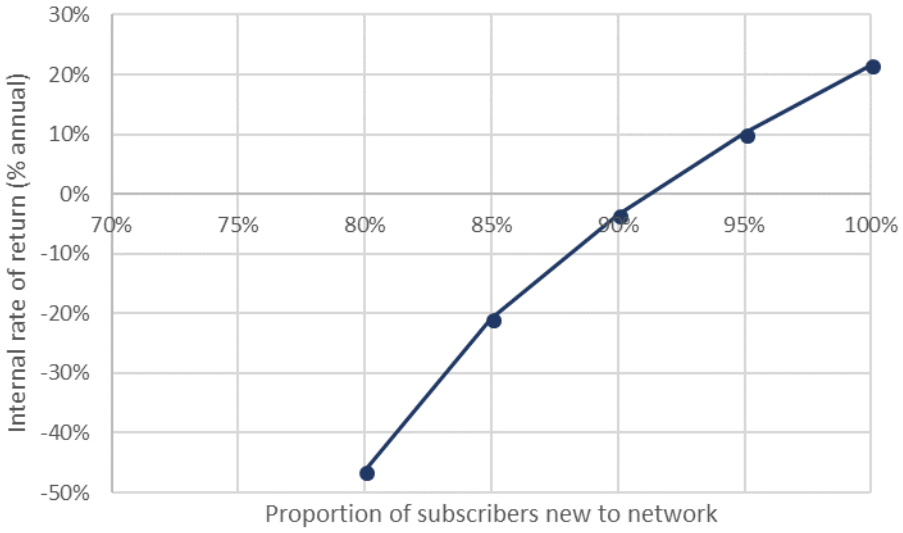
consistent with figures provided by Vodafone – ARPU for the mass market segment as a whole runs at around GHS 3 per month, whereas ARPU for VFC was around GHS 2.5 per month.

An attractive product can also persuade competing networks' subscribers to migrate to Vodafone. In this instance, the ARPU of these new subscribers represents additional revenue to Vodafone, in much the same way as people who have signed up for a mobile phone account for the first time.

It is not clear how many of the subscribers gained during the 'freemium' model stage were previous Vodafone customers and how many were attracted from other networks by the free service. Nor can we say what the ARPU of Vodafone customers was before and after they signed up for VFC. The discussion of the freemium model in Section 6.4 suggests that the product would lose money if the content provider fee was fixed at GHS 0.85 per subscriber per month. Any provision for a negative marginal revenue to account for those Vodafone customers who simply changed from one plan to VFC would make the financial performance worse still.

The IRR calculated for the low subscription model was 22% (based on a fee of GHS 0.5 per month, with 100% revenue share with the content provider). However, Figure 13 suggests that this is highly sensitive to the issue of simply getting existing customers to swap plans. If even 10% of subscribers were to have swapped from existing plans, then the product appears to lose money, at least from a group perspective.

Figure 13: Sensitivity of IRR to existing customers transferring from other plans (low subscription model)



Source: Authors' own.

By September 2016, the planned marketing activities targeting low-income smallholder farmers had attracted approximately 70,000 users. As a result of restructuring the product, relaxing the eligibility criteria, and inviting existing customers to join, membership peaked at around 240,000 in October 2016. The difference of approximately 150,000 users represents roughly 60% of the peak membership. These additional subscribers will have comprised:

- first-time mobile phone subscribers;
- customers migrating from other MNOs; and
- existing Vodafone customers transferring from other plans.

Without knowing the percentage breakdown, it is not possible to model the financial viability of the low subscription model. However, if these new customers were spread evenly across the three categories, then the proportion of new subscribers brought on to the network would be 80%. The effect of swapping existing customers would then ruin the financial viability of the product (see Figure 13).

6.7 Strategy for Value-Added Service (VAS)

The previous section outlined that the original purpose of VFC was to be a vehicle for getting first-time mobile phone users onto the Vodafone network. In this respect, the concept was appropriate at the time, when substantial numbers of the population were not yet mobile phone users. Penetration rates have continued to rise steadily over the six years since VFC was conceived, but may now have reached such high levels that they are levelling out (see Figure 3 and Figure 20). The original strategy for VAS was, therefore, appropriate at a given point in time, and only appropriate for a given duration, until the potential market of underserved consumers diminished. This is discussed in more detail in Section 7.2.

In a mature market, in which almost all potential subscribers are signed up with one MNO or another, the strategy of VAS is to encourage subscribers on other networks to transfer, and to encourage network subscribers to stay with the MNO that provides a valuable service rather than switching to competing networks.

6.8 Demand scenarios (price elasticity of demand)

Introduction

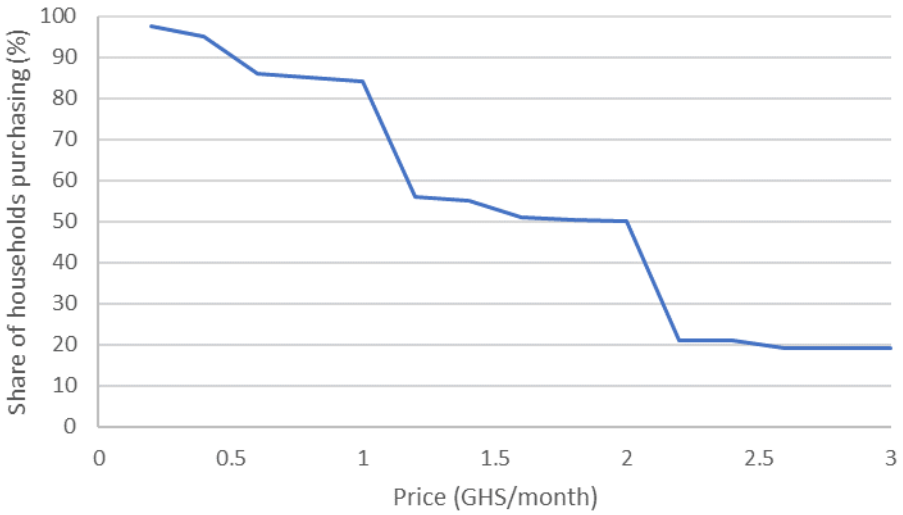
Up to this point, the analysis has been based on the growth of subscriber numbers represented in Figure 7, resulting in 270,000 subscribers at the end of the four-year period. It has already been explained that the actual history of VFC subscribers is difficult to use in any analysis because of the changing nature of the product and how it was marketed. Clearly, demand for any product will be sensitive to price, but it is not clear from subscriber figures achieved by other mAgri products supported by the mNutrition programme that it is the dominant factor in determining the uptake of mAgri services. The highest uptake was achieved by the Khushaal Zaminder service offered by Telenor, Pakistan as a free service (8.6 million). However, among the subscription services, the highest subscriber numbers were achieved by Krishi Sheba in Bangladesh (430,000) and Govi Mithuru in Sri Lanka (580,000), both of which charged customers around 50% more than the cost of the VFC subscription (based on the GHS 0.5 per month fee rate).

This, in essence, confirms that the success of a product is due to a combination of factors behind customer acquisition. Success is due to a high product value proposition, adequate pricing, appropriate marketing strategy, and effective service design, all of which had shortcomings in the VFC offering. It also suggests that to make a successful product requires good product development practice and processes, as well as a strong team, adequate organisational structure, and smart incentives for all staff involved in rolling out the product. Based on the model created to represent the operating finances of the VFC, this section considers the price elasticity of demand and the implications for financial viability.

Willingness to Pay (WTP)

As part of the baseline survey, the independent study team conducted a WTP game designed to explore potential levels of demand for the VFC product at difference price points. The results in Figure 14 suggest that demand would drop substantially if the product were priced above GHS 2 per month, and that demand would be high below a price point of GHS 1 per month.

Figure 14: Results from WTP experiment (IFPRI)



Source: Authors' own.

Size of the potential market

VFC achieved 70,000 subscribers at the GHS 2 per month price point. The WTP chart suggests that at a price point of GHS 2 per month, uptake would be 50%; however, this can only be 50% of those farmers effectively 'reached' by the product, i.e. farmers who have never heard of the product cannot elect to pay for it. Combining these two figures implies that the 'pool' of farmers reached is 140,000. This seems unrealistically low, given that the product went on to gain nearly 250,000 subscribers when the combination of marketing initiatives was introduced to boost numbers.

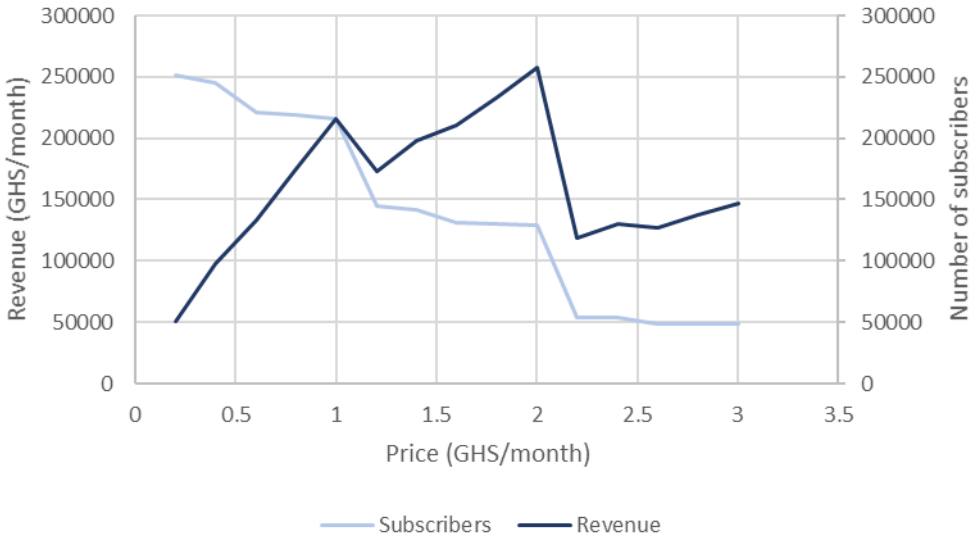
Comparing VFC with other mAgri projects suggests that VFC had the worst performance in terms of percentage of target market achieved (4.8%, compared to around 30% for subscription products in Sri Lanka and Bangladesh). However, it also implies that the target market identified by VFC seems more ambitious than those for other countries. Expressed as a proportion of the total rural population in the country, the target markets for other countries ranged from 1.7% to 4.4%, but the figure set for Ghana was 11.4%.

Interestingly, if 2% of the rural population were to be used as a guideline for the target market, this would be equivalent to 257,600 – almost exactly what was achieved at the peak demand. This is the figure for eligible target market size that has been used in the following analysis.

WTP and revenue

Figure 15 shows how the number of subscribers would be expected to vary with the subscription fee rate, according to the WTP findings presented in Figure 14. The figure also illustrates how revenue would be maximised at a high fee rate of GHS 2 per month. However, this considers only the revenue generated from subscriptions – even given an ARPU as low as GHS 2.5 per month, the revenue from airtime would be the dominant share of total revenue.

Figure 15: Variation of subscriber numbers and revenue with subscription fee

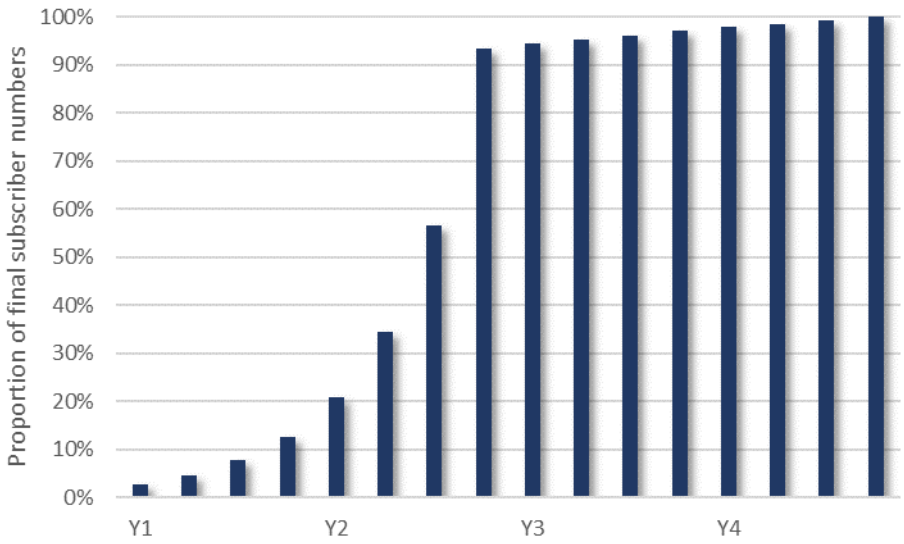


Source: Authors' own.

Variation of financial viability with subscription fee rates

The financial model has been used to estimate the IRR of a product at different subscription fee rates and corresponding levels of demand, as presented above in Figure 15. A limited number of price points have been taken, and similar subscriber growth profiles created for each. These profiles were created using a two-year (eight-quarter) rapid growth stage; an example is presented in Figure 16. The financial performance figures were calculated for a four-year period.

Figure 16: Subscriber numbers growth profile used in model

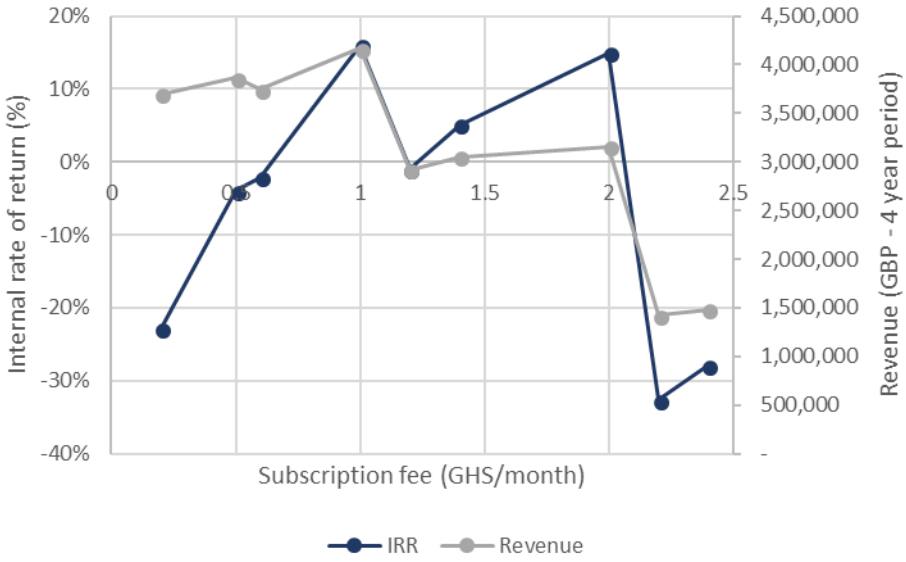


Source: Authors' own.

The results presented in Figure 17 below show that total revenue would be stronger below the GHS 2 per month price point, peaking at a fee rate of GHS 1 per month. The financial performance (the IRR), on the other hand, drops off at fee rates below GHS 1 per month. This is because although the revenue remains relatively constant (airtime revenue increases with increasing subscriber numbers at lower fee rates), the cost of sales increases with increased subscriber numbers. Note that these figures are based on a constant content provider fee rate of GHS 0.5 per subscriber per month, and an SMS cost to the MNO of GHS 0.055 per SMS.

This figure thus suggests that the product would be most attractive if offered at a fee rate between GHS 1 and GHS 2 per month.

Figure 17: Financial performance with varying price and demand



Source: Authors' own.

Figure 17 highlights an interesting dilemma for operators considering a social VAS. Based on the assumptions used, the analysis suggests that from an MNO's point of view, the service becomes most commercially attractive at a fee rate of GHS 2 per month (given a revenue share with the

content provider of 25%). However, at this rate, it is likely to be adopted by fewer customers than if it were marketed at a lower fee rate. For example, at GHS 2 per month, the analysis indicates that the number of subscribers would be only 55% of the number of subscribers that might adopt for a service priced at GHS 0.5 per month. This illustrates a potential conflict between the development benefit (maximising the impact on smallholder farmers) and the commercial benefit (maximising return on investment).

The original marketing activities acquired 70,000 VFC members. Then, after the change in product and marketing to reach the 200,000 target, the number of subscribers returned to around 60,000 after a subscription fee was reintroduced (at GHS 0.5 per month). This would seem to indicate that VFC commands a loyal following of around 70,000 farmers (exhibiting inelastic demand), even though there is a known monthly attrition. The financial model indicates that with this number of subscribers, it is not possible to make a positive return at any tariff fee rate below GHS 3 per month. Furthermore, it indicates that, given a content provider fee of GHS 0.5 per subscriber per month, the product will not make a positive return even if the cost of SMS messages is reduced to zero.

7 Changes in the mobile for agriculture market

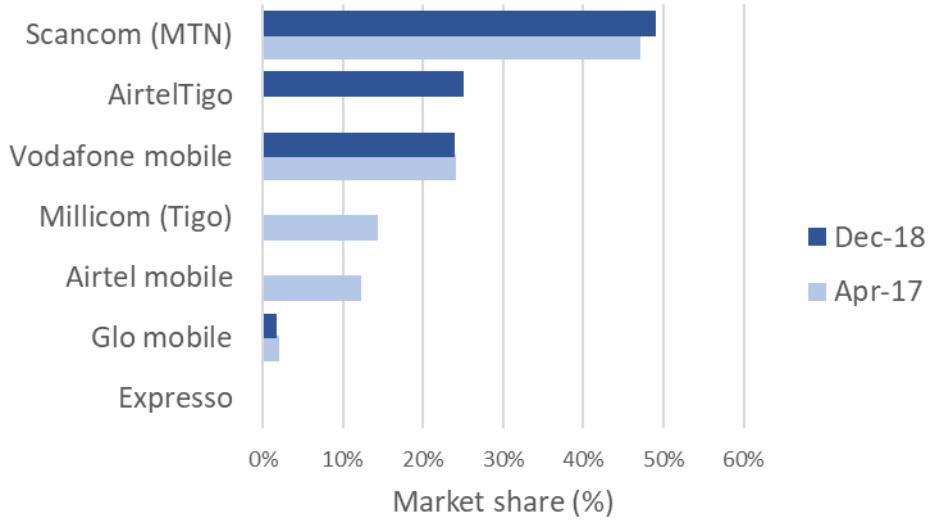
7.1 Vodafone and telecoms in Ghana

According to the latest figures published by the regulator, the total number of mobile subscriptions rose from 36 million in April 2017 to 41 million in December 2018.[13] Over this period, the population has also increased, from 28.3 million to 29.5 million (representing a growth rate of 2.6% per year). The mobile market continues to mature, as the penetration rate increased from 127% to 139%, and National Communication Authority (NCA) figures show that the rate of growth of mobile subscribers continues to slow down:

- January 2015 to January 2016 15.7% (numbers increased by 4.8 million)
- January 2016 to January 2017 9.5% (numbers increased by 3.4 million)
- April 2017 to April 2018 7.9% (numbers increased by 2.8 million)

A substantial change took place in the Ghana telecoms market when Tigo merged with Airtel in November 2017. MTN continues to have the largest market share, and has increased this share from 47.2% (April 2017) to 49.1% (December 2018) (see Figure 18). The consolidation of the two brands resulted in a modest drop in the combined market share (26.6% in April 2017 to 25.1% in December 2018), but this is still enough to push Vodafone into third place, at 24% market share; note that this is exactly the same as the company's share in April 2017.

Figure 18: Market share of voice subscribers (April 2017 and December 2018, derived from NCA data)



Source: Authors' own.

In 2016, 39% of the population of Ghana was under the age of 15.[14] If they are considered to be economically inactive and highly unlikely to own a mobile phone, then figures more accurately represent a penetration rate of 228%, meaning that adults typically own more than two SIMs. This tends to reflect a mature market, but also hides uncompetitive market conditions, notably restricted network coverage in certain areas and off-net tariff premiums (i.e. it costs more to call someone on a different network). There also remain parts of the population that lack access to mobile

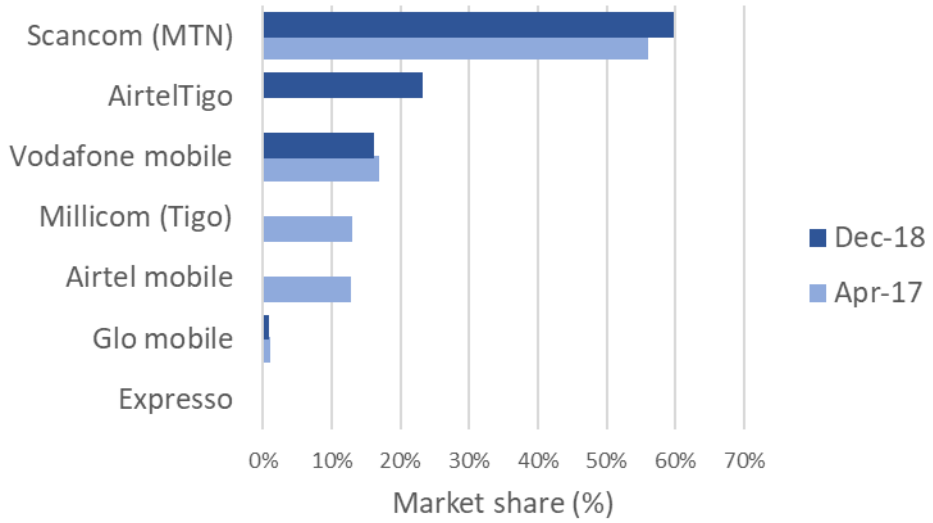
[13] https://nca.org.gh/industry-data-2/market-share-statistics-2/telecom-voice/
[14] www.demographicdividend.org/country_highlights/ghana/

communications, but the Ghana Investment Fund for Electronic Communications (GIFEC) is mandated with increasing the access of those currently unconnected in Ghana. It is a partnership between government, MNOs, and private investors that administers the country's universal access fund. It has set itself a target of reaching 95% access to mobile services in rural communities by 2019.[15]

Mobile internet subscribers have also grown over the period from 21.6 million in April 2017 to 26.2 million in December 2018. Expressed as a share of mobile subscribers, internet use has increased from 60% to 64% of mobile subscribers. However, as with mobile subscriptions, the rate of growth of internet users has reduced, from 16% growth between April 2016 and April 2017 to 4.1% growth between April 2017 and April 2018.

MTN has increased its market share from 56% to 60% over the previous 20 months – see Figure 19. During this period, Vodafone's market share has remained more or less constant at 17%.

Figure 19: Market share of data subscribers (April 2017 and December 2018)



Source: Authors' own (NCA data).

There is an appetite among mobile internet service providers to develop the data market. For example, GIFEC has partnered with Vodafone and GSMA in a project to increase rural access to the mobile internet. The partnership is to be funded under the Connected Society Innovation Fund for Rural Connectivity.[16] The purpose of the programme is to enable mobile network equipment suppliers to test innovative solutions to extend internet coverage to remote areas lacking infrastructure. Vodafone has also recently announced a partnership with Facebook to deploy low-cost wi-fi hotspots across the country, with a focus on underserved and underprivileged communities.[17]

[15] https://gifec.gov.gh/
[16] https://www.gsma.com/newsroom/press-release/gsma-vodafone-and-gifec-partner-to-deliver-connectivity-to-rural-communities/
[17] https://wifinowevents.com/news-and-blog/vodafone-ghana-teams-up-with-facebook-for-nationwide-public-wi-fi/

7.2 Trends in mAgri Innovations

Technology and mobile business models

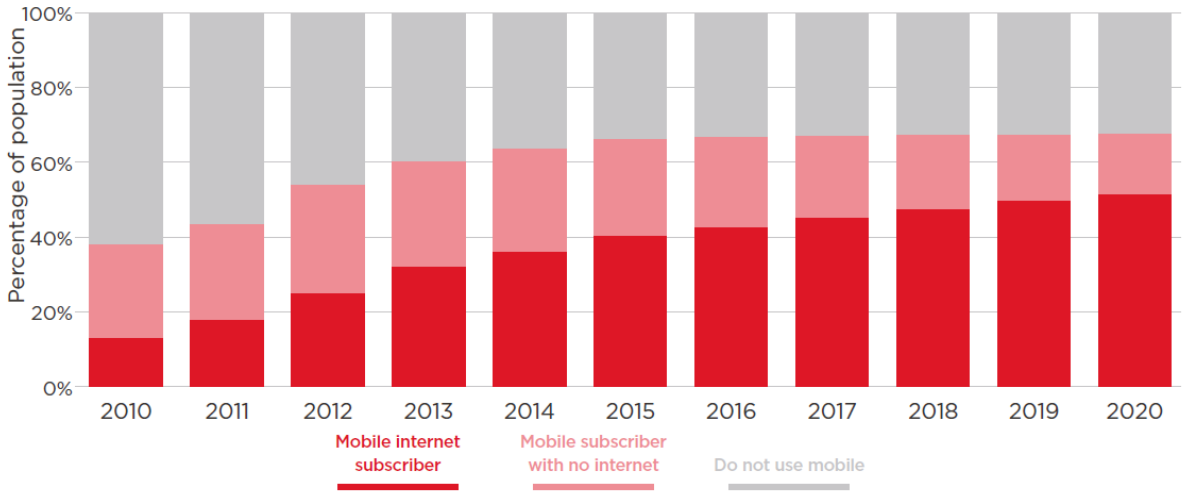
Mobile data use is set to grow. GSMA (2019) predicts that mobile data consumption across sub-Saharan Africa will multiply seven-fold by 2024 (from 1.1 to 8.5 GB per subscriber per month). Although 4G is growing and there is much interest in 5G, 3G internet connections are likely to remain the dominant technology for the medium term. Multiple features are driving data usage (see Annex E for further detail):

- Over the top (OTT) services continues to grow. In 2017, 32% of adults in Ghana used social networking sites such as Facebook and Twitter (Pew Research Center 2018). Use grew by 50% in the two years since 2015.
- Increased revenue from data services can more than make up for any decline in voice revenue from OTT services (Esselaar and Stork, 2018).
- Entertainment services. TVs are becoming more widespread and the affluent are spending more time watching TV and video on mobile devices.
- Smartphone sales are on the rise. Smartphone ownership stood at around 35% of adults in 2017, marginally above the median for sub-Saharan Africa (33%) (Pew Research Center, 2018). GSMA estimates that the number of handsets will more than double from 2018 to 2025.

These factors suggest that mobile data use is set to grow.

When the VFC concept was put together in 2013, the primary aim of Vodafone was to increase its rural base by specifically targeting new mobile subscribers from rural areas. This strategy is valid in a growing market but not in a mature market. GSMA research suggests the number of mobile users may already have plateaued (see Figure 20). The VFC concept was, therefore, appropriate at a given time, and for a given duration, i.e. until most people who aspired to own a mobile phone were already signed up.

Figure 20: Saturation of mobile phone market in Ghana



Source: Hatt *et al*., (2017).

Vodafone's priorities have changed. As the market has changed, Vodafone has shifted its priority from increasing its rural base to maximising revenue generated by that rural base. It plans to do

this by integrating a number of products based on different technologies. The six years from 2013 to the present date is a long time in the world of telecommunications.

Perhaps the most transformational technology that has blossomed since the baseline report is mobile money. Adoption of mobile money accounts increased from 13% of Ghanaians in 2014 to 39% in 2017 (World Bank Group, 2019). Mobile money has been instrumental in increasing financial inclusion from 41% in 2010 to 58% in 2015. The mAgri industry has picked up on the possibilities for digitising financial transactions throughout the value chain and for offering a range of financial services to farmers. MTN mobile money is the market leader in Ghana, with Vodafone trailing, as Vodafone Cash was only launched late in 2015.

7.3 Agriculture and technology

VFC is an example of an mAgri product that provides farmers with access to agricultural information, although VFC itself is a bundle that offers more. Davis and Franzel (2018) concluded that mobile phone-based systems have a role to play in agricultural extension and advisory services and that they do indeed represent a low cost per farmer for information dissemination. However, they are not best suited as a primary source of information. They tend to be most useful where they reinforce more conventional face-to-face interventions.

The qualitative research shows that farmers' top priority was access to financial services, notably credit and, to some extent, insurance, which most commonly comes in the form of guaranteed price agreements between farmers and buyers. Most respondents also complained that financial limitations were a major barrier preventing them from implementing the advice they obtained from VFC. GSMA also identified access to markets and finance as key challenges (Palmer & Darabian, 2017a), but concluded that, in 2014, financial solutions were not scalable. Instead, GSMA argued that information-based services would provide systems that could subsequently be built on. This has proved to be exactly the case for Tulaa and Esoko.

Annex E describes some examples of innovative services that illustrate how emerging mAgri products are tending to integrate financial and data capability into a broader range of farmer support services that address different parts of the value chain. These include, for example, financial profiling and savings schemes for unbanked customers (Tulaa), crop and livestock insurance (ACRE Africa), online trading platforms (Agrotrade), and logistics (TruckR).

A much more detailed and comprehensive overview of emerging products is available from CTA (2019). In this publication, CTA makes a distinction between ICT4Ag products such as Esoko, which were mostly information dissemination VAS deployed in partnership with MNOs, and the new landscape of D4Ag innovations that use digital technologies and data to transform practices across the agricultural value chain (further detail is presented in Annex E).

CTA (2019) points out that D4Ag enterprises are increasingly diversifying their business models and bundling services from multiple categories. This is interesting as social impact investors are coming to the view that start-ups that provide multiple services are likely to be better investments. This is partly a consequence of the cost of customer acquisition among smallholder farming communities. A user base represents an asset of value, which can then be exploited by providing multiple services or products. Emerging opportunities within the value chain is an area where GSMA has already done a good deal of research and continues to work with MNOs and entrepreneurs through the AgriTech programme.[18]

[18] www.gsma.com/mobilefordevelopment/agritech/

8 VFC in the context of other mNutrition projects

8.1 Overview of mNutrition projects

Billings *et al*., (forthcoming, 2020) conclude that VFC has had little effect on primary nutrition and agricultural outcomes: 'Being offered the VFC service or having used it at least once has minimal impacts on household and women's dietary diversity, agriculture production, or nutrition or farming knowledge.' However, in terms of implementation, VFC has not been the most successful of the mAgri projects, so it is important not to judge the viability of the concept deployed under the mNutrition programme (i.e. of using mobile technology to support smallholder farmers) solely on findings from the study on VFC. The purpose of this section is, therefore, to put the performance and structure of VFC into the broader context of other similar products supported through the mNutrition programme. Learning points from all six of the agriculture solutions supported under the mNutrition initiative are summarised in the GSMA report by Palmer and Darabian (2017a), which has been used as the source of much of the detail in this section. This has been supplemented by information from the six individual case studies published by GSMA. The six products are:

- VFC (Vodafone, Ghana) – free calls to members, advice on crops, weather, and market prices available in 10 languages via SMS and OBD; 70,000 active users (Palmer, T. and Darabian, N. 2017c).
- Govi Mithuru (Dialog, Sri Lanka) – agricultural advice on eight crops, nutrition, and home gardening, with a focus on reducing chemical inputs; 252,000 active users (Palmer, T. and Darabian, N. 2017d).
- GP Krishi Sheba (GrameenPhone, Bangladesh) – agricultural advice on 16 crops plus livestock via OBD; 432,000 active users (Palmer, T. and Darabian, N. 2017e).
- M'chikumbe (Airtel, Malawi) – information on 15 crops and Airtel Money via IVR and SMS; 90,000 active users (Palmer, T. and Darabian, N. 2017f).
- Khushaal Zaminder (Telenor, Pakistan) – messages on agriculture plus livestock and weather via OBD, SMS, and IVR; 2,465,000 active users (Palmer, T. and Darabian, N. 2017b).
- Site Pyo (Ooredoo, Myanmar) – smartphone app providing access to information on 10 crops and weather, supported by SMS reminders; 38,000 active users (Palmer, T. and Darabian, N. 2017g).

Further detail of the partnerships involved in each product are presented in Annex F. The Annex also includes a comparative analysis of key aspects of the products, which is summarised in the following section.

8.2 Comparing key aspects of mNutrition products

Responsibility for product development

Krishi Sheba (Bangladesh), Site Pyo (Myanmar), and VFC (Ghana) all relied on strategic partners to drive product development. In contrast, in two of the more successful products (Govi Mithuru in Sri Lanka and Khushaal Zaminder in Pakistan), the MNO sourced product development expertise internally. This led GSMA to conclude that MNO ownership and strong product development teams are key to success when the service is MNO-led. Where product development is driven by a strategic partner, the nature of the relationship is key.

GSMA concluded that 'dynamic, informative push messages increase users' engagement' (Palmer & Darabian 2017a). Two of the most successful products included specific provision for stylisation partners (Sync Solutions in Sri Lanka and Planet Beyond in Pakistan) to do just that.

GSMA concluded that an agile and user-centric product development process is key to success. Esoko had technical expertise, infrastructure, and a long track record so VFC was the first of the projects to launch. However, the nature of the partnership meant that it subsequently proved to be resistant to change.

Top-level leadership for mNutrition projects

Continuity of vision and leadership is a key factor in driving a new product, and was lacking in VFC. Vodafone experienced a high degree of staff turnover at all levels (see Section 4.2). The first new CEO introduced drastic changes to the VFC business model (although there were multiple factors behind this decision – see Section 4). The VFC product was paused shortly before the CEO changed again. In contrast, Telenor's CEO was convinced of the commercial viability of the agricultural sector in Pakistan, as he set up a dedicated mAgri business unit.

Technology platforms

In two of the more successful products (Govi Mithuru in Sri Lanka and Khushaal Zaminder in Pakistan), the technology partner had an existing relationship with the MNO prior to the mNutrition partnership. Vodafone had no previous partnership with Esoko, and Esoko was unique among technical platform partners in providing services to farmers under its own brand prior to the partnership with Vodafone.

Customer acquisition

Face-to-face contact is highly valued by famers, especially in terms of building trust, but on-the-ground marketing activities were universally found to be prohibitively expensive. Three projects tried working with field partners (NGOs) to facilitate a field presence, but with limited success. VFC worked through field agents but struggled to find incentives that got them to adhere to complex onboarding processes.

Almost all the products initially had difficulty with the registration and onboarding processes, especially around the profiling of farmers. They all went on to devise some form of single click registration (including VFC). UX research conducted by other operators found that it was important for the pathway from registration to accessing data to be a short as possible. However, VFC had a two-step registration process (invisible to the user) whereby Vodafone passed details of registered customers to Esoko, who then entered them into the information dissemination platform. Customers could, therefore, wait up to seven days before receiving information.

Early stage subscriber growth trends show that most projects grew at a similar exponential rate, but VFC and M'chikumbe in Malawi grew at a much slower rate. Only Khushaal Zaminder in Pakistan came close to reaching the estimated target market, so is the only programme in which subscriber growth might be expected to be restricted by saturating the potential market.

VFC appears to have been unique in specifically targeting new mobile subscribers from rural areas. Given this target market, low-cost methods such as OBD/SMS campaigns were not an option.

VFC was a complex product. Other products only provided farmers with information (e.g. agriculture, livestock, and weather). Only VFC and M'chikumbe also provided users with market

prices. VFC was more than a VAS – it was a bundle or customer plan. This contributed to some confusion over the identity of the product, as sales agents could sell VFC as a low-cost airtime product rather than as an agricultural VAS.

Commercial viability

VFC was unique in targeting new, rural customers not yet on any network. This segment will tend to generate low ARPU, and have low churn rates given that rural communities typically have only one reliable network. Other MNOs demonstrated the effectiveness of products in increasing the stickiness of customers (reduced churn) and increasing rural revenue (higher ARPU). These metrics are key in multi-SIM markets where customers tend to swap SIMs between operators.

Govi Mithuru (Sri Lanka) and Krishi Sheba (Bangladesh) were justified in financial terms (breakeven and payback period), whereas free/freemium services such as M'chikumbe (Malawi), Khushaal Zaminder (Pakistan), and Site Pyo (Myanmar) were justified in terms of indirect benefits (ARPU and churn). The successful piloting of advertising by Khushaal Zaminder illustrated potential for monetising a rural customer base.

mNutrition and capacity building

Vodafone highlighted the UX work of Cobalt and Frog (funded by the mNutrition project) as being of particular value, and has since contracted in this kind of expertise to assist with the development of other products. Dialog in Sri Lanka has used product development and UX research methodologies introduced under the mNutrition programme to develop further products, using a mix of in-house and bought-in expertise. Telenor Pakistan internalised the mNutrition techniques and set up a dedicated design studio.

The Advanced Analytics team within Telenor's Business Intelligence team used innovative data-modelling techniques to devise improved marketing methods.[19] They created a model to identify existing Telenor customers likely to sign up to Khushaal Zaminder. They then launched an OBD/SMS marketing campaign targeting these customers, and found the conversion rate improved from 1% to over 5%.

[19] www.gsma.com/mobilefordevelopment/country/pakistan/telenor-pakistan-uses-data-science-and-analytics-to-boost-mAgri-uptake/

9 Discussion

9.1 Sustainable business models

For a while, VFC was offered as a free product. Financial modelling shows that this was not financially sustainable, at least not on the basis of the assumptions made about costs and the customer base. However, it also showed that financial performance was highly sensitive to ARPU from this base. This suggests that if the product could be marketed to a slightly higher status market segment (with higher ARPU), this would be enough to make even a freemium model financially attractive.

The subscription model did not work at a subscription rate of GHS 2 per month because subscriber numbers were too low. There are multiple reasons behind this, relating not only to WTP but also to problems with marketing through agents and freelancers, and with registration and onboarding. At this subscription level, 44% of revenue was generated from fees. However, even at a lower subscription rate (GHS 0.50 per month), the subscriber numbers were similar, at around 60,000, while fees generated only 17% of revenue. The service was not financially viable under these conditions either.

The level of subscriber numbers at the lower fee rate was similar to the number achieved at the higher rate. This is due to multiple effects, such as customer confusion over pricing, mis-selling by agents, problems with onboarding, payment mechanisms, etc. However, what if higher subscriber numbers could be achieved? Estimates have been made of a potential rural market of 260,000 and combined with results from a WTP experiment, as well as assuming that all of the potential market can be 'reached' so they can make an informed decision to subscribe or not. Modelling indicates that a subscription model could be financially viable at a fee rate of GHS 1 per month, reaching around 80% of the potential market. There is another peak in financial return at a fee rate of GHS 2 per month, but due to the elasticity of demand predicted by the WTP experiment the product would only be taken up by 50% of the potential market. This illustrates a potential for disconnect between commercial ways of working (maximising financial return) and donor ways of working (maximising social impact).

One of the premises of the mNutrition programme was that business models should be financially viable. This is often assumed by the casual observer to mean that farmers should pay for the service, and there is a view that offering farmers information for free is not sustainable. Experience from the mNutrition programme suggests this is not necessarily the case. For example, Khushaal Zaminder (Telenor, Pakistan) and Site Pyo (Ooredoo, Myanmar) both offered the product for free. Khushaal Zaminder in particular has been hugely successful and prompted the development of further agricultural services. Certainly, GSMA throughout the programme has been fully aware that free services can be financially viable through indirect benefits to the MNO. Three business models can be seen:

- Offering an advisory product where farmers pay for the service can be financially viable (e.g. Dialog Sri Lanka).
- Offering an advisory product as a freemium offering can be financially viable. If adequate scale can be reached, revenue generated by upselling (airtime) can more than cover costs.
- Using a multi-sided platform, Khushaal Zaminder ran a pilot that demonstrated how the Telenor platform could be used to generate revenue on a B2B basis by selling advertising services to an agribusiness.

The cost of sending SMS messages is the largest single component of operating costs, which raises the question: 'What is the real cost of sending an SMS?' Where a content provider sends messages to a client base, it will bulk buy SMS from an MNO at a known cost. Vodafone covered the cost of messages sent by Esoko, but there is no evidence that Vodafone actually allocated a cost internally to these messages. Modelling confirms that if message costs can be discounted, even a freemium model can be financially attractive.

9.2 Achieving changed behaviour

All advisory and extension services aim to help farmers adopt improved practices. GSMA mAgri's ToC explicitly acknowledges there is a sub-ToC that needs to take place between farmers accessing information through VFC and the adoption of improved practices (agricultural, nutritional, post-harvest, and marketing): 'In all cases adoption is assumed to require changes in knowledge and attitude' (see Figure 21).

In the baseline report, it was felt that the CUG offering free calls to other farmers would be a highly valued component of the VFC bundle that would appeal to famers, and more importantly provide a platform for peer-to-peer information exchange. It was felt that enabling farmers to share and discuss information and to share experiences and opinions would reinforce knowledge and strengthen intent to implement recommendations in the messages, which would in turn enhance behaviour change. However, this optimism does not seem to have been justified. In fact, only 3% of users felt that being able to make free calls was the most useful aspects of the bundle. It is not entirely clear why take-up of this feature has been so weak, but anecdotal evidence suggests that farmers do not want to confer beyond their local networks. Fellow farmers whose opinion they value and who they choose to discuss farming matters with are farmers in their local community, who they meet regularly, so they have no need to use the phone.

There is evidence that once farmers have experience of VFC, they like it: quality and satisfaction ratings are high, suggesting that, given a satisfactory payment mechanism, resubscription rates should be high. Therefore, from a business model point of view, it is the decision to subscribe to the service that is of greatest interest – how to get farmers to sign up. This is explored in Annex G, which focuses on whether motivation and behaviour change theory can help explain low levels of WTP. The argument looks at the role of social referents shaping the intention to sign up. Emerging, data-intensive service providers typically enter into an agreement with a third-party institution, such as an agricultural input supplier or off-taker, which wishes to engage with a defined target group of farmers. Even though the partner institution typically pays for the service (the B2Bmodel), the farmer still has to sign up for the service to receive information and messages via his or her mobile phone. The key difference is that involving these institutions increases the locus of social referents relevant to the farmer's decision to adopt the mobile service. Under the VFC model, the adoption decision rests entirely with the individual. All the risk associated with implementing changes in agricultural practice (and paying fees) is taken by the individual farmer, and all the benefits are enjoyed by the farmer. When a third party is integrated into the model, then costs, risks, and benefits tend to become shared. By lowering perceived risk barriers (outcome attitudes), engaging farmers in a relationship (subjective norms), and endorsing a service (perceived behavioural control beliefs), engaging agribusiness actors can ease the progress of farmers to the 'Action' stage of signing up for mAgri services.

9.3 Product development

GSMA has concluded that strong product development is key to success: 'Successful services require a robust product team, including a core team of dedicated staff and cross-functional links to other departments' (Palmer and Darabian, 2017a). This reflects learnings from the weak product development of VFC. The small team in Vodafone had cross-functional support within Vodafone, at least for the duration of the grant period, but it lacked internal UX expertise, agricultural expertise, and content platform resources. These were resourced through contractual-type partnerships. In principle, the partnership had all the right resources, but challenges with communications made it difficult to make progress.

The contractual relationship with Esoko provided little incentive to innovate (and take risks). Multiple staff changes meant that Vodafone lacked a clear vision for the development of the product and the locus of decision making authority kept changing. Shifting responsibilities for VFC, changing priorities, poor performance of VFC, a lack of expertise within Vodafone, and a confrontational partnership all contributed to the lack of development of the VFC product and the failure to make progress with the *Connected Farmer* product. Given the level of changes that have taken place at Vodafone, even if it had set up an internal group to drive product development, it is by no means certain that this would have survived the various restructuring initiatives.

The developments that have taken place at both of the key partners in the VFC service have been remarkable. Vodafone experienced multiple changes of management at the most senior level, at the level of managers with responsibility for VFC, and at the level of product managers. This led to a lack of continuity of ideas discussed with partners to develop the VFC product, to the point where the product has been dropped. Esoko also experienced changes at the top, with Hillary Miller-Wise taking over as CEO in October 2015, well after VFC had been conceived. The company then split, before Miller-Wise left to run the Kenyan spin-off company in mid-2017. The two resulting companies identified new products to pursue but in the end, the core market information service remained a component part of both sets of offerings. Nevertheless, the splitting of the company, including the dividing up of the staff, and the subsequent demise of the Tulaa Ghana operation, must all have taken their toll on senior management and staff alike.

GSMA has concluded that an agile and user-centric product development process is key to success. There are examples of ways in which the product has been adapted to address issues arising from field research. For example, additional capacity was installed at Esoko to help ensure that OBD messages were received at appropriate times of the day; an autorenewal mechanism was introduced for the payment of subscriptions; and an automatic profiling system was introduced to streamline the registration process. However, some fundamental flaws in the product remained unresolved. For example, the Vodafone and Esoko registration systems were not integrated, leading to unacceptable delays in customers receiving information; an inappropriate set of incentives meant agents were selling VFC SIMs to anybody; the automatic profiling solution meant farmers were not receiving weather information; and SMS messages in English were poorly received. The failure to address these issues reflects the lack of a strong product development team and a lack of commitment by Vodafone. The contractual nature of the partnership with Esoko moderated any incentive for innovation.

When Vodafone won the Challenge Fund award, VFC may well have appeared to have strong partners with all the skills needed for agile product development. In practice, key personnel moved on and the residual levels of interest and the contractual nature of relationships led to an inability to mobilise these skills. A further finding is that although the original VFC concept, based on a strategy of acquiring new phone users, may have been appropriate at the time of the inception of VFC, it appears no longer appropriate. For example, the study has found that VFC has failed to

increase mobile penetration (even though the financial performance of VFC customers is acceptable). It can be argued that plans for the *Connected Farmer* product are a response to this, but it has yet to be implemented.

9.4 Advisory services

All of the agriculture projects supported under the mNutrition programme were advisory services, based around the dissemination of information (relating to both agriculture and nutrition). Since the programme was conceived, the mobile industry has moved on, with possibly the most significant development being the growth in mobile money. Ghana is the fastest-growing mobile money market in Africa[20] (2017 data). This has opened up opportunities for innovation in digitising the value chain (enabling transactions) and extending financial services to smallholder farmers previously excluded from formal financial institutions. These are the kinds of services that meet the needs that farmers articulated as their priorities right from the beginning of the study. Given that farmers said they were unable to implement the advice because of lack of financial resources, access to these kinds of services is likely to overcome barriers to the increased adoption of improved practices. However, such digital services (D4Ag, as coined by CTA) risk opening up a further digital divide, leaving behind the poorest farmers who are not digitally literate and who are least able to adapt to, and benefit from, digital services.

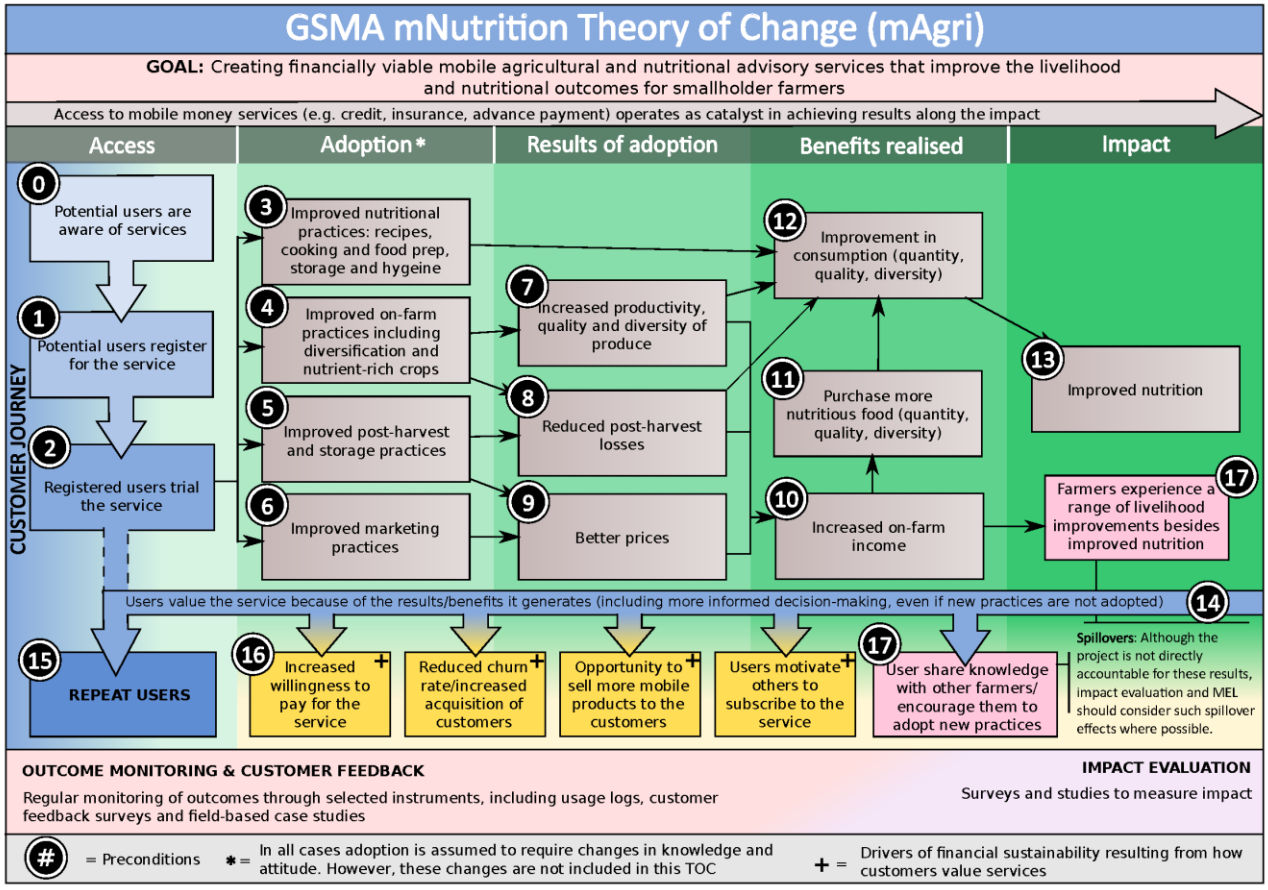
Within advisory services, there are options for the best way to get messages to farmers. VFC relied on SMS for weather and market price information, and this study has highlighted the shortcomings of this approach in reaching illiterate farmers. Disseminating agricultural and nutrition tips via OBD has been much more successful and better received by farmers, primarily because it overcomes literacy barriers, but the timing is crucial. The downside of OBD is that it is still a 'push' service, the timing of which is determined not only by the scheduling of the sending agency but also the capacity of the technology (some Esoko messages were sent several hours after scheduling because of congestion on the E1 line). Farmers will not pick up messages if they are delivered at an inconvenient time. This therefore leaves 'pull' type services, such as IVR, which can be voice driven. The disadvantage of pull services is that they are passive, and users can easily get out of the habit of searching for information. GSMA concludes that a hybrid of push and pull services is best. SMS is much cheaper than voice-based services. Financial modelling has shown how financial performance is highly sensitive to the price allocated by the MNO to messages. If an MNO can justify discounting the price allocated to voice messages, this would help build the case for more effective hybrid advisory services.

9.5 Revisiting the Theory of Change

Findings from the study have been mapped onto GSMA's original Theory of Change (Figure 21). This section presents a brief commentary on the different parts of the ToC; more detail is available in Annex A.

[20] https://qz.com/africa/1662059/ghana-is-africas-fastest-growing-mobile-money-market/

Figure 21: GSMA mNutrition ToC for mAgri



Source: GSMA (2016). Reproduced with permission.

Customer journey (Access)

VFC struggled with the earlier steps in this sequence. Promotional activities to raise awareness were expensive, and low cost methods such as blast SMS were not applicable when targeting new users not on the Vodafone network. Onboarding was a challenge, and both users and agents often failed to complete the registration process. Technical shortcomings and poorly integrated systems meant that trial users had a poor experience. However, users expressed high levels of quality ratings and customer satisfaction, and more recent data suggests low attrition rates.

Adoption (behaviour change)

Evidence from the study suggests VFC has achieved only weak behaviour change among users. The only significant change found by the quantitative study was an increase in the consumption of dairy foods at the household level. Although self-reported levels of changes in on-farm practices were high (75%), the quantitative study found no evidence. Neither did it find any effect on knowledge relating to post-harvest techniques. The study found no evidence of farmers increasing revenue.

Benefits realised

The quantitative study found no evidence of changes to the key metrics of dietary diversity. Neither did it find any evidence of increased yields or profits.

Benefits to MNO

Once enrolled, repeat users were willing to pay for the service. There was no evidence that VFC achieved VAS benefits of reduced churn or upselling of other products (increased ARPU).

9.6 The Independent Study

Annex H presents some reflections on the methodology of the independent evaluation and how it relates to the implementation of mNutrition projects. It addresses the diversity of stakeholders engaged, the short product timescales required of the industry, and the variety of projects supported under mNutrition.

Telecommunications is a dynamic and rapidly evolving industry. During the five-year duration of the programme, there have been changes in leadership and structure within the commercial organisations involved in the VFC partnership. This has inevitably led to changes in priorities. For example, once the champion of a product moves on, then the next responsible person is unlikely to exhibit the same degree of commitment and vision, preferring instead to pursue their own priorities.

The timescales of the evaluation have extended beyond the period of support offered by the GSMA mNutrition project in order to allow the intervention to take hold and make an impact. However, stakeholders' commitment (and interest) in the product tends to wane after it is no longer being actively supported and they no longer have any obligations to the grantor. This can manifest itself in a reluctance to invest further time in the form of interviews and discussions, for example, but it can also have structural implications, e.g. cost data is not collected and disaggregated in the same detail that it was for the purposes of reporting under the GSMA mNutrition project.

MNOs tend to have poor institutional memory. This is not only a result of high staff turnover but because customer call data (call detail records) are stored only for a finite period of time, so if they are not analysed on a regular basis, that understanding is lost.

Although Vodafone and Esoko both expressed positive intent to share various data, this has not been forthcoming. GSMA has, however, been fully supportive in securing permission from Vodafone to share the final mNutrition Financial Report. Esoko has also shared subscriber numbers. However, commercially sensitive cost information within the sub-contract agreement has not been shared in detail. Despite expressions of positive intent to share, the reality of commercial sensitivities makes it difficult for businesses to share financial data.

Information on costs and performance became even more sensitive when the MNO was considering different options and talking to potential competitors to provide sub-contract services. It was around this time that the independent study team organised the in-country information dissemination event. Concerns were subsequently expressed at having invited competitors to the event. This highlights a disconnect between commercial ways of working and donor-funded ways of working, which are focused on sharing public goods. GSMA is open and transparent regarding its experience of working with mNutrition projects and has published widely.

During the inception phase of the evaluation study, the particular projects to be studied needed to be identified. This was done in consultation with GSMA, relying heavily on its knowledge of partners and products. VFC appeared to be a good choice because it had established partners, a proven platform, and was one of the earliest projects to be rolled out. However, with the benefit of hindsight, lessons have been learned about the importance of product development, MNO expertise, and other institutional factors, and GSMA has published these lessons learned (Palmer and Darabian, 2017a). GSMA is now of the opinion that VFC is not one of the better implemented

projects, and can show how it measures up against the lessons learned. Nevertheless, given the cost of an intensive impact evaluation, this choice needs to be made.

Findings from the study do not, therefore, necessarily reflect the performance of other mAgri projects. They were all designed as agriculture and nutrition advisory services, but the industry has moved on to innovate around financial and transactional services. These are likely to lead to greater impact because they enable farmers to overcome more pressing barriers associated with buying, selling, saving, insurance, logistics, etc. However, it is noted that they are likely to open up a digital divide, risking leaving behind the poorest farmers, who are not digitally literate.

10 Conclusions

10.1 The future for advisory services

Although the trajectory of the mobile market is clearly heading in the direction of data and increased internet use, the fact remains that substantial parts of sub-Saharan Africa are underserved in terms of mobile coverage. Even in areas with coverage, the signal can be patchy and often only a single network is available, which limits people's access to services. Although universal access funds are addressing these issues (GIFEC's activities in this regard have been mentioned in Section 7.1), progress is slow. Communication features available over voice networks (e.g. SMS, USSD, IVR, and OBD) are, therefore, likely to continue to be the channels of choice for reaching the poorest parts of a country for the time being. Having said that, these channels are a poor fit with low-status consumers. Literacy is a major limitation. Large proportions of smallholder farmers cannot read SMS messages because they may not be familiar with the languages used in messages or may not be able to read in their own language. Accessing information systems also requires literacy and digital literacy skills for navigating menus and interactive SMS exchanges, which can be done much more intuitively using icons on smartphones.

The growth of mobile money in Ghana has been a game changer. Farmers' top priority is access to financial services, and emerging agricultural services are employing innovative approaches to meet this demand. Emerging services typically integrate financial services into a broader range of farmer support services addressing the value chain. Mobile money has also been key to unlocking the potential for transactional services that enable farmers to conduct value chain activities with greater ease (e.g. buying and selling).

Growth in data revenues is driven by demand for social media apps and entertainment (music and video) as well as falling smartphone handset prices. Digital data collection and analytics mean that mobile-enabled services can move beyond providing knowledge to farmers (as with traditional agricultural extension) and provide them with tools to enable them to participate better in economic activities.

10.2 Viability of the VFC service

The VFC system reached a total of 350,000 subscribers[21] (as at March 2018). However, why have so many failed to re-subscribe on a regular basis? All the evidence from multiple research activities indicates that users are positively disposed to the service – quality ratings are high, the agriculture tips are regarded as useful, and the information is highly trusted – so it appears that the content aspect of the service is not at fault. This leaves the onboarding, information delivery, and payments parts of the customer journey. The subscription fee was reintroduced at a much lower rate using an autoenrollment process and the qualitative study did not reveal any particular complaints about this. GSMA identified creating the shortest pathway from registering to getting information as one aspect of good practice, but revisions to the VFC onboarding process meant that it could take over a week for a subscriber to receive information from Esoko. Therefore, it seems most likely that the onboarding process thus remains the weakest link (including marketing).

Vodafone was not geared to develop content. Rather than investing in internal agricultural VAS capacity, Vodafone bought in this expertise from a third party. This offered advantages in terms of speed, capital cost, and flexibility. Esoko had agricultural experts, an agricultural information

[21] This is the total number of farmers who had accessed the service at any point in time, i.e. it does not represent the number of subscribers on the system at any single point in time, which will be lower.

database, and a tried and tested platform, so VFC was the first of the mNutrition products to launch. Sub-contracting the service meant it could be set up quickly, and Vodafone had the option to change the offering by switching or adding contractors. Upfront costs were minimised by utilising Esoko's expertise and platform. On the other hand, the approach meant Vodafone was less invested in the product, and lacked a detailed understanding of farmers as consumers. Even if Vodafone had set up an internal unit, it may not have survived the changes and restructuring that have taken place in Vodafone.

It is not enough to provide market prices alone. Farm products are marketed through a complex web of middlemen in the value chain, and farmers generally have low levels of leverage even though they may know the 'right' price. This is especially true for the poorest farmers as they are more likely to sell at the farm gate where there is no competition between off-takers. They also tend to have an urgent need for cash, which further reduces their negotiating power.

VFC offered a complex bundle of services. Customers may have struggled to understand a complex product, especially when agents had a poor understanding of the product and tended to sell it as a SIM rather than a VAS package. A product that is both a SIM and a VAS serves two potential purposes, which led to perverse incentives among agents and left some customers confused (i.e. unaware of VFC features).

10.3 Achieving social impact

Among VFC users, quality and satisfaction ratings were high, as were self-reported levels of changed practices, yet the quantitative study found that use of VFC had minimal impact on the primary outcomes.[22] The types of changes implemented at the household level have not, therefore, been significant enough to result in changes in the primary outcomes.

mNutrition was predicated on the reach of mobile services as an effective source of information (on agriculture and nutrition). Given a context of declining access to traditional channels of communication of information, notably agricultural extension workers and radio, it potentially offered a low-cost mechanism for reaching farmers. The promise of reach has not been realised in Ghana with VFC, as discussed in the report, but GSMA case studies indicate that this promise has indeed been realised by other services in other countries, notably the Khushaal Zaminder service offered by Telenor, Pakistan. The evaluation studies shed some light on how effective mobile services can be as sources of agricultural information. Among farmers who used VFC, utility ratings were high (72% found agriculture and nutrition tips to be useful) and self-reported changes in agricultural practice were high (75% reported changing their behaviour based on agriculture and nutrition tips). Yet the changes implemented were not significant enough to result in improvements in the primary outcomes. Behaviour change is a complex process and the influence of a short voice message clearly does not compare with that of a face-to-face visit by an extension worker. Nevertheless, information is a prerequisite for behavioural change and given that extension workers are increasingly scarce, farmers felt that mobile-based information on its own could still be useful.

All of the agriculture projects supported under the mNutrition programme were advisory services, based around the dissemination of information (relating to both agriculture and nutrition). The growth in the mobile money market has opened up opportunities for innovations in digitising the value chain (enabling transactions) and extending financial services to smallholder farmers previously excluded from formal financial institutions. These are more likely to result in substantive impacts, as farmers have consistently cited the lack of financial resources as their main limitation.

[22] Household and women's dietary diversity, agriculture production, and nutrition and farming knowledge.

However, as noted above, digital services risk opening up a further digital divide. Programmes promoting digital literacy and literacy (see Mozilla's Web Literacy framework[23]) could help mitigate the gap.

It is very difficult to support the poorest smallholder farmers. The analysis has identified a number of features of mobile services (both advisory and transactional) that effectively exclude this group:

- SMS-based services are largely inaccessible to illiterate farmers;
- they lack the financial resources to implement changes to their agricultural practices (and tend to be risk averse);
- emerging data-driven digital services are inaccessible to digitally illiterate farmers (and often those unable to afford smartphones); and
- it is difficult to justify offering a freemium model to customers with the lowest ARPU.

10.4 Validity of the business model

Six years from the inception of the VFC concept to the present date is a long time in the world of telecommunications. The original aim of Vodafone was to increase its rural base by specifically targeting new mobile subscribers from rural areas. As the market has matured, the number of potential customers who aspire to phone ownership has diminished. Despite being highly regarded by users of the service, the bundle does not appear to have a sufficiently sustained attraction to encourage people to continue to sign up with Vodafone (or any other operator for that matter). The quantitative study found that levels of mobile ownership and access were no higher among the encouragement communities. The strategy may have been appropriate at a given time, but only for a given duration. Vodafone has since shifted its priority to maximising the revenue generated by its rural base.

Nor is there any evidence that ARPU is higher among VFC users. GSMA has demonstrated higher ARPU among advisory service users in a number of other mNutrition projects. This reflects Vodafone's strategy of using VFC to expand its rural base. There are two effects: first, airtime is offered at a discounted rate; and second, remote rural consumers will have the lowest ARPU. Vodafone reported that VFC ARPU is lower than that of the mass base altogether. A normal VAS strategy aims to increase ARPU and reduce churn, but this is not relevant in underserved areas where people have no choice of network.

The quantitative study did, however, generate some evidence of VFC yielding indirect benefits in terms of stickiness of the Vodafone network. VFC users were more likely to use Vodafone as their main network provider (primary SIM). VFC users were 43% more likely to use a Vodafone SIM than respondents in the comparison group, 20% of whom used a Vodafone SIM as their main SIM.

During the study, VFC was offered under two business models:

- Freemium (free access to information and CUG calls, with upselling of airtime): Financial modelling shows that this was not financially sustainable, but if the product could be marketed to a slightly higher status market segment (with higher ARPU), this would be enough to make a freemium model financially attractive.
- Subscription: Financial modelling shows that this was not financially sustainable at the subscriber levels achieved.

[23] https://mozilla.github.io/content/web-lit-whitepaper/

The cost of sending SMS messages is the largest single component of operating costs, but it is not clear that Vodafone accounted internally for the cost of messages. Modelling suggests that if messages costs can be discounted, even a freemium model can be financially attractive.

Price elasticity of demand predicts that more farmers will sign up to a low-cost product, but as subscriber numbers go up, so do the cost of sales, making the product less financially attractive. This again illustrates the potential disconnect between commercial and donor ways of working.

Customer acquisition can be expensive. VFC initially spent a lot of money on targeted marketing, e.g. roadshows. Along with most of the other mNutrition projects, Vodafone found this proved too expensive. An MNO partner provides access to its agent network to sign people up. However, agents had limited capacity (i.e. they did not fully understand the VFC bundle) and the incentives were inadequately structured, but VFC could not tailor incentives because agents were under a group contract. Self-registration was greatly simplified with the introduction of an automated profiling process, but without detailed profiling, weather services were withheld. VFC failed to find an effective one-click registration process.

The main market for companies offering agricultural advisory services has typically been institutional clients engaged at some point in the value chain, e.g. government agencies or agro-input suppliers (B2B business model). Some have also made services available to individual farmers (a business-to-customer (B2C) business model). The mNutrition project provided an opportunity for companies such as Esoko to take the B2C model to scale by partnering with an MNO. The experience of VFC highlights some of the challenges encountered and the limited impact achieved (primary outcomes).

10.5 The evaluation approach

The short timescales involved in developing mobile VAS products mean that formative evaluations need tight feedback loops to inform product design. The implementing partner would ideally collect and retain key data for longer. In the future this could be a more explicit part of any grant agreement, although it is recognised that commercial parties will typically build trust in each other over the implementation of the intervention.

The VFC project cannot be regarded as representative of all of the mAgri projects supported under the mNutrition programme. To conduct a rigorous study of all six mAgri projects would be prohibitively expensive, so just two projects were selected. Selecting a single project for detailed evaluation is something of a lottery. While VFC appeared to be a good choice because it was one of the earlier projects to be rolled out, had strong partners, and a proven platform, GSMA is now of the opinion that this was not one of the better implemented projects. The recent history of the key partners is remarkable. Esoko split into two companies, splitting staff resources, and each setting about developing new products (still in the mAgri market). Vodafone Ghana had two changes of CEO in the duration of the independent study, changes at director level, staff changes at senior management level, and changes in product manager, as well as a major group restructuring. These events also set VFC apart from other projects within the mNutrition portfolio.

VFC struggled to obtain viable numbers due to the changes in offering to the customers, and problems with its onboarding processes. Even in the absence of viable numbers, however, there were elements of commercial sustainability, e.g. the satisfactory contribution margin and some indirect benefits such as the use of Vodafone as the main SIM. The business model could be made more attractive if the structural factors were more consistent with GSMA-defined good practice.

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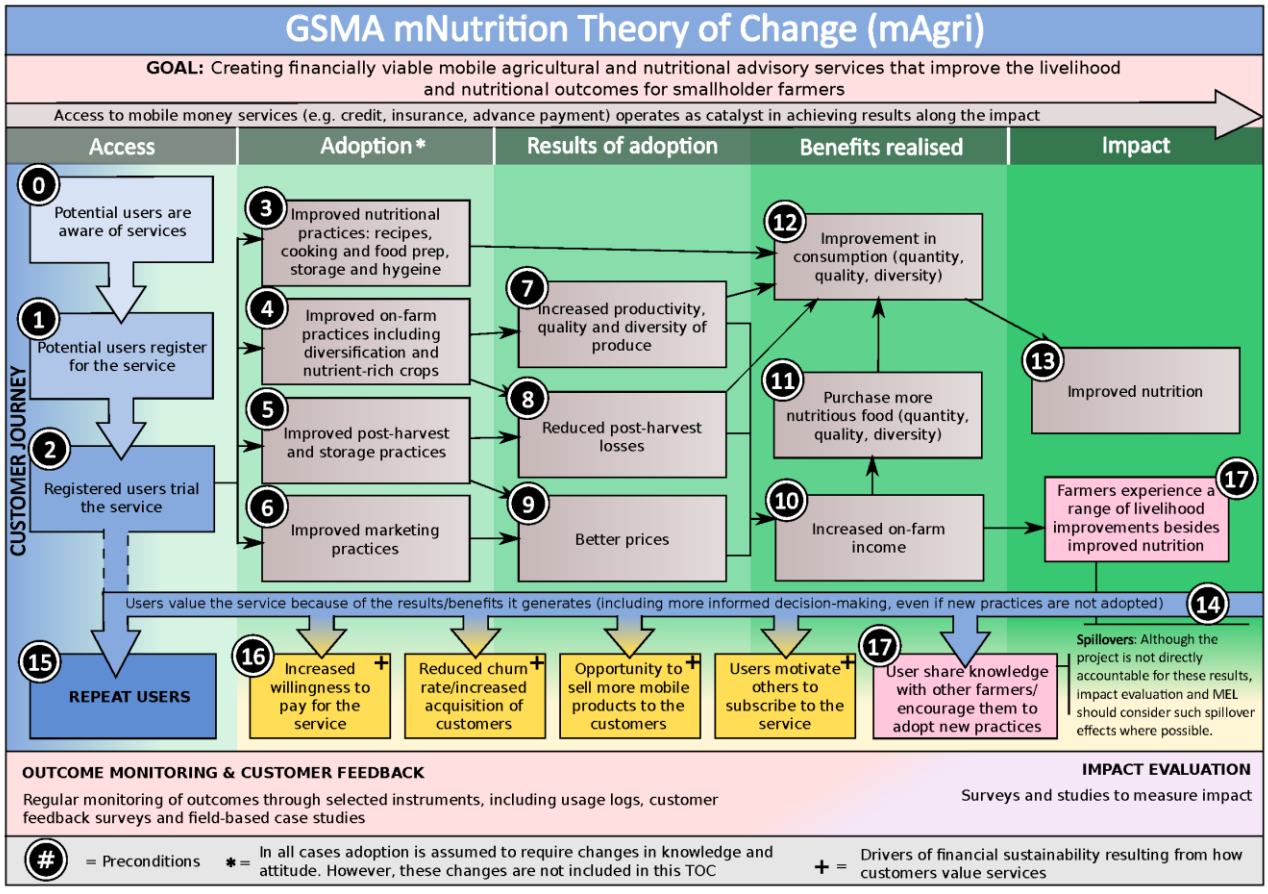
Annex A Revisiting the Theory of Change

The objective of mAgri projects under mNutrition was to create and scale commercially sustainable mobile advisory services that enable smallholder farmers to improve the nutritional status of their household and increase their productivity. The expected linkages between exposure to information via mobiles, through adoption of improved practices, to improved nutrition and farm income are illustrated in Figure 22.

This section maps some of the findings from the study onto the Theory of Change (ToC), which has been used as a framework for summarising some of the key findings from the study. It should be stressed that the ratings awarded here do not necessarily reflect on the validity of the ToC itself, which is felt to be robust and comprehensive. Rather, the ratings highlight context and events from the VFC journey and how they have affected the progression of changes encapsulated in the ToC. Other projects from within the portfolio of mNutrition agriculture projects will have performed much better.

The narrative is presented in the form of the following tables, each of which addresses different parts of the ToC.

Figure 22: GSMA mNutrition ToC for mAgri



Source: GSMA (2016). Reproduced with permission.

Table 8: Customer journey (access)

Step	Rating	Comment
Potential users are aware of services		Customer acquisition costs are high. Low-cost marketing methods, such as blast SMS, are not applicable to potential users that are not yet on the Vodafone network (the primary target was new rural users).
Potential users register for the service		From the beginning it was recognised that onboarding was a complex task, which is why agents were commissioned at the launch. It was subsequently confirmed that potential users often failed to complete the registration process, but agents also failed to complete the process because incentives were not in place. VFC had limited flexibility to explore incentives because agents' contracts covered multiple products.
Registered users trial the service		Two-thirds of VFC SIMs were registered (by Vodafone), and only one-third were successfully profiled on the Esoko platform. This indicates there were technical shortcomings on both platforms. Systems were poorly integrated, so a two-stage registration process was required. Vodafone sent a list of subscriber numbers to Esoko once a week. This led to delays in trial users receiving data – GSMA identified a short pathway to accessing data as a key success factor.
Users value the service because of the results/benefits it generates		Both qualitative and quantitative studies generated evidence that users regard the service highly, in terms of quality ratings, value ascribed to information, and trust in information. They also found high levels of self-reported behaviour change (changes in farming and nutrition practice), which is consistent with M&E findings. However, these findings are at odds with the overall conclusions from the quantitative study that exposure to VFC has no effect on the primary outcomes (dietary diversity, agricultural yields, and profits).
Repeat users		M&E research found that, during the early stages of the product, the attrition rate was 88% (i.e. only 12% of trial users renewed their subscription). More recent data (after the subscription fee was reintroduced) showed that the attrition rate had fallen dramatically, to roughly 5%. This indicates that the content side of the product does have traction and is a good fit with farmers. Solutions need to be found for other aspects of the product (such as marketing, onboarding, and payment mechanisms).

Source: Authors' own

Key:

	Step fully realised
	Step partially realised
	Step not realised
	Insufficient information

Table 9: Adoption (behaviour change)

Step (adoption)	Step (Results)	Rating	Comment
Registered users trial the service	Repeat use	*	Behaviour change is a complex process – expecting trial users to change behaviour after minimal engagement with content is unreasonable. It is only repeat users that are likely to adopt improved practices.
Improved nutritional practices			The only change in nutrition-related behaviour found by the quantitative study was an increase in the consumption of dairy foods at the household level. There is anecdotal evidence from the qualitative study that users introduced new foods into their diets, and that they improved their hygiene practices (e.g. not eating old food). It is not clear how widespread these changes in behaviour were.
Improved on-farm practices	Increased productivity, quality, and diversity of produce		Self-reported levels of changed behaviour were high (75%). Areas mentioned included sowing, land preparation, and fertilisers (preparation and correct application). No mention was made specifically of diversification or nutrient-rich crops (from the ToC). The quantitative study found no evidence of crop diversification.
Improved post-harvest and storage practices	Reduced post-harvest losses		The quantitative study tested knowledge on a number of post-harvest techniques; no effects were found. Messages on food preservation were positively mentioned as a motivating factor in using the service.
Improved marketing practices	Better prices		50% of respondents self-reported making changes to their marketing practices, but there was no evidence of increased revenue. Even if smallholder farmers were informed about prevailing prices at local markets, they lacked leverage to realise higher prices. The poorest farmers sell at the farm gate, where there is no competition and they tend to sell because they need cash urgently, further weakening their bargaining power. They also lack transport facilities to access new markets, and are not sufficiently well networked together to aggregate products for transporting or selling to wholesalers.

* This is regarded as a rather trivial observation given that the line on the ToC chart could easily have been drawn from the 'Repeat users' box, and it does not really have any bearing on the fundamental sense of the ToC, so no rating has been given.

Source: Authors' own

'Access to mobile money services […] operates as a catalyst in achieving results along the impact' is framed as a high-level enabling feature of the ToC. In hindsight, this was a prescient provision, as access to financial services (and credit in particular) has been consistently articulated by farmers as their priority need. Despite both Vodafone and Esoko stating an intention to integrate financial services (loans) and transactional services (buying/selling) into VFC, this has not materialised. Given that farmers said they were unable to implement advice because of a lack of financial resources, it seems likely that farmers might well have been able to adopt more substantial changes to their agricultural practices had they been able to access credit. This, in turn, may have led to measurable changes in outcomes.

Table 10: Benefits realised

Step	Impact	Rating	Comment
Improvements in consumption (quantity, quality, diversity)	Improved nutrition		The quantitative study found no evidence of changes to the key metrics of dietary diversity. It did find increased consumption of dairy foods.
Purchase more nutritious food (quantity, quality, diversity)			The quantitative study explored the consumption of foods rather than purchases.
Increased on-farm income			The quantitative study found no evidence of increased yields or profits.

Source: Authors' own

Table 11: Benefits to MNO

Step	Rating	Comment
Increased WTP for the service		Low attrition rate (around 5%) indicates repeat users are willing to pay (at a reduced fee rate of GHS 0.5 per month). The more pertinent challenge is to enhance WTP at Step 2 of the Access pathway (i.e. persuade new users to subscribe). Experience from other mNutrition projects suggests WTP need not necessarily be a problem if fees are low enough.
Reduced churn rate / increased acquisition of customers		These are separate issues. Poor coverage in rural areas means that consumers often have no choice of network, so churn rates tend to be low among rural customers (e.g. 1% in rural Malawi). The indirect benefit of reduced churn diminishes where this is the case.
Opportunity to sell more mobile products to customers		The VFC was intended to attract new mobile consumers to sign up with Vodafone. The quantitative study was conducted in areas where 79% of men and 50% of women owned a mobile, so there was some potential to acquire new customers; however, results showed no evidence of this effect.
Users motivate others to subscribe to the service		This was an aspiration articulated by Vodafone, especially in terms of integrating mobile money offerings, but ideas for an improved VFC product never materialised. A VAS typically enables upselling (mostly of airtime) by keeping the SIM in the handset. However, this basic opportunity was diminished in VFC as the bundle included free calls within the CUG, and discounted calls outside.

Source: Authors' own

Annex B Stakeholder contact list

Organisation	Contact
Key stakeholders	
GSMA	Natalia Pshenichnaya (Head of mNutrition)
GSMA	Tegan Palmer (Business Intelligence mAgri)
GSMA	Matthew Strickland (MAgri project manager)
CABI	Charlotte Jordan (Nutrition Project Manager)
GAIN	Kyla Stockdale (Senior Programme Manager)
Esoko	Daniel Asare-Kyei (Managing Director)
Esoko	Eugenia Ankomah Malan (Senior Business Advisor)
Esoko	Godwin Cudjoen
Esoko	Francis Adjei
Tulaa	Mohammed Issifu (Agriculture Content Specialist)
Tulaa	Alfred Yeboa
Vodafone	Luois Manu
Vodafone	Nanama Boa-Essilfie (VFC Manager)
Vodafone	Victor Bannerman Chedid
Vodafone	Cephas Pobi (Manager, VFC)
Vodafone	Carlos Asare Okoh
Acumen	Rebecca Mincy

Alternative service providers	
Syecomp	Solomon Elorm Allavi (Founder, GIS Mapping Specialist)
Farmerline	Worlali Senyo (Director of Business Development)
Viamo	Sandra Abrokwa
Viamo	Hannah Metcalfe
Agro Sourcing	Richmond Nutsuglo
Onyeka Akumah	FarmCrowdy (CEO)
Emmanuel Bakirdjian	Precision Agriculture for Development (Country Director)
Safaricom	Benjamin Makai (Tech for Development, Kenya)
MobileContent.com	Rudolph Kotoka
Agrocenta	Michael Ocansey
Hamwe	Allan Asiimwe
Spiderbit	Alex Rukundo

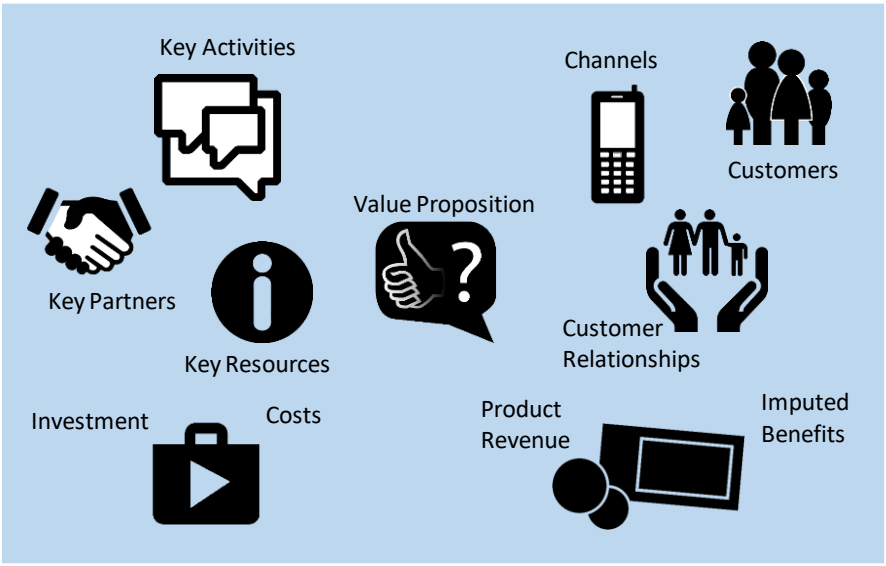
Annex C Review of the business model

C.1 The O&P framework

The O&P framework is commonly used as a framework or canvas for describing a business model. Businesses rarely have a simple model of selling a product and gaining revenue from that product. A simple income versus expenditure model is thus insufficient to describe the business. Instead, a product might enhance the brand of a company, or enhance the overall experience of the consumer, causing them to buy other associated goods or services. This idea was at the very heart of the submission of GSMA to FCDO. The GSMA mNutrition logical framework discusses indirect benefits or imputed benefits, which are described in Section 5.6.

In order to map the various components of the business model and to capture these indirect or imputed effects (beneficial or otherwise), we use the O&P canvas. The nine elements (or building blocks) of the canvas form the basis of our analysis below. Note that we have amended the framework slightly by splitting the 'Revenue' building block into two components, considering cash generated and imputed benefits separately. We have also split 'Costs' into two, considering operating costs and previous investments separately. This has been proposed because of the importance of indirect costs to VAS business models, and because some of the key resources brought to partnerships have benefited from prior investments. Figure 23 presents a generic overview of the framework, i.e. the descriptions and example questions illustrate how the framework is applied to business models in general, so not all are directly relevant or applicable to the VFC service.

Figure 23: Building blocks in the canvas (derived from Osterwalder and Pigneur, 2010)



Source: Authors' own.

Table 12: Description of the building blocks in the canvas

Canvas building block	Description	Example questions
Customers		
Customer segments	The business model should define different groups of people or organisations to reach and serve. Distinct segments will have common needs, behaviours, or other attributes. The business model should be designed around a strong understanding of customer needs.	For whom are we creating value? Who are our most important customers?
Channels	How a company communicates with customer segments. Channels are customer touch points that shape the customer experience, e.g. communication, distribution, and sales.	How are we reaching customer segments? How do they want to be reached? Which ones work best and are most cost-efficient?
Customer relationships	The types of relationships a company establishes with specific customer segments. Relationships may be driven by various motivations, e.g. customer acquisition, customer retention, and boosting sales.	What type of relationship does each of our customer segments expect us to establish with them? How costly are they? How are they integrated with the rest of our business model?
Offering		
Value propositions	The bundle of products and services that create value for a specific customer segment by satisfying a need or helping solve a problem. Value propositions may be innovative (disruptive) or similar to others, but with added features.	What value do we deliver to the customer? Which of our customers' problems are we helping to solve? Which needs are we satisfying?
Business operations		
Key resources	Those assets required to make the business model work. Resources that allow an enterprise to create and offer the value proposition, to reach markets, to maintain relationships, and to generate revenues. They can be physical, financial, intellectual, or human.	What key resources do value propositions require?
Key activities	Things a company must do to makes its business model work. The activities required to create and offer the value proposition, reach markets, maintain relationships, and generate revenues.	What activities do our value propositions require?
Key partnerships	The network of suppliers and partners that make the business model work. Companies forge partnerships for many reasons, e.g. to reduce risk, acquire resources, etc.	Who are our key partners? Who are our key suppliers? Which key resources are we acquiring from partners? Which key activities do partners perform?
Finances		
Revenue streams	The cash generated from each customer segment. Revenue streams will depend on what customers are willing to pay. Revenue streams can be either one-off payments, or recurring	For what value are customers willing to pay? How are they currently paying? How would they prefer to pay?

Canvas building block	Description	Example questions
	revenues. Each revenue stream may have different pricing mechanisms.	How much does each revenue stream contribute to overall revenues?
Cost structure	Costs incurred to operate the business model. Creating and delivering value, maintaining customer relationships, and generating revenue all incur costs.	What are the most important costs inherent in our business model? Which key resources are most expensive? Which key activities are most expensive?
Investment	Number of investors, type of investors, and commitments made to investors. These will influence acceptable profit margins, and may affect cash flow.	Who has invested in the company? What kind of returns are expected? And over what timescales?
Indirect benefits	Ways in which the service can benefit the company other than by direct revenue generation.	How does the service increase acquisition and loyalty? Does the service boost other sales? How does the service improve brand image?

Source: Authors, generated from Osterwalder and Pigneur (2010).

The baseline analysis is summarised in Figure 24.

Figure 24: Summary of canvas (baseline)

Source: Authors' own.

C.2 Customer segments

Review of baseline

The primary target for VFC was articulated as 5 million smallholder farmers in Ghana, who account for 77% of the entire agricultural base in the country (GSMA, 2014). Three key segments were described, which are not mutually exclusive:

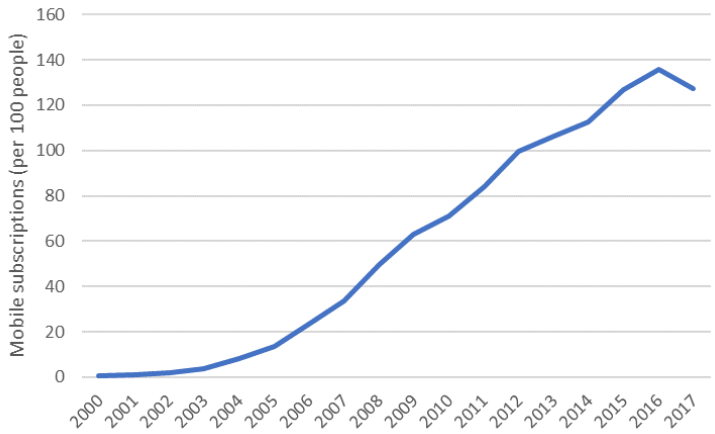
- female farmers – estimated at 2.8 million (56% of the agricultural labour force);
- semi-literate and illiterate smallholder farmers – estimated at 3.3 million (30% of the entire agricultural base is estimated to be illiterate), who also lack numerical skills; and
- rural residents without access to mobile phones – estimated at 3.2 million.

Migrating base customers (on other plans) onto VFC in late 2016 enabled Vodafone to reach the key performance indicators (KPIs), but introduced a mix of non-farmer customers into the VFC base. Nevertheless, Vodafone was keen to retain the integrity of the original concept, which is to support farmers, so they then started weeding out ineligible subscribers. These were evident from inappropriate behaviour, particularly exclusive use of the CUG – bona fide customers will also make some use of calls outside the group.

Although the product was inclusive of women farmers, a number of factors make this difficult to achieve in practice. Qualitative research confirms that mobile phone ownership is lower among women, but it also found that men were not willing to share phones with their spouses. Also, men typically adopted innovations more rapidly than women (Ragasa, 2012), while literacy rates tend to be lower among women – which poses an additional barrier to SMS text-based services.

Targeting rural residents without access to mobile phones assumes that there remains a potential customer base that still aspires to mobile ownership. Published subscription rates (see Figure 25) suggest that the market in Ghana may be saturated (although, on the other hand, a one-year dip does not necessarily reflect a long-term trend). The qualitative research also identified some resistance to mobile phone ownership, especially among the poor, who may feel subject to peer pressure yet can ill afford to pay for airtime (Barnett *et al*., 2017).

Figure 25: Mobile subscription rates per 100 people (Ghana)[24]



Source: Authors' own (updated 2019).

[24] World Bank data.

VFC did try to engage with local champions or ambassadors – influential local people who are well respected within their communities. They were intended to promote VFC among target groups of farmers and rural communities. However, incentive schemes failed, and the concept was not pursued.

Endline update

The quantitative study found that 68% of households in the encouragement group registered for the service (1,297 households). Of these, 49.8% had actually used the service in the last 18 months (646 households).[25] However, women were less likely to have used the service than men: 63% of men had used the service in the last 18 months compared with 43% of women. Among both men and women, the main reason for not using the service was losing or not using the SIM. However, having no access to a phone was more commonly given as a reason by women than by men (by 32% of women who did not use the service, and 12% of men). This suggests that lower uptake of the service by women may reflect gendered aspects of cultural and economic characteristics rather than any shortcomings in the design of the VFC bundle.

The qualitative study found that sharing of information between genders was uncommon. This implies that where women have no access to a phone, even if their husband signs up to VFC, they are not likely to access information. The study found that men usually share with men while women share with women, which is due to the cultural norm that adults who are married should not interact with the opposite sex. Some husbands indicated, though, that they do share information with their spouses. Sharing of information within farming communities more generally can also be constrained by gendered norms. For example, a woman may be unable to share with men because it is believed a woman cannot know more about farming than a man.

Similarly, women are more likely than men not to read the weather or market price information because they cannot read, and not to listen to voice messages because they do not have access to phones. Both of these findings simply confirm the well-documented barriers faced by women in accessing mobile services, and especially text-based services that require users to be literate.

The baseline report describes the farmer archetypes constructed by Frog design (an external agency contracted by GSMA to support projects with UX), which served as a useful framework for discussing uptake and adoption, e.g. they identified certain archetypes likely to be early adopters. However, there is no evidence that customer acquisition activities specifically targeted distinct groups (or archetypes) of farmers.

C.3 Value proposition

Review of baseline

The VFC bundle includes the following components:

- **Weather information**: three SMS messages in English with local weather information per week. ALINe (2016b) found weather to be the second most commonly used type of information. Farmers did not mention weather forecasts as one of their information needs relating to agriculture during the qualitative research, although determining the best time for harvesting and planting was a high priority, which suggests that farmers were generally

[25] Under the encouragement design process, 91.5% of treatment households agreed to be registered and were given a VFC SIM. Uptake among this passively registered group will not be representative of the wider base of VFC customers.

satisfied with existing sources of weather information. Even so, farmers might value confirmation through VFC weather information.

- **Market price information**: one SMS message in English with local market price information per week for a selected crop and selected market. ALINe found market prices to be the most commonly used type of information (ALINe, 2016b). Qualitative research suggest that the value of market price information depends on geographical location (access to a variety of markets) and the type of farmer. For example, it is of limited value to 'Trapped' farmers (one of the Frog design archetypes), as they lack bargaining power with farm gate traders, and are likely to have an urgent need for cash. 'Competent Optimists' (another archetype) are able to seek out new markets, or to store goods to sell when prices rise, and so can make good use of price information. 'Agri-businessmen' are most likely to grow cash crops, for which prices are set by the government, so this service is of limited value for them.
- **Agri and nutrition tips**: one weekly recorded voice message in the selected local language with seasonal agricultural or nutrition tips (three agri tips and one nutrition tip per month) for the selected crop. Agri tips had limited appeal. This is particularly disappointing given the level of effort that the mNutrition programme invested in developing and localising content. However, the endline research found that once farmers had used the service for an extended period of time, the agriculture and nutrition tips were the most frequently accessed information (see below). Quantitative research found that government extension workers were the most important source of agricultural information in Upper West district, and the second most important source (second to spouses) in Central Region (Billings *et al*., 2017). Information on nutrition was not perceived as a priority by farmers and most farmers had never actively looked for information about nutrition.
- **Access to Farmer Helpline call centre**: free access to a call centre with advice available from an agricultural expert. Users mostly called the helpline for farming tips, and information from the call centre was felt to be most actionable.
- **Free community calling**: free calls to other VFC users. Vodafone marketing felt that free calls were the main selling point for the product and may have contributed to the low value placed on the content elements: 'The popularity of the free group calling detracts from the total value proposition of the product' (GSMA, 2016). In practice, free calls are capped at 600 minutes per month, but few users get near this cap; they estimate the average is less than 300 minutes.
- **Discounted SMS and calls** to non-VFC members. The Vodafone Ghana website simply offers 'competitive call rates'. Vodafone explained that they have increased the discounted voice call tariffs from GHS 5 (to the same network) or 9 (to a different network, known as off-net calls) per minute to GHS 9/11 per minute. This is still a good offer, as most MNOs offer GHS 12–13 per minute for off-net calls, and Vodafone's normal tariff is GHS 11/13 per minute.

Innovative features in the application distinguishing this from competitor services were:

- a platform for peer-to-peer sharing and learning – free community calling; and
- a more active engagement than just receiving voice and SMS calls – helpline, free calling to other farmers, mobile money transactions, and content tailored to crops/livestock and to location.

The original VFC design included a facility to use mobile money to complete transactions, which would have been innovative at the time, but was dropped from the implemented product.

Subscribers were, however, not fully aware of the features available within the VFC bundle. Subscribers signed up by the OSJ agency were much more likely to be aware of the content elements of the product, whereas those signed up by Vodafone's below-the-line efforts were more likely to be aware of free and discounted calls. This highlights how the different agencies marketed the VFC product differently, illustrating the crucial role played by channels in educating customers

and establishing the value proposition. More worrying still is the proportion of users (roughly one-third) signed up by both agencies that were unaware of any of the benefits of VFC.

Endline update

The Esoko contract with Vodafone was signed in June 2017 and the new contract added two additional nutrition messages/month, which started in July 2017:

- agri tips are sent in weeks 1, 2, and 3 each month; and
- nutrition tips are sent in weeks 2, 3, and 4 each month.

Surveys indicate that the most commonly **reported behaviour change** among users was negotiating a better price at markets (note that this was both in regard to selling produce and buying to feed their household). Other commonly reported changes included changing the way they keep their soil fertile and using weather information to change the timing of farming activities.

Esoko identified that VFC was experiencing a high number of hang-ups of voice calls. It therefore undertook a phone survey in November 2017 (target sample size of 1,500) but was unable to get the desired sample size because its E1 line (32 channels) was congested; Vodafone had not scaled up this capacity during the programme. The call centre uses the same channels and inbound calls also get disturbed. Findings from the limited number of interviews conducted showed that most subscribers did not know about VFC and they did not want to be on the product. They also found that Vodafone's deactivation code (9090) was not working.

The quantitative study showed that making calls and texts to friends or family was by far the most frequently used function, with 24.6% of households using it every day. Note that it is not clear if these calls were made on the CUG or if they used airtime; however, the low airtime expenditure figures suggest intensive calling is likely to be on the CUG. Among the information-related push-type services, the agriculture and nutrition tips were most popular:

- 73% listened to the agriculture and nutrition voice messages always or often;
- 55.4% read the weather messages always or very often;
- 54.2% read the market price messages always or often; and
- 36.2% had used the call centre to speak with an agricultural expert.

The main reasons for not listening to the tips (by outbound dialling (OBD) in local languages) were weak service and not having access to a phone. The main reason for not reading weather and market price information (by SMS in English) was not being able to read or not knowing English. The main reason for not using the call centre was not knowing that it was available, followed by believing they would be charged for the service.

Overall, these results suggest that voice messages in the local language was a better platform than SMS in English for delivering content. However, this is a substantially more expensive medium.

Among those respondents who used each of the information services offered under VFC, the call centre was the most highly regarded, both in terms of the value of and trust in the information. Indeed, 96% 'found advice from the agricultural expert useful' and 94% agreed that they trusted and felt confident in advice provided by VFC. Tips on agriculture and nutrition were the next most popular, while weather and market prices were least valued (see Table 13). Note that there is a very strong correlation between the two indicators of trust and value.

The quantitative survey also asked active VFC users a more general question on the value offered by features of the bundle. Even though farmers who used the call centre found the information to be very useful (as discussed above), among all users it was regarded as the least useful aspect of the service (see Table 14). This discrepancy is due to more than the dilution effect; almost all farmers rated the value of tips at around 70%, while one-third of farmers used the call centre and nearly all regarded it as valuable. On this basis, the utility ratio might be expected to be around 2,[26] but figures from Table 14 suggest a ratio closer to 25 (55% / 2%). This seems to indicate that there is something especially attractive to farmers about the agriculture tips. The relatively low rankings given to weather, market prices, and nutrition tips are consistent with the finding from the baseline report that farmers already have access to sources of information on weather and market prices, and they are not interested in nutrition tips.

In that light, to find 8% of users ranking nutrition tips as the most useful aspect of the service is perhaps surprising. The majority of respondents in the qualitative study reported having introduced some changes into their nutrition and eating habits, e.g. adding eggs, beans, or pears to their meals, eating vegetables, etc. They also now avoid eating late at night, particularly heavy foods such as fufu. In addition, they are also more aware of health hazards, such as cracked eggs and food that has been stored for a long time.

Table 13: Perceived value of information services

Information service	n	Value of information	Trust in information+
Call centre	234	96%**	94%
Agriculture and nutrition tips	582	72%*	81%
Weather	594	57%*	69%
Market prices	576	51%*	64%

* Always or very often found the information useful.

** Found advice from the agriculture expert useful.

+ Agrees that they trust and feel confident in information provided by VFC.

Source: Authors' own, based on Billings *et al.* (forthcoming, 2020)

Table 14: Most useful aspects of the VFC service (n=646)

VFC feature	Proportion who found it most useful
Agriculture tips	55%
Weather information	12%
Market prices	10%
Nutritional tips	8%
Free calls	3%
Discounted calls	3%
Call centre	2%
Other	8%
Total	100%

Source: Authors' own, based on Billings *et al.* (2020, forthcoming)

The key metric used by the mNutrition M&E was behaviour change: did farmers change their behaviour as a result of receiving information through VFC? According to ALINe (2016b), they did:

[26] (100% * 70%) / (33% * 100%).

its 'Outcome Fieldwork survey (sample of 28 face-to-face interviews) confirmed the finding from their earlier Outcome Survey (sample of 420 phone interviews) that around 97% of users reported some kind of behaviour change arising from use of VFC'. Respondents to the qualitative study felt VFC had helped them to increase their yields and improve their food storage and land preparation practices – information on sowing, pruning, fertiliser application, and the use of pesticides represents examples that led to changes in farming outcomes.

The figures obtained by the quantitative study are also high, but not quite so optimistic (see Table 15). This can be explained by differences in the sample selection between the two survey techniques. IFPRI solicited responses to the question from all users in the random sample, whereas the self-selecting nature of ALINe's sample (users who agreed to take part in a phone survey) may have resulted in a slight bias toward those who were more positively disposed toward the service. Either way, self-reported levels of behaviour change are high.

Despite high quality ratings, and high levels of self-reported behaviour change, the quantitative study found that use of VFC (at least once in 18 months) had minimal impact on the primary outcomes of household and women's dietary diversity, agriculture production, or nutrition or farming knowledge. Findings from Barnett *et al.,*'s (2018) study confirm that information on agricultural tips, weather, and market prices was all regarded as useful, but actual benefits were aspirational: 'they continue to use the VFC services with the hope that they can increase yields and reduce postharvest losses'. On the other hand, it also says that '[m]ost respondents opined that they have benefitted immensely from the VFC advice, which have ultimately improved their yields and health of their families' (Participatory Development Associates, 2019).

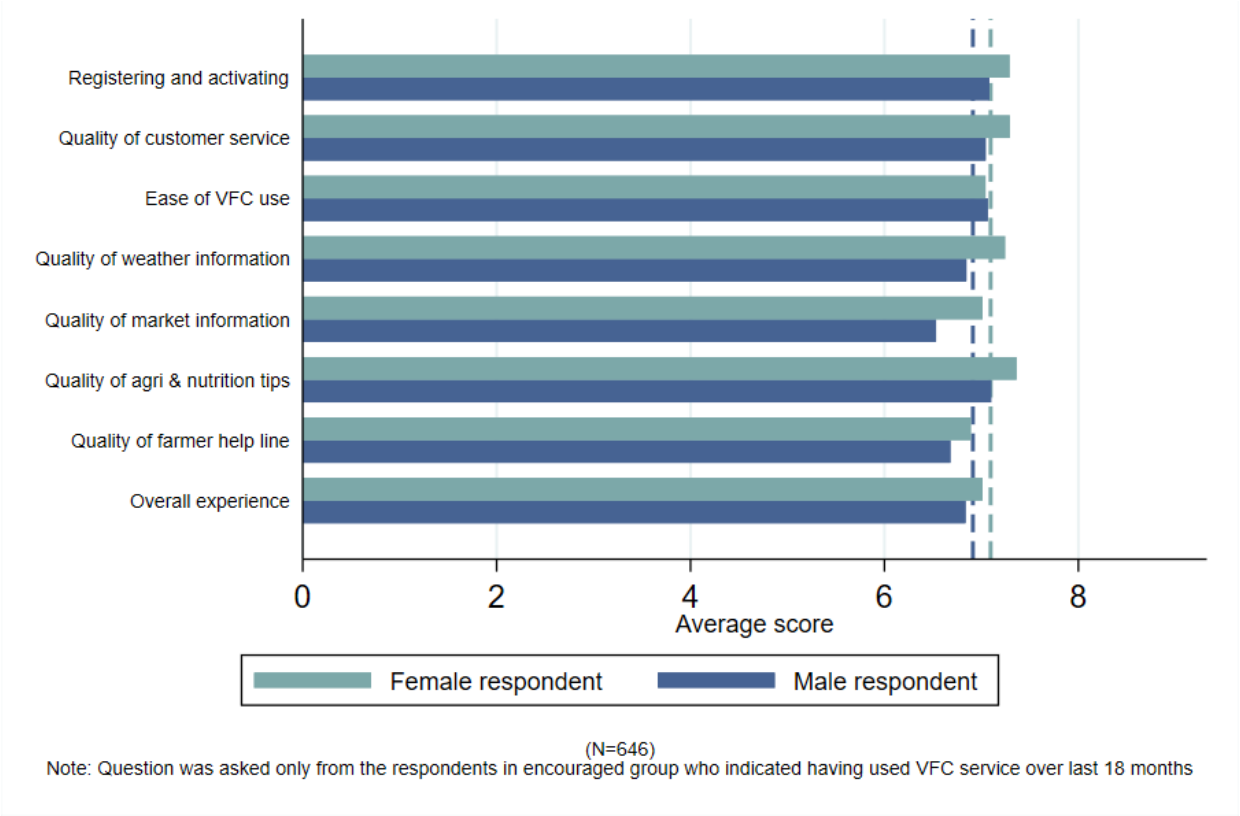
Table 15: Perception of information services leading to changed behaviour

Information service	n	Proportion who reported changed behaviour
Agriculture and nutrition tips	582	75%
Weather	594	65%
Market prices	576	50%

Source: Authors' own, based on Billings *et al.* (forthcoming, 2020)

Figure 26 shows that women rated the quality of the service more highly than men. Ratings were on a scale from 1 to 10, with 1 being very low and 10 being very high. The average score for respondent's overall experience with the VFC service was 7 for women and 6.8 for men.

Figure 26: Reported quality scores[27], by gender



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

All of these positive metrics are at odds with the weak WTP for the service, which was evident when the subscription fee was reintroduced, and two-thirds of users left the service. It is likely that shifting prices confused customers, who had come to expect the service to be free after the subscription fee was temporarily dropped.

C.4 Channels

Review of baseline

The main channels through which customers come into contact with Vodafone are as follows:

- **Customer acquisition** – enrolling in the club (SIM registration). There were originally three channels through which Vodafone acquired VFC members:
  - Agents – agents were employed during the launch of the product. They followed a schedule of moving from village to village. Vodafone contracted two organisations to promote VFC (only) – one in the north, one in the south. Teams of 12 with a bus moved a roadshow from community to community. Customers' understanding of the VFC value proposition (and lack thereof) was strongly influenced by the performance of the agents who signed them up.
  - Freelancers – Vodafone employ around 3,000 individuals to go out into communities and promote Vodafone products in general, rather than only VFC. Agents serving rural areas are trained in VFC and if they engage an eligible farmer, they can sell the VFC package. They represent the 'business as usual' acquisition vehicle.

[27] On a scale from 1 (very low) to 10 (very high).

  - There are also 'retailers' – these are stationary (e.g. a table at a market). There are 30,000 of them, but most are in urban areas, so only relatively few in rural areas have been trained and equipped to sell VFC.

  The highest number of acquisitions were achieved by agents, followed by freelancers – few were brought on by retailers. All three types work on commission, although agents' commission is higher because their costs are higher, as a result of them going to more remote locations. The cost per acquisition is also highest for agents.
- **Registration or profiling** – once enrolled, farmers need to enter details of their farming practice in order for the Esoko system to send them information tailored to their needs. VFC has struggled with the onboarding and profiling of farmers. Field agents were expected to profile farmers onto the Esoko system at the same time as they signed them up to VFC, but they were incentivised by the number of farmers signed up, and because the profiling process was time-consuming it was therefore often skipped. An automated profiling process was thus adopted, whereby farmers were allocated a 'typical' profile based on the crops most commonly grown in their geographical location. Thereafter, there were three possible methods of profiling, each of which had shortcomings:
  - Farmer calls Esoko call centre – fieldwork indicates that farmers are not aware that they can amend their farming profiles (GSMA, 2017).
  - Esoko calls farmers – restricted by the capacity of the call centre.
  - Agent does the profiling – effective incentive schemes were never found, and renegotiating incentives was problematic as Vodafone's contracts with the agencies covered multiple products.
- **Helpline** – free access to agricultural experts in Esoko's call centre. Farmers appreciated being able to speak to a real person. The midline qualitative research found that only a few VFC members were aware of the centre and even fewer knew that they could consult the centre free of charge, but by the time of the endline study most were aware of the call centre, even though few actually used it.
- **Payment** – airtime vendors and automated billing systems. VFC struggled with devising an effective payment mechanism. Initially, farmers had to make a payment each month (manual renewal), but dropout rates were high, and farmers did not understand the system well. An autorenewal service was introduced in late 2015, but again farmers did not understand the system and complained of the service eating their money. The autorenewal system initially dropped many customers who did not have sufficient airtime balance on the day their subscription was due, so the rules were relaxed to give farmers a 90-day window in which to pay their subscription before being removed from the system. Farmers struggled to pay GHS 2 per month, not necessarily because it was too expensive but because they were not accustomed to the concept of paying a monthly subscription for a service (reinforced by the fact that 98% use prepaid mobiles).
- The **automated services** themselves (voice and SMS messages). There are strong indications from the qualitative research that farmers prefer voice messages, preferably in local languages. As most farmers are illiterate, information sent to the farmers via SMS text messages is unlikely to be read.

Endline update

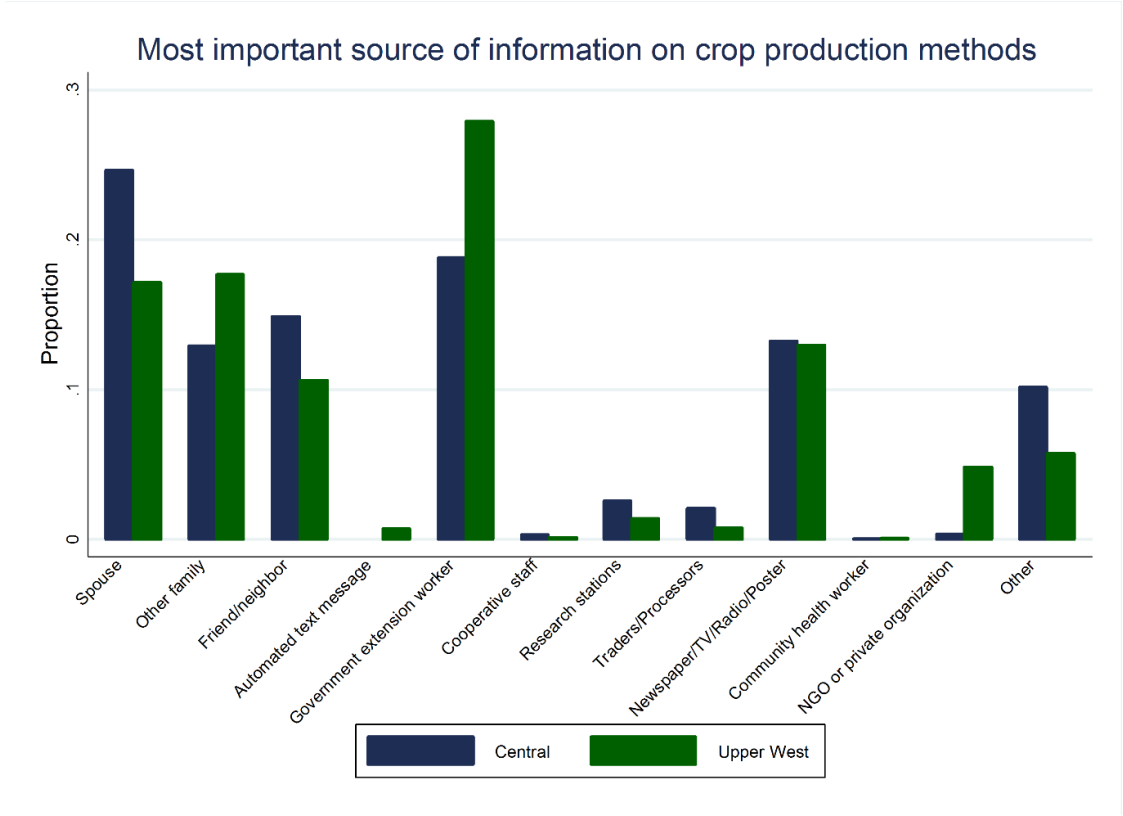
The qualitative research found that farmers engage well with OBD voice messages and that these were the most used feature of the VFC bundle, which is consistent with the findings from the quantitative study presented in Section 5.2. The recorded messages are in local dialects, which farmers easily relate to and understand. However, Esoko found that farmers were not listening to

these messages. When conducting research to understand why not, they found that there were two groups of users:

- Those who were not farmers – they found rural agents were simply giving customers VFC SIMs without checking they were farmers, or explaining the full features of the VFC bundle. This is a problem with incentivisation, as agents get a commission for selling VFC SIMs and have to achieve targets, which they will do by any means.
- Farmers who wanted the information but for whom the timing was wrong, e.g. messages came through when they were out in the fields. This has (at least partly) been caused by limited capacity in the system. Messages may be scheduled to go out at 08.00, but the last messages may be despatched at 15.00. This has subsequently been addressed as additional E1 lines are installed.

The reach of the SMS-based services (weather and market prices) is limited as most farmers indicated that they cannot read or understand English. Those who do make use of the SMS services mostly depend on friends and family who are literate in English. The baseline quantitative study showed that government extension workers were clearly regarded as the most important source of information for crop production (see Figure 27) and at that time, text messaging was hardly recognised at all. However, respondents to the qualitative study revealed that, in practice, access to agricultural extension workers is rare. Radio has commonly been used as a low-cost channel for extension, but radio audiences are in decline as people switch to TV and mobile media. The Ghana Socioeconomic Panel Survey baseline report (2011) found that a maximum of 14% of households received agricultural extension advice through the radio (Northern region). Given this context of declining access to traditional sources of information, respondents to the qualitative study felt that mobile-based information on its own can still be useful. Note that even if text messaging is not regarded as the most important source of information, it can still play a part in behaviour change by reinforcing messages from other sources, and providing supplementary information.

Figure 27: Source of information on crop production, by region



Source: Billings *et al*., (2018).

The quantitative study found that only 50% of participants who had registered for the VFC service reported that someone in the household had actually used the service in the last 18 months.[28] The main reason given for not using the services is losing or not using the SIM, followed by not having access to a phone; faulty phones and poor network connectivity were other reasons mentioned, albeit less often. Women were more likely to complain of not being able to access a phone; the qualitative research shed more light on the multiple reasons behind this:

- Although women largely signed up for VFC, it is men (i.e. husbands) who usually receive the messages. This stems from the fact that some households operate a single phone that is held or controlled by men.
- Some men claimed they have signed up as members of VFC even though it was their wife's name that appeared on the list for sampling.
- A few women reported that their handsets were damaged, so they use the VFC SIM card in their husband's phone.
- Customer acquisition activities were not specifically designed to attract women, nor to address the specific needs of women.

[28] Under the encouragement design process, 91.5% of treatment households agreed to be registered and were given a VFC SIM. Uptake among this passively registered group will not be representative of the wider base of VFC customers.

C.5 Customer relationships

Review of baseline

VFC is branded as a club. The VFC offering is exclusive in that Vodafone has been fastidious in ensuring that it is only made available to farmers in rural areas; membership entitles farmers to call other members for free, which is a real benefit. Initial ideas of fostering personal relationships through local ambassadors did not materialise. Moreover, agents were transient and present only during the launch phase of the product, leaving freelancers and retailers, neither of whom were fully engaged with the VFC product. When Vodafone offered the product to existing customers, they changed their intended customer relationship into one that was simply appropriate to acquiring new customers, based on blast SMS messages, for example.

The call centre facility offered a means of establishing personal relationships with customers. However, the endline quantitative study found that only 26% of VFC members called the call centre. Esoko at the time had 10 people in their call centre. The growth of users led to an increasing number of 'unsuccessful' calls (GSMA, 2016a) and the workload increased when the call centre was required to call customers in order to complete their profile.

From early on in the VFC journey, Vodafone was aware that payment mechanisms were a problem. For example, in 2015 ALINe showed that most people who tried VFC but failed to re-subscribe either did not know how to re-subscribe or were simply unaware of the need to do so (ALINe, 2015). In an attempt to improve resubscription rates, an autorenewal system was introduced in late 2015 with some success: 'An auto-renewal process was created for new users from November 2015 which led to an increase in users paying for the product from 4% of the user base in September to 12% in March 2016' (GSMA, 2016a). However, ALINe's subsequent rapid feedback research showed that, in early 2016, most users (62%) still did not know how to pay for the service (ALINe, 2016a).

Qualitative research indicates that people in rural areas with poor connectivity tend to feel 'trapped' in their choice of MNO by network coverage and signal availability. This suggests that there is little point in Vodafone investing in improving the customer relationship as it has little influence on customer retention. However, the qualitative sample was limited in scope, and the quantitative component reports that, in their sample, VFC users were more likely to use Vodafone as their main network provider (primary SIM) – an increase of 9% (for both women and men).

C.6 Revenue streams

Review of baseline

The original business model was built on a hybrid approach, generating revenue from both selling airtime (discounted airtime tariffs) and from subscription fees. Calls within the CUG (to other VFC members) are nominally free. In fact, there is a cap on the number of free minutes (600 minutes per month) and any calls in excess of this amount are charged at the discounted rate, but most users are nowhere near this limit.

During the life of VFC, pricing models have changed. In October 2016, the subscription fee of GHS 2 per month was dropped in the interests of attracting higher subscriber numbers in order to meet targets. Then a subscription charge was reintroduced in June 2017, albeit at a much lower rate (GHS 0.50 per month). This rate was set to cover the cost of delivering the bundle of messages to customers.

A WTP experiment was carried out as part of the baseline quantitative research (Billings *et al*., 2017). This suggests that most farmers (over 85%) are willing to pay a small subscription fee (up to 1 GHS/month), but that demand drops dramatically at prices beyond 1 GHS/month, such that only 50% were willing to pay 2 GHS/month. Although these may seem like low subscription rates, they should be considered in the context of an ARPU for VFC users of only 2.5 GHS/month.

Furthermore, farmers are accustomed to getting information for free. Weather information is freely available on the radio and television, and farmers do not expect to pay either government extension workers or agricultural input suppliers for advice.

Endline update

Vodafone report ARPU for the VFC base as GHS 2.5 per month. However, the quantitative study found much higher levels of expenditure: GHS 11 per month among women and GHS 27 per month among men. Note that this is their entire expenditure, which will be spread across multiple SIMs.

C.7 Indirect benefits

Review of baseline

Key indirect benefits to Vodafone are customer loyalty (reduced churn) and increased ARPU. Vodafone has not investigated these metrics, despite encouragement from GSMA and the study team. The qualitative research, conducted in areas with multiple network coverage, giving consumers an effective choice, confirmed that the majority of farmers own multiple SIMs. Deciding which SIM to use was found to be based on a number of factors, most important of which was network availability, but also cost, especially important given that operators charge a high premium for off-net calls, and special offers, promotions, and bonuses.

The qualitative research highlighted an issue of loyalty whereby people stick with the first operator that they signed up to. However, this is a negative reluctance to change, based on the ‘cost’ to the customer associated with changing to a new number.

Endline update

The primary aim of Vodafone was to increase its rural customer base by offering a low-cost, high-value product to smallholder farmers who were not yet signed up with a mobile operator. The quantitative study does not provide any evidence that this strategy has been successful within the communities sampled. Levels of phone *ownership* were 79% and 50% among men and women respectively, and levels of *access* to a phone were 89% and 83% among men and women respectively. Levels of ownership and access were no higher among the encouragement communities.

Nonetheless, the VFC offer led to significant increases in the stickiness of the Vodafone network:

- VFC users were more likely to use Vodafone as their main network provider (primary SIM) – an increase of 9% (for both women and men). Given that 20% of women and 22% of men in the comparison group used a Vodafone SIM as their main SIM, this represents an increase of roughly 43%.

- The proportion of phone numbers owned by an individual on the Vodafone network increased by 9.6 and 11.4 percentage points for women and men respectively. Given that the proportions of phone numbers on the Vodafone network were 20% among women and 22% among men in the comparison group, this represents an increase of roughly 50%.

However, there is no evidence that SIM turnover is lower among VFC users: 77% of women and 89% of men in the comparison group have had their SIM for over a year, and rates were similar among the encouragement group. These high rates are consistent with previous findings that rural consumers tend to be 'trapped' by poor network coverage, so churn rates tend to be low among rural communities. Note that the dominant network provider in both communities was MTN, used as the main network provider by 67% of respondents.[29]

There is no evidence that the VFC led to any increase in ARPU. Average expenditure across all mobile phones was GHS 11 per month among women and GHS 27 per month among men. The VFC service did not increase usage in terms of making or receiving calls, sending or receiving text messages, or total amount spent on airtime.

In fact, it was found that respondents using VFC (both men and women) were less likely to send mobile money. A total of 21% of men and 7% of women in the control group had sent mobile money (in the last 14 days), but rates were lower among VFC users (by 28% and 18% among female and male users respectively). This may be consistent with the midline qualitative findings that respondents felt that a shortfall of the VFC service was not providing access to other Vodafone services such as Vodafone Cash (Barnett *et al*., 2019). This could, however, be a misunderstanding. Any Vodafone user has access to Vodafone Cash but Vodafone's rural presence for mobile money services is limited comparing to MTN, entailing lower mobile money use. Since there are no VFC functions that require the use of mobile money, respondents could have believed that they had no access to Vodafone Cash. That said, the endline qualitative study found that respondents were not aware of the Vodafone Cash services (Upper West region). This represents a missed opportunity, as not only is access to financial services a priority among farmers but not explicitly including access to Vodafone Cash via the VFC product represents a loss of revenue.

Levels of customer satisfaction were generally high: 83% of women and 91% of men said that they were likely to recommend their main network provider to their friends or family. However, being offered the VFC service had no impact on this customer satisfaction metric among women, but significantly decreased satisfaction ratings among men.

In terms of branding, the qualitative study found that notwithstanding complaints about poor network quality, users largely expressed positive sentiments concerning the Vodafone network, describing it as the one that cared for the needs of farmers and asserting that VFC has been beneficial to farmers.

C.8 Key resources

Review of baseline

The resources contributed to the product by each of the partners are summarised in Table 16.

[29] This is consistent with the number of VFC users, which was 646, equivalent to 34% of the encouragement sample.

Table 16: Summary of resources brought by key VFC partners

	Vodafone	Esoko	GSMA / GAIN and partners
Physical	Network infrastructure Billing systems	Call centre Software platform	
Intellectual	Brand Customer base	Agricultural content database Experience of working with agri VAS Experienced staff	Nutrition content Quality control processes
Human	Product development Experienced staff Marketing	Expert network Software developers Network of market enumerators	UX researchers Business intelligence Monitoring, evaluation, and learning Business consultancy

Source: Authors' own

The VFC partnership offers Esoko a route to scale because Vodafone offers nationwide reach (infrastructure), can push services to existing customers (customer base), and has systems that deal with billing and micro-payments. Because VFC is more than a third-party VAS, and is branded as a Vodafone product, the MNO also brings marketing and product development skills. Vodafone has a nationwide network of 3,000 regional freelancers and up to 30,000 point-of-sale agents (see Section 4).

Esoko has a long track record of working with agri VAS, having set up Tradenet in Ghana over 10 years ago. It provides the technology platform for disseminating information and market prices, and has developed a database of locally relevant agricultural content that it brings to the partnership, but which remains its intellectual property. It has agriculturalists who fulfilled the role of the local content partner (LCP) and employed a nutritionist to manage the integration of nutrition tips. Esoko also had quality control and data validation processes in place, including an Expert Network, which proved to be a particularly valuable resource. Esoko has a network of 35 enumerators, covering 43 markets across Ghana, who provide data on market prices.

Endline update

Vodafone found it difficult to justify allocating management resources to VFC. The VFC base was running at around 70,000 active subscribers, which represents less than 1% of a total of 7.9 million mass market customers. This made it impossible to justify a marketing budget, and with a team of five staff members, the manager could not justify allocating meaningful staff time to VFC.

The proposed merging of various rural focused products (VFC, 3-2-1, Farmerline, Fisherfolk, and Vodafone Cash) was delayed due to staff shortages.

C.9 Key activities

Review of baseline

Key activities carried out by each of the partners are summarised in Table 17.

Table 17: Summary of activities conducted by key VFC partners

	Vodafone	Esoko	GSMA / GAIN
Platform/network	Operate network Billing customers	Operate Esoko platform (distribute content)	Continuous product feedback from users
Production		Create content Aggregate and localise content continuously (weather and market prices) Update advisory and nutritional content Maintain call centre	Create content
Marketing	Customer acquisition Customer retention	Customer profiling	Continuous feedback from users

Source: Authors' own

Vodafone operates the mobile network and Esoko operates the content platform; however, problems appear to arise with the interface between the two. Only one-third of VFC customers were successfully profiled by Esoko, which appears to be due to the two-stage (manual) process of porting numbers from Vodafone into the Esoko platform. Consumers also complain of poor network quality.

Vodafone deals with customer acquisition and registering new SIMs. The Esoko platform requires profiling of farmers, but the mechanism for doing this has changed in response to difficulties. Data suggest that up to one-third of SIMs were not successfully registered and that Esoko cannot profile customers that are not registered on the Vodafone network. Data also suggest that Esoko has been able to profile only half of registered SIMs.

Research highlights a need for ongoing customer education. Resubscription rates have been low because customers were not aware of how to pay their fees. Also, customers were not aware of the functionalities available in the VFC bundle.

Content creation (agriculture and nutrition tips) has been managed by GAIN in a two-part process of global and local content generation, with Esoko responsible for local content generation. CABI has pointed out that content cannot be regarded as a static commodity because, as local conditions change, it will go out of date. It will therefore be necessary to continually update content to address new challenges, changes in policy, advances in knowledge and technology, and so on.

Endline update

The last promotion carried out by Vodafone was in autumn 2017.

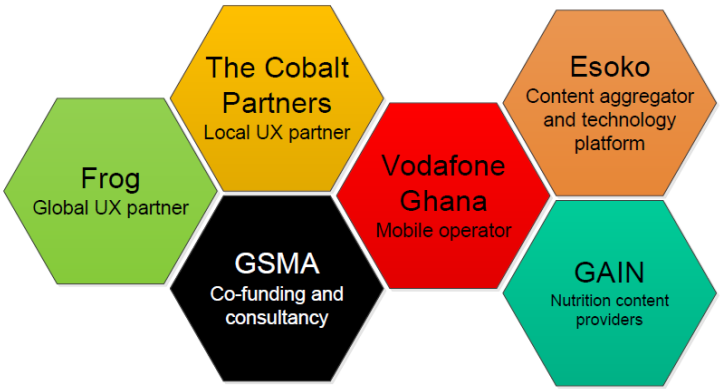
C.10 Key partnerships

Review of baseline

Parties to the partnership model are illustrated in Figure 28. The nature of the relationships between different sets of partners are summarised in Table 18, and the primary roles of each are:

- Vodafone Ghana – lead partner, funding, marketing, and billing
- Esoko – main partner, content, platform, and helpline
- Cobalt – local UX design research
- Frog – global UX partner
- GSMA – co-funder, business intelligence, M&E (provided via contract with ALINe), and consultancy
- GAIN – global content partner

Figure 28: Partners and other key players



Source: GSMA (2016a). Reproduced with permission.

Table 18: What parties give and get from partnership relationships

Partnership	Contribution of parties		Type
	First set of partners	Second set of partners	
Vodafone – Esoko	Vodafone: Reach, marketing (customer acquisition), billing	Esoko: Agricultural expertise and database (content), content platform, content management	Symbiotic, acquisition of resources; Vodafone want VAS, Esoko want scale
Vodafone – GSMA	Vodafone: project lead	GSMA: funding, technical assistance	Symbiotic: reduces risk to Vodafone of new product; VFC contributes to GSMA development strategy
GSMA – GAIN	GSMA: funding, project management	GAIN: agricultural content expertise	Symbiotic: open-access database fits GAIN mandate, and adds value to mNutrition project
Esoko – Expert Network	Esoko: financial compensation	Network members: refine product (reduce risk), credibility	Symbiotic: VFC contributes to members' mandate to improve agriculture
GSMA – Frog	GSMA: funding	Frog: design resources	Contractual
Vodafone – Cobalt	Vodafone: funding	Cobalt: design resources	Contractual
Vodafone – Agents	Vodafone: funding	Agents: marketing resources	Contractual

Source: Authors' own

Vodafone has explored additional options for customer acquisition, including partnering with local champions and large corporate customers. After preliminary discussions failed to establish how this could be done, however, the idea was dropped. This experience suggests that the transactional cost of negotiating with third parties such as commercial institutions, farmers' organisations, NGOs, etc. can be too high. It may not even be possible to establish relationships with institutions that are reluctant to, or even prohibited from, aligning with one MNO.

Endline update

When VFC was launched, Esoko entered into a two-year contract with Vodafone. However, when the new CEO (Yoland Cuba) joined Vodafone Ghana in March 2016, she introduced a policy that contracts should last no more than one year. The renegotiated contract started in June 2017, and expired in May 2018. This was then extended for a further three months to August, and then a further six-month extension was agreed. The contract was then not renewed, so the product was paused in January 2019.

The partnership relationship between Vodafone and Esoko was always a contractual one and, as such, was based on intense commercial negotiations. Several parties reported that the nature of the relationship deteriorated over the course of the project. Some said that the change was initially triggered by the departure of the original product manager early on in the history of VFC. Another difficulty was the departure of another product manager on maternity leave – her replacement was not familiar with procedures or the history of the project.

Esoko has continued to deploy its core market information system in collaboration with other programmes in parallel with VFC. For example, the multi-donor-funded Agricultural Development and Value Chain Enhancement Project commissioned Esoko to disseminate market and weather information and agriculture tips to 20,000 farmers in Ghana.

C.11 Cost structure

Review of baseline

The baseline report presented set-up and ongoing costs covering a two-year period, mainly derived from the grant application, costs reported by the content providers, and GSMA. Now that more detail has been provided, these costs have been superseded by a more comprehensive and rigorous analysis presented in Section 6.

The original analysis pointed out that the value of SMS messages delivered was the largest single cost component, when SMS messages were priced at the prevailing market rate for individual customers (GHS 0.055 per text). Even if bulk purchasing prices were used and these costs halved, they would still represent the largest single cost component.

Endline update

Vodafone has shared the final financial report that was submitted to GSMA under their grant agreement. This has been used as a source of much of the cost data for the financial model described in Section 6. Unfortunately, Vodafone was unable to provide similar data for subsequent years because it was no longer obliged to compile the information for GSMA, and VFC no longer had any time allocated by the accountant from Finance.

Voice messages sent out to farmers were well received (Barnett *et al*., 2018), but they are expensive. Esoko had previously used SMS to send messages, but as part of the VFC project it ported messages on agriculture tips from SMS to OBD to accommodate illiterate users. Esoko did not bear any additional costs as, under the VFC product, Vodafone met the cost of all messages. However, if this had not been the case, MNO charges are roughly GHS 1 per minute for voice messages, compared with GHS 0.05 per SMS (i.e. 20 times the cost) – such a difference would have a substantial impact on the viability of an information dissemination service. The cost of recording messages (in multiple languages) also adds up. Under the mNutrition programme, developing the words (text) for messages was covered by funding from GSMA through GAIN, but Esoko covered the cost of recordings.

Esoko originally received GHS 1.50 per subscriber, but under the new contract this was reduced to GHS 0.40. There is a tiered payment structure, but these figures are rough averages. Esoko noted that the price is below that charged for other projects, but acknowledged that Vodafone was not making any profit from the partnership. At the same time, even at the lower rates, Vodafone was still of the view that this did not represent value for money and considered various ideas to make it more profitable, such as moving to an alternative content provider. Another idea mooted was to take the mNutrition database (publicly available) and recreate it internally.

MNOs pay a number of taxes and fees at the company level.[30] If a product designer designs a service that will generate GHS 2 per month from each subscriber, the Finance department will make a claim on part of this revenue to contribute to these overheads, meaning that the product owner will benefit from less than GHS 2 per month. The Finance department deals with calculating these contributions, but these were not assessed for the purposes of the VFC financial report to GSMA.

C.12 Investment

Review of baseline

In addition to those costs directly associated with VFC (both operating and capital), FCDO and GSMA have invested in wider programmatic costs that have stimulated and supported this action.

It is worth noting too that Esoko has a history of investments made over the years by the founder, equity investors, programme partners, and various donors.

[30] www.gsma.com/publicpolicy/wp-content/uploads/2014/02/Mobile-taxes-and-fees-A-toolkit-of-principles-and-evidence_fullreport-FINAL1.pdf

Annex D Cost data utilised for the financial model

Capital expenditure

Item	Estimate (GBP)	Source	Description
Vodafone investment			
Funding for integration and technology upgrade (content provider)	25,000	VFC financial report	Actuals: 23,300
STK set-up	10,000	VFC Financial report	Actuals: 6,786
Localisation of content	85,000	CABI budget	Half of all LCP payments allocated to Ghana (it has both mAgri and mHealth projects)
Staff costs (Global Content Partner)	30,000	CABI budget	Half of all LCP payments allocated to Ghana
Direct costs	9,000	CABI budget	Half of all LCP payments allocated to Ghana
mNutrition programme (country specific)			
Product development			
Formative evaluation (international)	78,000	GSMA communications	See average country breakdown below
UX expert and design consultants	150,000	GSMA communications	See average country breakdown below
mNutrition programme (global)			
Global content development			
Global content partners	250,000	CABI budget	255,910 (per country programme)
Programme management			
Business intelligence and programme management (GSMA)	550,000	GSMA communications	See average country breakdown below

Source: Authors' own

GSMA mAgri total project budget average per country:[31] £1,422,550.

Breakdown of above cost per country (using Ghana specifics where available):

- M&E/business intelligence £78,000
- UX £148,600
- Global content £255,910 (from CABI budget for Ghana)
- Local content £123,698 (from CABI budget for Ghana)
- Grant amount (VF) £262,500

The remainder covers GSMA contributions to business intelligence and programme management: £553,843.

[31] Personal communication.

Operational expenditure

The following estimates assume that the subscriber base was acquired over an eight-month rapid growth period.

Item	Estimate (GBP)	Unit	Source	Description
Fixed costs				
Product development				
UX expert	4,000	GBP/qtr in rapid growth stage	VFC Financial report	Actuals: 19,373 (deliverable payments). Budget 25594 in four instalments. Actuals: 12,480 (UX peak salary). Budget: 10,969. Total: 31,853
UX expert (T&S)	200	GBP/qtr in rapid growth stage	VFC Financial report	Actuals: 1,321 (single claim)
UX Misc (data, airtime and smartphone, feature phone, dongle)	200	GBP/qtr in rapid growth stage	VFC Financial report	Actuals: total of 1,273 over eight quarters
User testing	0	GBP/qtr in rapid growth stage	VFC Financial report	No actual expenditure
Project M&E	3,000	At launch then 50% during rapid growth	VFC Financial report	Actuals: 6,462, budget was for 21,755 over seven quarters. Grant application was 1,500 per quarter
Content curation (LCP)	34,000	GBP/year (after launch)	Esoko Sustainability Plan	Lump sum estimate for keeping content up to date
Marketing expenses				
Marketing events	5,000	GBP/qtr in rapid growth stage	VFC Financial report	Actuals: 38,707 spent in three quarters (Budget was for 149,909 in six instalments).
Local radio slots and production	15,000	GBP/year during rapid growth stage	VFC Financial report	Actuals: 26,634 spent in two instalments
SIM branding and customisation	14,000	Launch only	VFC Financial report	Actuals: 13,938 spent in first year
Ambassador merchandising / Sales activation	48,000	At launch then 50% during rapid growth	VFC Financial report	Actuals: 211,070. Approx. 200,000 over two years, drops to approx. 22,000/quarter in second year
Administration expenses				

Item	Estimate (GBP)	Unit	Source	Description
Working group travel	2,000	GBP/qtr in rapid growth stage	VFC Financial report	Actuals: 15,688 over first seven quarters
Staff cost: PM	3,000	GBP/qtr rapid growth stage, then 50%	VFC Financial report	Timesheet: 60 day/qtr at £50/day
Support staff	5,000	GBP/qtr rapid growth stage, then 50%	VFC Financial report, interviews	Personnel listed in timesheet, levels of effort from interviews, our estimates of charge rates
Training	1,000	GBP/qtr	VFC Financial report	Actuals: 2,016 spent in two quarters; budget was 8,227 over eight quarters
Variable costs (cost of sales)				
Cost of SMS	5.5	GH p/SMS	Website	Prevailing market rate for individual customers
Taxes and fees	1.5	% of revenue		
Content provider	0.46	GBP/qtr/subscriber	Interviews	Original contract paid around GHS 0.85 per subscriber per month to Esoko. Based on original subscription of GHS 2 per month, this is a 42.5% revenue share
Call centre	0.02	GBP/qtr/subscriber	VFC Financial report	Call centre costs are listed as variable cost. Average of actuals cost over four quarters = 0.143 GBP/subscriber/qtr but this gives unrealistically high costs. Use budget average of 34,454, equivalent to average of 0.022 GBP/sub/qtr
Cost of scratchcards	0.007	GBP/qtr/subscriber	VFC Financial report	Budget figures are consistently based on 0.007 GBP/subs/qtr. Actuals are higher; average is 0.015
Sales commission	0.15	GBP/qtr/subscriber	VFC Financial report	Actual expenditure averages out at 0.15 over a six-quarter period. Budget values give average of 0.18

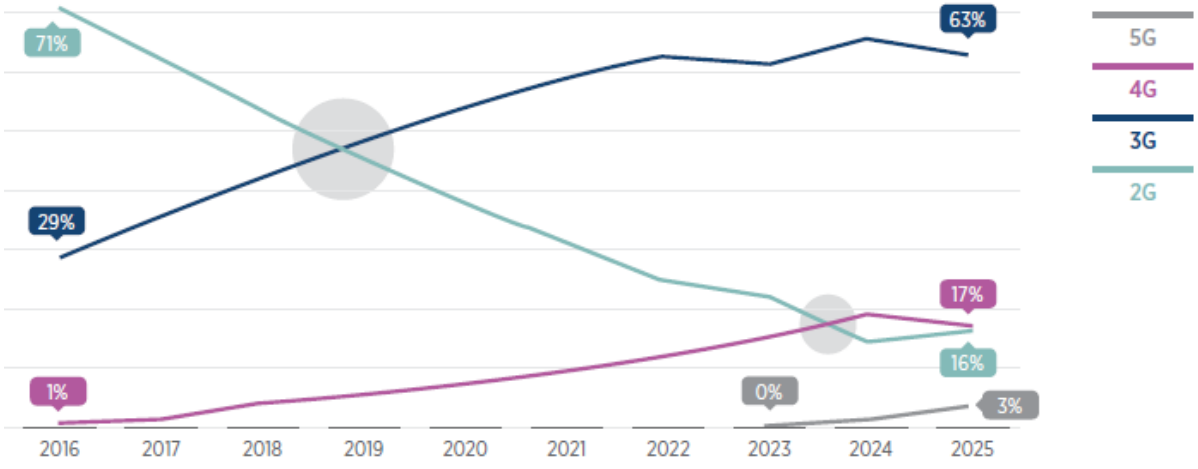
Source: Authors' own

Annex E Mobile Technology Developments and Agriculture

E.1 Technology and mobile business models

Mobile data use is set to grow. GSMA (2019) predicts that mobile data consumption across sub-Saharan Africa will multiply seven-fold by 2024 (from 1.1 to 8.5 GB per subscriber per month). Although 4G is growing and there is much interest in 5G, 3G internet connections are likely to remain the dominant technology for the medium term (see Figure 29).

Figure 29: Breakdown of mobile internet connections by technology



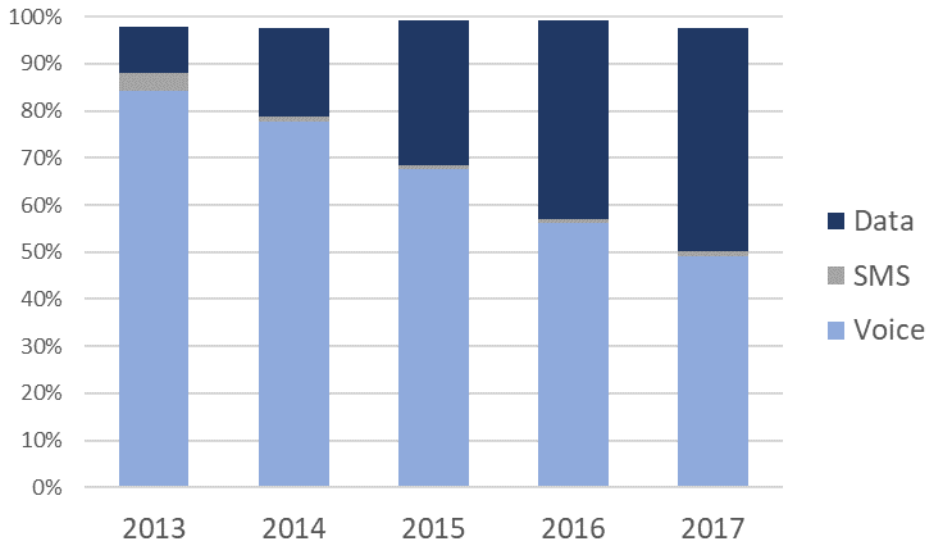
Source: GSMA (2019).

Vodafone Ghana's partnership with Facebook highlights the growing influence of over-the-top (OTT) services on telecommunications markets; currently, 32% of adults in Ghana use social networking sites such as Facebook and Twitter (Pew Research Center, 2018), and usage grew 50% in the two years since 2015. Furthermore, Esselaar and Stork (2018) argue that with data-driven business models, increased revenue from data services can more than make up for any decline in voice revenue from OTT services. They present financial data from MTN Ghana as an example of a data-centric business model. Figure 30 shows how data has generated an increasing share of total revenue, to the point where it is likely to generate more revenue than traditional voice and SMS communication.

Entertainment services drive a good deal of growth in data use. While televisions become more widespread (e.g. demand for solar home systems is often driven by affordable LEC televisions; see Global Partnership on Output Based Aid, 2016), the affluent are spending more time watching TV and video on mobile devices.[32] This trend toward increased access to TV and video is an important feature of the changing media landscape in sub-Saharan Africa, and may well have implications for agricultural extension services.

[32] www.ipsos.com/en/how-digital-driving-media-growth-africa

Figure 30: Breakdown of revenue by service (MTN Ghana)



Source: Authors' own (data from Esselaar and Stork, 2018).

Smartphone ownership is a key barrier to extending access to mobile internet services. In Ghana, smartphone ownership stood at around 35% of adults in 2017, which is marginally above the median for sub-Saharan Africa (33%). Smartphone sales are on the rise; GSMA estimates that the number of handsets will more than double between 2018 and 2025. Adoption of smartphones in remote rural areas is likely to be relatively slow, not only because of poor data network coverage but also because of the relatively poor battery life offered by cheap smartphones. Access to a smartphone alone is not enough to get people onto the internet. Although 35% of adults had smartphones (in 2017), only 30% used the internet, and even then, many will use free wi-fi spots rather than purchasing data bundles. Nevertheless, the falling price of smartphones will continue to strengthen access to data services. For example, MTN has ambitious plans for selling a $20 'smart feature' phone that uses the KaiOS operating system to create a smartphone UX providing access to Google and social media apps.[33]

Data services will be instrumental to overcoming literacy barriers, as well as to providing a richer information dissemination experience in the form of, for example, video. It is likely, therefore, that the reach and efficacy of mobile agricultural services targeting the poorest farmers will improve once they can be delivered via smartphones. However, the poor network coverage discussed in Section 5 suggests that this is unlikely to be the case within the medium term and, in the meantime, voice-based features (e.g. Interactive Voice Response (IVR), OBD, the call centre, etc.) are likely to be the most effective media for engaging with smallholder farmers.

There are several indications that Ghana's mobile market is maturing. Section 7 describes how the rate of growth of subscribers has slowed since 2015, adults typically have more than two SIMs, and 64% of mobile subscribers use mobile data. Although there remain parts of the country that are underserved, steps are being taken to provide coverage to the most remote communities and, as mentioned earlier, GIFEC has adopted a target of reaching 95% access to mobile services in rural communities during 2019.

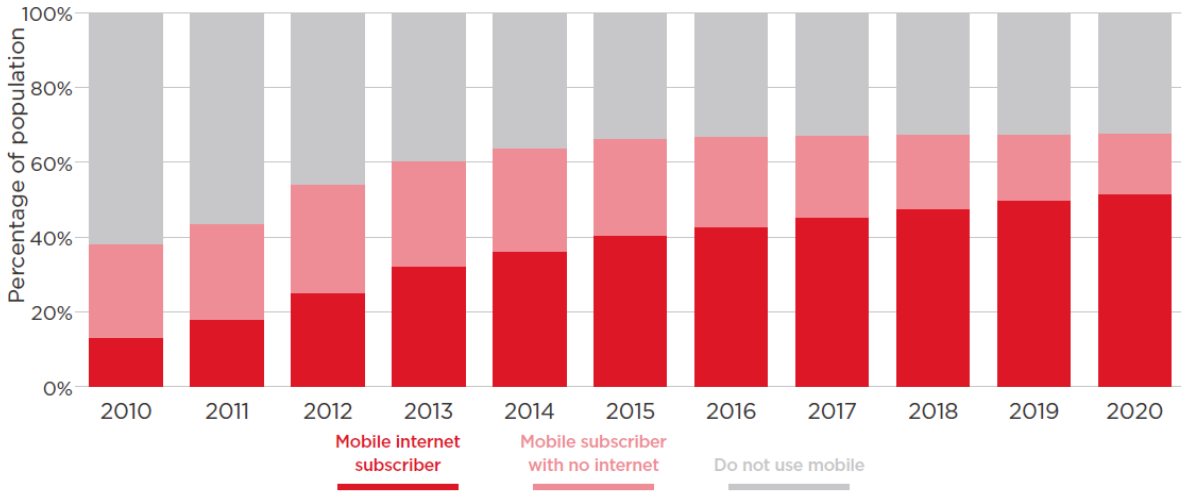
When the VFC concept was put together in 2013, the primary aim of Vodafone was to increase its rural base by specifically targeting new mobile subscribers from rural areas. This strategy is valid in a growing market where there remains a sufficiently attractive number of potential customers who

[33] www.businesslive.co.za/bd/companies/telecoms-and-technology/2018-11-14-mtn-to-offer-entry-level-smartphones-costing-20/

have not yet signed up with an MNO (the 'laggards'). However, this potential diminishes in a mature market. GSMA research suggests that the proportion of the population that will not sign up for a mobile subscription will bottom out at around one-third of the population after around 2017 (see Figure 31). In this case, MNOs compete to retain existing customers and to persuade customers on competing networks to switch. The VFC concept was, therefore, appropriate at a given time, when a substantial part of the population were not yet mobile phone users. The strategy was also appropriate only for a given duration, until the people who aspired to own a mobile phone but were not registered had done so.

In a mature market, in which almost all potential subscribers are signed up with one MNO or another, the strategy of VAS is to encourage subscribers on other networks to transfer and to encourage network subscribers to stay with the MNO that provides a valuable service rather than switch to competing networks.

Figure 31: Saturation of mobile phone market in Ghana



Source: Hatt *et al*., (2017).

Vodafone's priorities have changed. As the market has changed, Vodafone has shifted its priority from increasing its rural base to maximising revenue generated by that rural base. It plans to do this by integrating a number of products based on different technologies. The six years from 2013 to the present date is a long time in the world of telecommunications.

Perhaps the most transformational technology that has blossomed since the baseline report is mobile money. Adoption of mobile money accounts increased from 13% of Ghanaians in 2014 to 39% in 2017 (World Bank Group, 2019). Mobile money has been instrumental in increasing financial inclusion from 41% in 2010 to 58% in 2015. It is also interesting to note that the largest part of this increase is due to the efforts of non-bank financial institutions such as microfinance institutions and credit unions, which have deployed solutions based on mobile money platforms. The mAgri industry has also picked up on the possibilities for digitising financial transactions throughout the value chain and for offering a range of financial services to farmers. MTN mobile money is the market leader in Ghana, with Vodafone trailing, as Vodafone Cash was only launched late in 2015.

E.2 Agriculture and technology

Farmers, information, and needs

VFC is an example of an mAgri product that provided farmers with access to agricultural information through mobile channels, although VFC itself is a bundle that offers more. These services held the potential to complement the faltering reach of traditional agricultural extension and advisory services by reaching large numbers of farmers at a much lower cost. They relied on complex partnerships that reflected the pluralistic nature of agricultural extension and advisory services in most countries, bringing together government services, NGOs, and the private sector.

Extension and advisory services are designed to help people break out of poverty by, in the words of Davis and Franzel (2018), 'providing farmers with knowledge and tools about modern agricultural practices, linking them to new technology, and providing them greater access to finance and market solutions'. Their study concludes that mobile phone-based systems still have a role to play in agricultural extension and advisory services and that they do indeed represent a low cost per farmer for information dissemination. However, they are not best suited as a primary source of information. Agricultural extension and advisory services should employ multiple methods in integrated approaches that reinforce messages through various channels. Davis and Franzel (2018) suggest that mobile phone systems tend to be most useful where they reinforce more conventional face-to-face interventions. However, this assessment appears to focus on the role of mobile technology in providing farmers with 'knowledge', and less on providing them with 'tools'. This section takes a look at emerging services, most of which strengthen the 'agency' of farmers by enhancing their ability to participate in economic activities, i.e. farming.

The qualitative research shows that farmers' top priority was access to financial services, notably credit and, to some extent, insurance, which most commonly comes in the form of guaranteed price agreements between farmers and buyers. Since the inception of the mNutrition programme, new services offering such services have come to market, such as Tulaa, Esoko's Insyt, eHavo, and ACRE Africa.[34] It is interesting to note that GSMA also identified access to markets and finance as key challenges (Palmer & Darabian, 2017a), but concluded that, in 2014, financial solutions were not scalable. Instead, GSMA argued that information-based services would provide systems that could subsequently be built on. This has proved to be exactly the case for Tulaa and Esoko.

In the baseline qualitative research, farmers themselves identified information on how to access credit as their top information priority. During the qualitative endline research, most of the respondents complained that financial limitations were a major barrier preventing them from implementing the advice they obtained from VFC. For example, they suffered from a lack of money to buy:

- agrochemicals such as fertilisers and herbicides to apply on their farms regularly, as directed in the advice;
- the safety equipment needed when spraying chemicals; and
- the fruits they had been advised to eat (such as pineapple), which is also common in their village.

[34] https://acreafrica.com/

Other products

Insyt is a data collection tool officially launched by Esoko in 2018. It is now positioned as the front end of an integrated system. It provides a means of gathering data, typically for registering users onto a programme (including useful features such as identifying duplicates), but then the service (content) is delivered to customers by the market information system (the core Esoko information messaging platform). Insyt provides analytics (dashboard) and Esoko provides further data analysis on a consultancy basis. Esoko has always gathered data on farmers as part of onboarding for its agricultural information services, so the Insyt product is the result of a move to commercialise that technical capability. Insyt was developed as a platform to complete assignments for the Livelihood Empowerment Against Poverty project (registering 300,000 farmers), has subsequently gathered data on 200,000 farmers for the Government of Ghana, and was also able to collect biometric and spatial data on 200,000 farmers for the government under the Planting for Food and Jobs Programme.[35]

Insyt is currently using a business-to-business (B2B) model whereby corporate clients (e.g. government or NGOs) want a service delivered to a specific target group. Insyt projects are typically one to four months in duration and account for around 30% of Esoko customers. However, they tend to be more intensive and higher-value projects, so revenues from the two services offered by Esoko are reasonably balanced.

A key feature is that Insyt is integrated with a payment system, so individual farmers can be charged, and money transferred directly to Esoko. As a bespoke service, Insyt can also offer payment and verification systems. As a B2B product, there is facility for direct payment by individual farmers, so at the end of a programme, for example, it was not possible for individual farmers who liked the programme to continue using the service. Insyt is available through the App Store and Esoko is developing an additional market aimed at use by individual users.

In principle, each Insyt project offers Esoko an opportunity to build its database of farmers. In the Planting for Food project it secured co-ownership of the data, but it does not have rights to data from the Livelihood Empowerment Against Poverty project. Although Esoko retains a copy of the data, it would need to secure permission from the Ministry to use it.

The original vision for **Tulaa** was to provide services required by farmers throughout the agricultural cycle – from procuring agricultural inputs to post-harvest. By aggregating transaction records, it would also create a financial profile for unbanked farmers, enabling them to access financial services. Tulaa developed an app for registering clients because it was developed before Insyt was developed.[36]

There are multiple ways of registering on Tulaa. Smallholder farmers can register on the system through Channel Partners, a network of 60 local field agents that recruits and supports individual farmers, and farmers can also contact the call centre.

Farmers select the products they want to purchase on the system and can then either save for this purchase or can take out a loan from Tulaa's banking partner (or a mixture of both). Tulaa has arrangements in place with a small number of suppliers who offer agricultural inputs at a discount. When the time comes to make these purchases, the field agents pick up products from the supplier outlet in the district capital and deliver them to farmers (Kenya only).

[35] https://esoko.com/esoko-digitising-data-collection-insyt/
[36] Fasiba (the first incarnation of Tulaa) was developed under a grant from USAID's Feed the Future in 2016.

Tulaa offers flexible savings arrangements in terms of frequency of payments and amounts. If a farmer is given credit, a deal is made with an off-taker to buy a certain amount of produce at harvest. This is at an attractive price, and has the advantage of being guaranteed. The off-taker then pays the money to Tulaa, who returns it to the financial service provider. The system sends farmers reminders on their savings plan and offers incentives such as free airtime.

The system uses a mobile money aggregator that links to the mobile money services of all MNOs. MNO sales teams tend to accompany Tulaa staff when they go into the field on marketing campaigns, because each farmer needs to set up a mobile money wallet with their own MNO. Tulaa then sets up the lay-wallets used for making purchases on the Tulaa platform.

Farmerline continue to offer services both to individual farmers and to agricultural businesses. Individual farmers can access market price information, weather information, and agriculture tips through the 399 service. Farmerline has scaled its reach by partnering with MTN Ghana. The subscription fee can be paid with airtime or via MTN mobile money. It also offers services that connect farmers to markets and that enable farmers to access agricultural inputs (including irrigation equipment) and even solar energy. Farmerline also expects to be able to use subscribers' credit history to facilitate access to more sophisticated financial services. The platform is marketed to businesses as a data-driven means of improving efficiency and productivity. It offers field and farmer monitoring, data analytics, and certification tracking, in addition to all the other improvements that farmers can make to their own agricultural practice.

ACRE Africa is an example of a purely financial services product that has been built on the features offered by MNO mobile money services. It enables smallholder farmers to insure their crops and livestock against climate-associated risks, such as drought. Although farmers can register and make premium contributions on an individual basis, ACRE also works through farmer aggregators. In Kenya it has launched a KSH 50 card as something tangible that farmers can 'buy'. They can then top up their account as and when they have spare cash up to two months before the harvest is due. Interestingly, 60% of ACRE's customers are women. If certain threshold climatic conditions are met, ACRE pays out to eligible customers using a fixed rate (e.g. KSH 1,500 per KSH 50 premium). ACRE is not in itself an insurer, but rather works in partnership with local insurance companies and reinsurers. The product is fully integrated with MNOs' systems, as onboarding requires USSD platforms, and the business is based on micro-financial transactions facilitated by mobile money services.

Agrocenta was founded by two ex-Esoko employees, Francis Obirikorang and Michael K. Ocansey, in 2015. It has developed two products, both heavily based on financial services:

- Agrotrade – farmer registrations, inventory management, logistics, and tracking: 'This is our online trading platform responsible for facilitating trade between smallholder farmers and consumers or buyers. Over 12,000 farmers are currently signed up on AgroTrade with over USD220k worth of commodities traded.'
- Agropay – digital payments, micro-lending, and crop insurance: 'This is our financial inclusion platform targeted still at smallholder farmers. We make is super easy for institutions to on-lend and disburse funds to a large network of small farmers.'

Cowtribe allows farmers to schedule and receive veterinary treatment for livestock and track the health statistics of each animal. Farmers pay an initial subscription fee of US$ 5, and then Cowtribe charges a commission on any vaccines ordered through the platform. Since launching in May 2016, it has expanded services to over 119 communities and 29,000 farmers in Ghana. It started providing access to vets who travelled to the farm when needed. This quickly proved not to be sustainable because distances in the north (Tamale) are too great – it can take six hours to get

to a farm (and six back again). After rethinking the solution, it instead focused on prevention rather than cure – delivering vaccinations to farms.

An innovation that has recently emerged is crowdsourcing of agricultural investment. This is an interesting idea because it sources funding from investors, often city dwellers, by appealing to their interest in farming (so-called 'armchair farmers'). One approach is for the company to link investors to farmers directly (e.g. Farmcrowdy). In an alternative model, the company raises funds from multiple small-scale investors and then invests the capital in farmland owned or managed by the company itself. Tsan *et al.* (2019) estimate that there are now around 30 such crowdfunding enterprises in Africa.

Another addition is products aiming to improve logistics at the bottom of the value chain:

- Ghalani supply chain management – provides a platform on which farmers can organise themselves into groups for deliveries (and bargaining); and
- TruckR – farmers can use a mobile app to book a truck to take products to market.

The government in Ghana is taking steps to promote digital systems in support of agriculture. In November 2018, Ghana recorded the first ever electronic trading of a commodity by the **Ghana Commodity Exchange**, whose 'key goal is to link Ghanaian smallholder farmers to agricultural and financial markets in Ghana and across the West Africa Region to ensure Ghana farmers secure competitive prices for their commodities, as well as supply good quality commodities which meet the nutritional needs of the Ghanaian people'.[37] The Ghana Commodity Exchange is a private company, structured as a public–private partnership, with the Government of Ghana being the sole shareholder.

Emerging trends

The services outlined above illustrate how emerging mAgri products are tending to integrate financial services into a broader range of farmer support services that address different parts of the value chain. Note that even transactional services that enable farmers to conduct activities with greater ease (e.g. transporting goods to markets through TruckR, or vaccinating their livestock at the right time through Cowtribe) take advantage of mobile money payment facilities. This section presents just a few examples of emerging mobile technology for agriculture products; a much more detailed and comprehensive overview of emerging products is available from Tsan *et al.* (2019). This publication makes a distinction between ICT4Ag products such as Esoko, which were mostly information dissemination VAS deployed in partnership with MNOs, and the new landscape of D4Ag innovations that use digital technologies and data to transform practices across the agricultural value chain. They also categorise D4Ag solutions into the five primary use cases described in Table 19.

It is worth remembering that farmers have no financial history, so they have no risk profile, which effectively excludes them from financial services. Furthermore, financial institutions generally regard smallholder farmers as high risk because they tend not to use modern agricultural practices that are more resilient, e.g. to drought or pests. Some of the emerging services see value in using transactional data from a digital platform to create financial profiles that can then enable farmers to access financial services.

[37] https://gcx.com.gh/who_we_are/

Table 19: Categorisation of D4Ag innovations

Category	Definition and link to smallholder farming ecosystem	Examples of solutions
Advisory and information services	Digitally delivered information on topics such as agronomic best practices, pests and diseases, weather, and market prices, as well as more sophisticated digital advisory services and farm management software tailored to the specific farmer, farm, or field that enable smallholder farmers to make decisions that maximise output from their land, improve the quality of agricultural production, and maximise farm revenues and profits via lower costs of production, improved ability to identify markets, and/or better price realisation	• Agronomic/livestock management good practices • Market information systems and services (i.e. agriculture input and crop/livestock price intelligence) • Early warning tools for weather/climate advisory or pest/disease control • Customised (precision) advisory services at the level of farmer, farm, or specific field • Participatory platforms (e.g. peer-to-peer smallholder communities or curated farmer videos) • Livestock and farm management software
Market linkages	Digitally enabled solutions that link smallholder farmers to high-quality farm inputs (e.g. seeds, fertilisers, herbicides/pesticides), production and post-harvest machinery, and mechanisation services (e.g. irrigation, tractors, and cold storage), or off-take markets, including agro-dealers, wholesalers, retailers, or even end-consumers. Digital market linkage solutions allow smallholder farmers to lower their costs of production via access to lower-cost and/or higher-quality inputs, reduce the costs and risks of finding and transacting with buyers, and ultimately increase their yields and incomes	• Linkages to agri-inputs (e.g. digitally enabled input distribution or online input marketplaces) • Mechanisation linkage platforms (e.g. shared economy for mechanisation or pay-as-you-go irrigation) • Linkage to market access (e.g. digitally enabled linkages to wholesale buyers) • End-to-end integrated market linkage models (e.g. digital linkage to both inputs and markets) • Buyer–seller digital marketplaces/exchanges
Supply chain management	Digital supply chain management solutions are B2B services that help agribusinesses, cooperatives, nucleus farms, input agro-dealers, and other smallholder farmer value chain intermediaries to manage their smallholder relationships in ways that lower costs through greater efficiency, improve value chain quality through better traceability and accountability, and ultimately increase smallholder farmer yields and incomes by making it easier for more commercial players to formally engage with large numbers of smallholder farmers	• Traceability solutions (e.g. digital sustainability and organic product certification tracking) • Enterprise resource planning platforms for smallholder farmer cooperatives, nucleus farms, and agribusiness out-grower schemes • Digital quality assurance solutions for farm inputs and produce • Logistics management solutions for post-harvest cold chains, storage, and transport
Financial access	Digital financial services relevant for smallholder farmers, such as digital payments, savings, smallholder credit, and agricultural insurance, which increase financial access and equip smallholder farmers to improve yields and incomes and invest in the longer-term growth of their farms (e.g. via better inputs, mechanisation, and expansion to new crops). Also includes	• Smallholder farmer payment solutions (e.g. agribusiness to farmer, government to farmer, farmer to input supplier, etc.) • Digital agri-wallets and commitment savings systems • Smallholder credit (e.g. digital credit assessment/delivery/collection platforms and products)

	B2B digitalisation and data analytics services for financial institutions that enable such institutions to serve smallholder farmers at substantially lower cost and risk	• Smallholder insurance (e.g. digitally enabled index weather, precipitation, and pest insurance) • Crowdfunding platforms for smallholder farming • B2B fintech data analytics intermediaries (e.g. digital credit profiles)
Macro agricultural intelligence	Data analytics solutions and digital decision support tools that integrate a variety of data sources on smallholder farmers, farms, and markets and convert this information into useful country- and value chain-level insights and decision tools for government policymakers, extension agencies, agronomists, agribusinesses, and investors	• Government agriculture sector tracking dashboards • Agriculture extension system management tools • Agribusiness and agriculture investor national and regional intelligence systems • Agronomy/research and development agenda-setting digital tools • Weather and climate observatories for agriculture

Source: Tsan *et al.* (2019).

Tsan *et al.* (2019) point out that D4Ag enterprises are increasingly diversifying their business models and bundling services from multiple categories. This is interesting as social impact investors are coming to the view that start-ups that provide multiple services are likely to be better investments. This is partly a consequence of the cost of customer acquisition among smallholder farming communities. A user base represents an asset of value, which can then be exploited by providing multiple services or products. Emerging opportunities within the value chain is an area where GSMA has already done a good deal of research and continues to work with MNOs and entrepreneurs through the AgriTech programme.[38]

[38] www.gsma.com/mobilefordevelopment/agritech/

Annex F VFC in the context of other mNutrition projects

F.1 Overview of mNutrition projects

Billings *et al*., (forthcoming, 2020) conclude that VFC has had little effect on primary nutrition and agricultural outcomes: 'Being offered the VFC service or having used it at least once has minimal impacts on household and women's dietary diversity, agriculture production, or nutrition or farming knowledge.' However, in terms of implementation, VFC has not been the most successful of the mAgri projects, so it is important not to judge the viability of the concept deployed under the mNutrition programme (i.e. of using mobile technology to support smallholder farmers) solely on findings from the study on VFC. The purpose of this section is, therefore, to put the performance and structure of VFC into the broader context of other similar products supported through the mNutrition programme. Learning points from all six of the agriculture solutions supported under the mNutrition initiative are summarised in the GSMA report by Palmer and Darabian (2017a), which has been used as the source of much of the detail in this section. This has been supplemented by information from the six individual case studies published by GSMA. The six products are:

- VFC (Vodafone, Ghana) – free calls to members, advice on crops, weather, and market prices available in 10 languages via SMS and OBD (Palmer, T. and Darabian, N. 2017c).
- Govi Mithuru (Dialog, Sri Lanka) – agricultural advice on eight crops, nutrition, and home gardening, with a focus on reducing chemical inputs (Palmer, T. and Darabian, N. 2017d).
- GP Krishi Sheba (GrameenPhone, Bangladesh) – agricultural advice on 16 crops plus livestock via OBD (Palmer, T. and Darabian, N. 2017e).
- M'chikumbe (Airtel, Malawi) – information on 15 crops and Airtel Money via IVR and SMS (Palmer, T. and Darabian, N. 2017f).
- Khushaal Zaminder (Telenor, Pakistan) – messages on agriculture plus livestock and weather via OBD, SMS, and IVR (Palmer, T. and Darabian, N. 2017b).
- Site Pyo (Ooredoo, Myanmar) – smartphone app providing access to information on 10 crops and weather, supported by SMS reminders (Palmer, T. and Darabian, N. 2017g).

An overview of the different country contexts is given in Table 20. Table 21 shows that all of the MNOs worked in partnership with both a technology partner and content partner, who 'localised' the content provided by the Global Content Partnership. This was not a trivial task and was closely linked to activities carried out by local UX partners – engaging with users was a key feature in getting the messages right. Two projects (Sri Lanka and Malawi) went further still by partnering with content stylisation companies.

Table 20: Countries and programmes at a glance

	Mobile phone penetration (2016)	Population (million) (2016)	Rural population (%) (2015)	% of gross domestic product contributed by agriculture (2004)	% of the labour force employed in agriculture	% of the female labour force employed in agriculture	Target market (million)	Active users	Users as % of target market
VFC, Ghana	67%	28	46%	22%	42%	38%	1.47	70,000	5%
Govi Mithuru, Dialog Sri Lanka	69%	21	82%	11%	39%	35%	0.75	252,000	34%
GP Krishi Sheba, GrameenPhone Bangladesh	53%	160	66%	16%	48%	68%	1.77	432,000	24%
M'chikumbe, Airtel Malawi	26%	17	84%	27%	64%	70%	0.49	90,000	1%
Khushaal Zamindar, Telenor Pakistan	47%	188	61%	25%	44%	76%	2.15	2,465,000	115%
Site Pyo, Ooredoo Myanmar	48%	55	66%	48%	70%	-	2.97	38,000	18%

Source: Palmer and Darabian (2017a).

Table 21: Project partnerships

	Content partner	Content stylisation	Local UX	Technology	Call centre
VFC (Vodafone, Ghana)	Esoko	n/a	Cobalt	Esoko	Esoko
Govi Mithuru (Dialog, Sri Lanka)	CABI	Sync Solutions	-	Synapse	n/a
GP Krishi Sheba (GrameenPhone, Bangladesh)	winMiaki	n/a	-	SDD Tech	Miaki
M'chikumbe (Airtel, Malawi)	Self-help Africa	Roofhouse	Revel	Human Network International (HNI)	n/a
Khushaal Zaminder (Telenor, Pakistan)	CABI, Scaling up Nutrition, MDF	Planet Beyond	n/a	Planet Beyond	Abacus
Site Pyo (Ooredoo, Myanmar)	Miaki	n/a	n/a	Revotech, IMImobile*	n/a

* server hosting and hardware support

Source: Authors' own

Note that, in addition to these partners, GSMA acted as funding and consultancy partner to all projects.

F.2 Comparing key aspects of mNutrition products

Drawing on key issues arising from the study, this section compares aspects of VFC with the other projects supported by mNutrition.

Table 22: Responsibility for product development

Product	Description
VFC (Vodafone, Ghana)	VFC was originally set up under the Strategy and Innovation Department but was subsequently relocated to mass markets under the Marketing Department. Staff turnover meant that it lacked strong product management. Although it had cross-functional support within Vodafone, it lacked internal UX expertise, relying on the external partners, Cobalt. However, without strong product management, insights from UX work were hard to implement.
Govi Mithuru (Dialog, Sri Lanka)	The product was developed by a dedicated team situated within the Sustainability Department. Initially, the project was assigned two full-time staff – a product manager and a UX lead. However, the team later grew to over six members, including a content specialist.
GP Krishi Sheba (GrameenPhone, Bangladesh)	Rather than being treated in the same way as a normal VAS product, Krishi Sheba was set up as a special project under the Commercial Department of GrameenPhone in Bangladesh. However, like VFC, GrameenPhone relied on strategic partnerships to drive product development. The product manager and UX lead resided in Win Miaki rather than GrameenPhone. Having yet another partner deal with technology (SSD Tech) led to problems in prioritising work, even though GrameenPhone had a longstanding arrangement with SSD Tech to host all of their VAS.
M'chikumbe (Airtel, Malawi)	Within Airtel Malawi, the product development team was located in the Airtel Money Department, although it was set up as a standalone product. The team included a product manager, a UX lead, and a part-time VAS expert. Like GrameenPhone, Airtel had a longstanding relationship with the technology provider, HNI, which was already providing the 3-2-1 VAS.
Khushaal Zaminder (Telenor, Pakistan)	Khushaal Zaminder originally appears to have been treated as any other VAS, established by a small team of two (product manager and UX lead) situated in the VAS department. However, once its growth was evident, it was restructured in 2015 as a separate business unit with its own director, even though, as a free service, it was not generating revenue. The unit has subsequently developed additional mAgri products, e.g. an app-based agricultural extension service in partnership with provincial government.
Site Pyo (Ooredoo, Myanmar)	Although Site Pyo was established as a special project within Ooredoo, product development appears to have been driven by a third-party developer Miaki, which had a team of three (product manager, data analyst, and content specialist).

Source: Authors' own

Krishi Sheba (Bangladesh), Site Pyo (Myanmar), and VFC (Ghana) all relied on strategic partners to drive product development. In contrast, in two of the more successful products (Govi Mithuru in Sri Lanka and Khushaal Zaminder in Pakistan), the MNO sourced product development expertise internally, as did Airtel Malawi (M'chikumbe). This led GSMA to conclude that MNO ownership and strong product development teams are key to success when the service is MNO-led. Where product development is driven by a strategic partner, the nature of the relationship is key. During the inception stages of VFC, communication between the two parties was facilitated by a single member of staff who had moved from Esoko to join the team at Vodafone before the project. However, after she left relations between the parties started to deteriorate.

Note also that the two most successful products included specific provision for stylisation partners (Sync Solutions in Sri Lanka and Planet Beyond in Pakistan). GSMA concluded that 'dynamic, informative push messages increase users' engagement' (Palmer & Darabian 2017a). For example, Khushaal Zamindar's OBD messages were formatted as conversations between household members, rather like a soap opera. When it was suggested that VFC messages be stylised in some way, Vodafone said this was Esoko's responsibility – and Esoko said it did not have the resources.

GSMA has concluded that an agile and user-centric product development process is key to success. Esoko stands out from other services in having a long track record of providing agricultural information services to smallholder farmers for over 10 years prior to their partnership with Vodafone. It had, therefore, well-developed products and processes refined over years of experience of working with farmers. On the one hand, this made for an attractive proposition because it had experience and systems in place, reducing the capital expenditure required; on the other hand, it meant that it was less interesting and appealing for it to engage with UX design processes offered to partners through the mNutrition programme. VFC was the first of the projects to launch, as a result of having pre-existing systems. However, it subsequently proved to be resistant to change. For example, Palmer and Darabian (2017c) describe six specific recommendations arising from product iteration workshops, of which four were implemented. Other projects were more willing to make changes to products; for example, Dialog in Sri Lanka implemented all seven of the recommendations made.

Table 23: Top-level leadership for mNutrition projects

Product	Description
VFC (Vodafone, Ghana)	Vodafone Ghana has had two changes in CEO over the duration of the programme. The C-level champion originally driving the project at the proposal stage also left.
Govi Mithuru (Dialog, Sri Lanka)	Expansion of the product team was driven by CEO-level support, which was stimulated by evidence of commercial benefit in terms of sales and indirect benefits, including increased revenue and improved loyalty.
GP Krishi Sheba (GrameenPhone, Bangladesh)	Turnover at the C-level led to internal changes and delays in development of the Krishi Sheba product.
M'chikumbe (Airtel, Malawi)	The M'chikumbe service is supported by Airtel's CEO, who regards it as a positive factor in establishing customer loyalty, even though it does not generate substantial revenues.
Khushaal Zaminder (Telenor, Pakistan)	Telenor's CEO was clearly convinced of the commercial viability of the agricultural sector as he set up a dedicated business unit to address mAgri, based on Khushaal Zaminder.
Site Pyo (Ooredoo, Myanmar)	No details.

Source: Authors' own

Vodafone experienced a high degree of staff turnover at all levels (see Section 4.2). The first new CEO introduced drastic changes to the VFC business model (although there were multiple factors lying behind this decision – see Section 4). The VFC product was paused shortly before the CEO changed again. Continuity of vision and leadership is a key factor in driving a new product, and was lacking in VFC. GSMA has subsequently identified the importance of this and recently

introduced provision for legacy planning as part of its due diligence procedures in ongoing programmes.[39]

Table 24: Technology platforms

Product	Description
VFC (Vodafone, Ghana)	The VFC technology platform was owned and previously developed by Esoko, but Vodafone had no previous partnership with Esoko.
Govi Mithuru (Dialog, Sri Lanka)	The technology partner, Synapse, had a strong relationship with Dialog.
GP Krishi Sheba (GrameenPhone, Bangladesh)	The technology partner, SSD, owns the platform, which is used for all its VAS.
M'chikumbe (Airtel, Malawi)	The platform was owned and operated by HNI, and is to be developed to handle OBD. HNI previously supported existing services for Airtel.
Khushaal Zaminder (Telenor, Pakistan)	The platform was owned and operated by Planet Beyond, who had an existing relationship with Telenor.
Site Pyo (Ooredoo, Myanmar)	The system was built and owned by the technology partner, Revotech, but technology aspects of the project were managed by Miaki, which drove product development.

Source: Authors' own

Esoko was unique among technical platform partners in providing services to farmers under its own brand prior to the partnership with Vodafone. Having developed its platform to match its own needs, and having continued to develop its own brand offerings throughout the project, it is understandable how Esoko might not have been as flexible in making substantial changes to the product and the platform as other partners. In most of the projects, the MNO had good working relationships with the content providers prior to the mNutrition project, but this was not the case with VFC.

[39] Personal communication.

Table 25: Customer acquisition

Product	Description
VFC (Vodafone, Ghana)	Intensive marketing at launch was expensive. It was difficult to devise effective incentives for ambassadors, so the idea was dropped. Similarly, incentives for field agents to do complex onboarding proved elusive.
Govi Mithuru (Dialog, Sri Lanka)	At launch, radio marketing and a dedicated field sales channel proved expensive and not very effective. Numbers were driven up by target OBD-based registrations, scratchcard activation, free trials, and field events. It also seems to have reached a critical mass of subscribers, at which point word of mouth became influential. Marketing expenses remained high, so costs were cut by reducing the team, adopting low-cost marketing, and strategic partnerships.
GP Krishi Sheba (GrameenPhone, Bangladesh)	On-the-ground marketing by Win Miaki and partner NGOs was expensive. Targeted telemarketing was less expensive but still failed to reach scale. Numbers were driven up by an SMS/OBD campaign and a free trial period.
M'chikumbe (Airtel, Malawi)	Acquisition costs were high during an initial nationwide launch. Costs rose again when rolling out a second campaign marketing revised content. Self-registration brought costs down.
Khushaal Zaminder (Telenor, Pakistan)	Targeted OBD marketing campaign. Rural sales teams raised awareness. A pilot of NGO partners raised awareness in 1,000 villages but this was found to not be cost-effective and was dropped. Once a critical mass of users signed up, word of mouth was the most common means of attracting new users.
Site Pyo (Ooredoo, Myanmar)	An initial low-cost marketing campaign using social media, SMS, and OBD resulted in slow growth. Although expensive, roadshows were effective in raising awareness and identifying problems. An updated version, with simpler registration and profiling, was then promoted through a more concerted digital marketing campaign.

Source: Authors' own

Face-to-face contact is highly valued by famers, especially in terms of building trust, but on-the-ground marketing activities were universally found to be prohibitively expensive. Three projects tried working with field partners (NGOs) to facilitate a field presence, but with limited success. GrameenPhone in Bangladesh and Telenor in Pakistan found that working with NGOs was still too expensive. The detail of these NGOs is not available, nor what activities they were asked to do. VFC customers struggled with registration and profiling, and Vodafone struggled to find the right set of incentives to ensure that agents did these tasks diligently. It would seem unreasonable to expect partner NGOs to do these types of activities significantly more cheaply than agents. However, in principle, raising awareness might be something simple that NGOs, cooperatives, etc. could do.

Note that OBD was commonly used as part of low-cost marketing activities that were successful in driving up numbers (e.g. Govi Mithuru in Sri Lanka, Krishi Sheba in Bangladesh, Khushaal Zaminder in Pakistan, and Site Pyo in Myanmar). However, VFC appears to have been unique in specifically targeting new mobile subscribers from rural areas. Given this target market, low-cost methods such as OBD/SMS campaigns were not an option.

VFC was also a complex product. Other products provided farmers with information, typically on agriculture, livestock, and weather. The M'chikumbe product in Malawi also provided information on the Airtel Money service. Only VFC and M'chikumbe also provided users with market prices. However, VFC was more than a VAS – it was a bundle or customer plan, as it provided users with access to free calls to other members (through the CUG) and discounted tariffs to other mobile users. This raised marketing challenges, as sales agents could sell VFC as a low-cost airtime

product rather than as an agricultural VAS. This, in turn, contributed to some confusion over the identity of the product, and the monitoring research found that many users were unaware of all of the features available with the product.

Table 26: Commercial viability

Product	Description
VFC (Vodafone, Ghana)	The primary mission was to increase the rural base and rural revenue. Capital expenditure was low as Esoko had established systems in place. Vodafone did not benefit from any substantial economies of scale as Esoko was paid a fee per subscriber.[40] The subscription fee was dropped to accelerate base growth, then reintroduced at a reduced rate. Operational breakeven was achieved in 15 months.
Govi Mithuru (Dialog, Sri Lanka)	The subscription rate of LKR 1 per crop per day was simple to understand, even if expensive (US$ 0.16 per crop per month). Direct revenues were, therefore, substantial. ARPU was 5% higher among users, and churn was marginally lower (by 3%). Operational breakeven was achieved in 18 months.
GP Krishi Sheba (GrameenPhone, Bangladesh)	Initially offering the product for free was not sustainable, especially given that users already tended to have multiple SIMs. A charge of US$ 0.24 per month was unaffordable, so this was reduced to US$ 0.16 per month. ARPU was improved, as the proportion of users not using their SIM (in 90 days) reduced from 17% to 5%. It is expected to pay back the investment in two years.
M'chikumbe (Airtel, Malawi)	The revenue generated is low (based on a subscription fee of only US$ 0.06 per month after three free calls), but data analysis showed that churn was reduced by 70% among users. Although churn in rural markets is low (around 1%), Airtel perceived value in M'chikumbe in engendering loyalty.
Khushaal Zaminder (Telenor, Pakistan)	The service is free so does not generate any direct revenue. Word of mouth marketing reduces cost of acquisition. Capital costs were limited by using existing technology (Telenor and Planet Beyond). Indirect benefits were demonstrated, including a 3.5% increase in ARPU and 42% reduction in churn. It ran a successful advertising pilot for a B2B agribusiness customer, and plans to generate direct revenue this way.
Site Pyo (Ooredoo, Myanmar)	As a free service, Site Pyo does not generate direct revenue. It did, however, contribute to Ooredoo's increased reach into rural areas. It also yielded indirect benefits: ARPU increased by 14% and there was a 6% increase in data use.

Source: Authors' own

Several MNOs demonstrated the effectiveness of these products in increasing the stickiness of customers (reduced churn) and increasing rural revenue (higher ARPU). These metrics are key in multi-SIM markets where customers tend to swap SIMs between operators. It has been pointed out that churn tends to be low in rural areas, which is consistent with the finding that many rural communities have access to only one reliable network. VFC is unique in specifically targeting new rural customers not yet on any network, who will tend to generate low ARPU levels. The structure was also different in that the product bundled the value-added type of services with airtime, rather than offering a VAS (free or subscription) to encourage customers to keep the operator's SIM as their active SIM.

Changes to the business model and fee subscription rates allegedly left consumers confused about the product, which had an effect on levels of trust and adoption rates.

[40] The contract included a sliding scale of fees, meaning that Vodafone paid slightly less at higher volumes.

Govi Mithuru (Sri Lanka) and Krishi Sheba (Bangladesh) claim to be justified in financial terms (breakeven and payback period), whereas free/freemium services such as M'chikumbe (Malawi), Khushaal Zaminder (Pakistan), and Site Pyo (Myanmar) were justified in terms of indirect benefits (ARPU and churn). The successful piloting of advertising by Khushaal Zaminder illustrates potential for monetising a rural customer base, which may become more widely recognised in the future. Note that Ghana is the most urbanised of the countries (only 46% of the population is rural), and a relatively small proportion of the workforce is engaged in agriculture (42% – only Sri Lanka is lower at 39%; see Table 20), so the future potential for monetising an agricultural base may be greater in other countries.

F.3 mNutrition and capacity building

Even though Vodafone did not invest in procuring UX expertise, it highlighted the work of Cobalt and Frog as being of particular value. It said that since the development of VFC, it had contracted in this kind of expertise to assist with the development of other products. Dialog in Sri Lanka has built on the success of the Govi Mithuri product and is developing an app version. It is employing the same product development and UX research methodologies introduced under the mNutrition programme, using a mix of in-house and bought-in expertise. Telenor Pakistan went a step further in internalising techniques learned through mNutrition. After the product development team showed the CEO the UX process, the company set up a dedicated design studio following the layout of mNutrition processes.

The Advanced Analytics team within Telenor's Business Intelligence team successfully used innovative data-modelling techniques to devise improved marketing methods.[41] They took a sample of 50,000 Khushaal Zaminder users and a sample of 50,000 users from the mass market base (i.e. not Khushaal Zaminder users). They then explored a wealth of data available from caller records to identify a limited number of variables used in a model to predict whether a user would be signed up for the services or not signed up. These variables included details of voice, SMS, data, and VAS usage, engagement indicators (e.g. ARPU, churn), and type of handset. They then tested the model on a further sample of 20,000 users, split equally between Khushaal Zaminder users and non-users. Running the model on the mass base identified a further 1.1 million Telenor customers whose behaviour closely matched that of Khushaal Zaminder users. They then launched an OBD/SMS marketing campaign targeting these customers, and found the conversion rate improved from 1% to over 5%. This contrasts with the blast SMS campaign run by Vodafone, sent to the mass subscriber base as a whole, which was part of the marketing push to reach the target number of subscribers. Only after the KPI was reached did Vodafone begin analysing the VFC customer base to weed out ineligible customers.

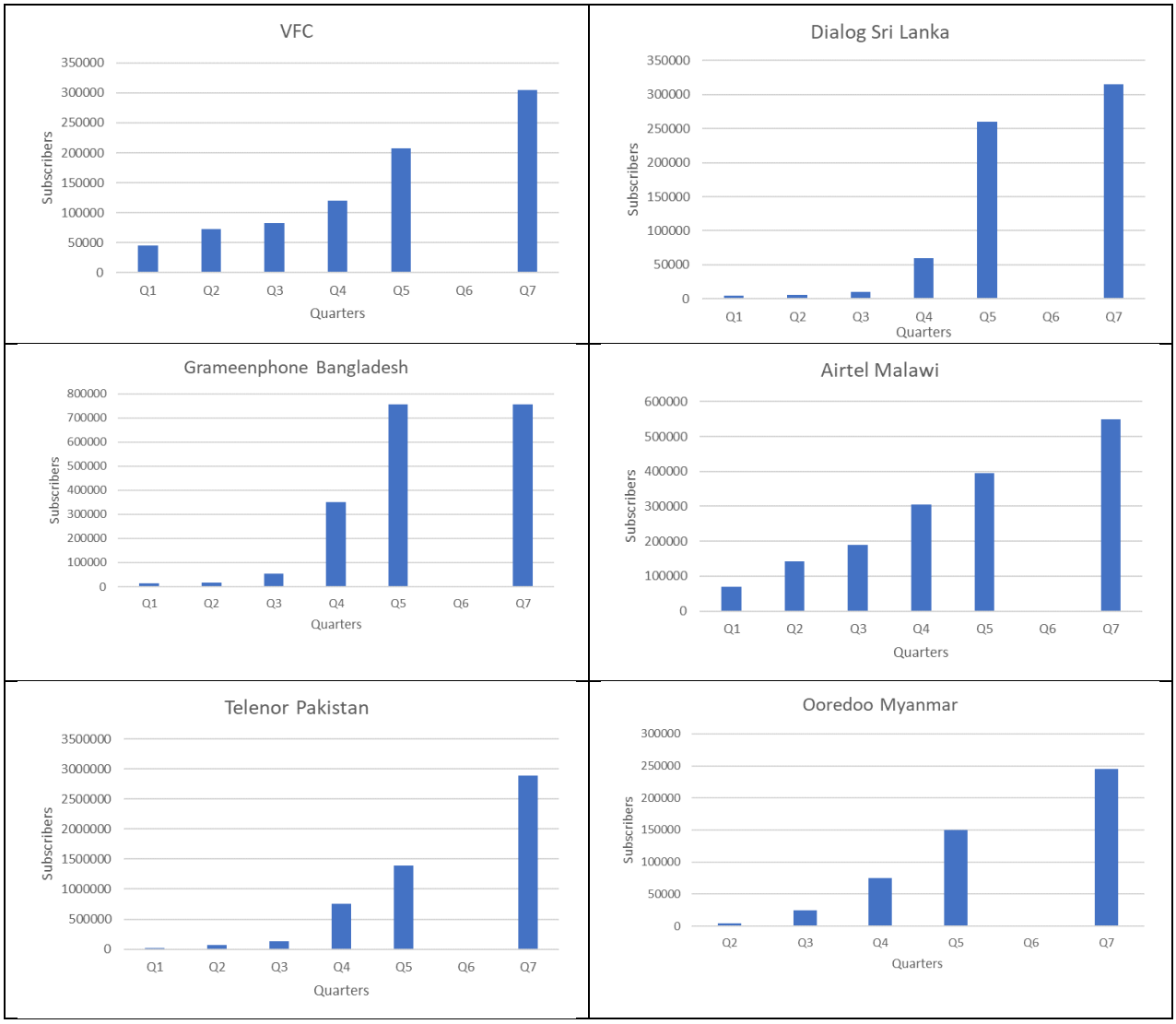
Almost all the products initially had difficulty with the registration and onboarding processes, especially around the profiling of farmers and their choice of crops, which tended to require multiple data entry. All the products, including VFC, went on to devise some form of single click registration that compromised the level of detail gathered. UX research conducted by other operators found that it was important for the pathway from registration to accessing data to be a short as possible. However, VFC had a two-step registration process (invisible to the user) whereby Vodafone passed details of registered customers to Esoko, who then entered them into the information dissemination platform. Customers could, therefore, wait up to seven days before seeing the kind of information they had paid for.

[41] www.gsma.com/mobilefordevelopment/country/pakistan/telenor-pakistan-uses-data-science-and-analytics-to-boost-mAgri-uptake/

F.4 Customer acquisition rates

GSMA reports (Palmer and Darabian, 2017a; 2017b; 2017c) show that, as at May 2017, the six agri VAS services supported under the mNutrition initiative had registered 5.1 million users. Subscriber growth trends for each of the separate projects have been disaggregated from their figures, and are presented in Figure 32. Of course, each product has its own development history, which may well explain the trends evident in the figures (e.g. changes in marketing strategy, product revisions and relaunches, etc.). In this section we look for similarities in the growth profiles of each of the products.

Figure 32: Subscriber growth trends



Source: Authors' own.

Although these data are far from complete, trends from Sri Lanka, Bangladesh, and Malawi in particular suggest that subscriber numbers initially grow exponentially, but once a certain threshold is reached (the point of discontinuity) growth continues but at a slower rate, closer to a straight-line profile.

Inspection of Figure 32 suggests that the point of discontinuity occurs at the end of quarter 5 (note that in the case of Ooredoor Myanmar, this represents only four quarters of growth). Exponential curves (represented by the following equation) give a reasonable fit to each of these periods of initial growth (see Figure 33 and Table 27):

$$N = e^{m.x}$$

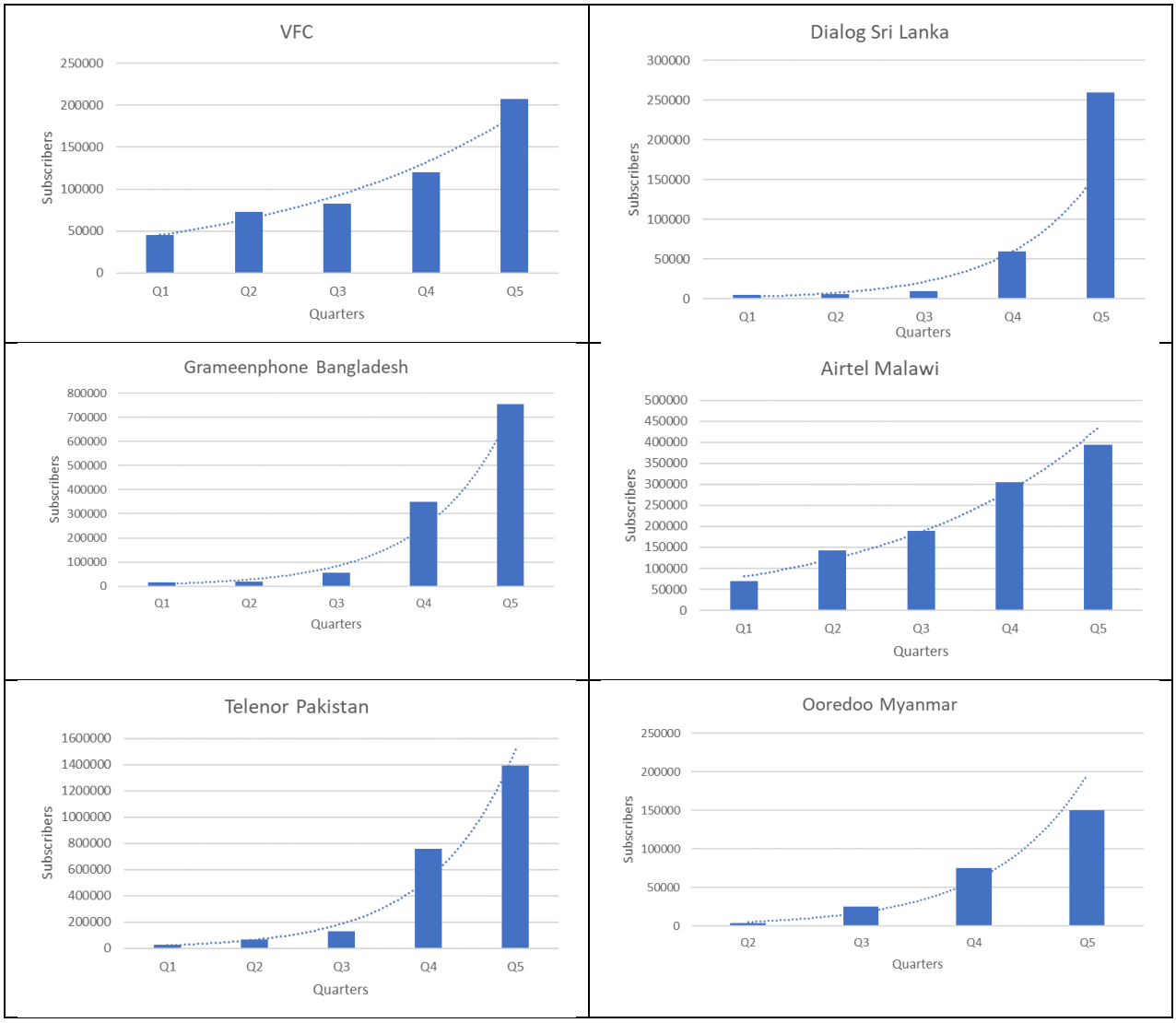
Where:

N = subscriber numbers

m = exponential coefficient

x = number of the quarter

Figure 33: Subscriber growth trends – rapid growth stage



Source: Authors' own.

Table 27: Exponential curve fit (initial growth period)

Product	Exponential coefficient (*m*)	Curve fit (R^2)
VFC, Ghana	0.36	0.97
Govi Mithuru, Dialog Sri Lanka	1.02	0.90
GP Krishi Sheba, GrameenPhone Bangladesh	1.08	0.94
M'chikumbe, Airtel Malawi	0.42	0.97
Khushaal Zamindar, Telenor Pakistan	1.05	0.97
Site Pyo, Ooredoo Myanmar	1.20	0.96

Source: Authors' own

This table shows that most projects grew at a similar rate (coefficient, *m*, of roughly 1.0), but two products grew at a much slower rate (VFC and M'chikumbe in Malawi) (coefficient, *m*, of roughly 0.4).

Only Khushaal Zaminder in Pakistan has come anywhere near reaching the estimated target market (see Table 20), so this is the only programme in which subscriber growth might be expected to be restricted by saturating the potential market.

Annex G Mobile services and motivation

G.1 The unwillingness to pay puzzle

One of the most compelling publications on the benefits of mAgri services is GSMA's synthesis of the six programmes supported through its mNutrition programming (Palmer and Tarabian, 2017a). This shows that not only did users of mAgri services access agricultural information through their mobile phone but, more importantly, they were more likely to adopt improved agricultural practices, something that was evident across all programmes. The numbers of subscribers attracted by some programmes is impressive, but especially so for the Khushhaal Zamindar service offered by Telenor Pakistan, which reported 2.9 million users, representing nearly half of the potential target market.

Although the VFC in Ghana reached nearly 250,000 subscribers by mid-2017 (Palmer and Tarabian, 2017a), numbers have since dropped off and appear to have settled at around 60,000.[42] This fall in numbers is ascribed to the reintroduction of a monthly subscription fee. Toward the end of 2016, the GHS 2 per month subscription fee was dropped as part of efforts to reach a target number of subscribers. Once this was achieved, a much-reduced fee of GHS 0.5 per month was introduced in mid-2017. It is interesting to note that the Pakistan services were offered free of charge to subscribers (Palmer and Tarabian, 2017b), being paid for (at least partly) by targeted advertising for commercial agricultural inputs companies and by providing extension services on behalf of the government.

The extent of the barrier that the modest fee of GHS 0.5 per month (US$ 0.1 per month) appears to present to farmers has puzzled Vodafone. Why are farmers so unwilling to pay for the service, even though the information provided is valuable, it offers free calls to other farmers, and discounted calls means that it represents one of the lowest cost SIMs on the market?

G.2 Behaviour change theory and VFC

It is proposed that the answer lies in motivation, and in behaviour change theory. Achieving changed behaviour is a complex process involving multiple actions and requiring people to adapt in different ways, usually over extended periods of time. Remember that at this point we are focused on the behaviour 'using an mAgri service', rather than on adopting any improved agricultural practices. Under the B2C subscription model employed by VFC, the decision to sign up (and to re-subscribe) lies entirely with the farmer him or herself.

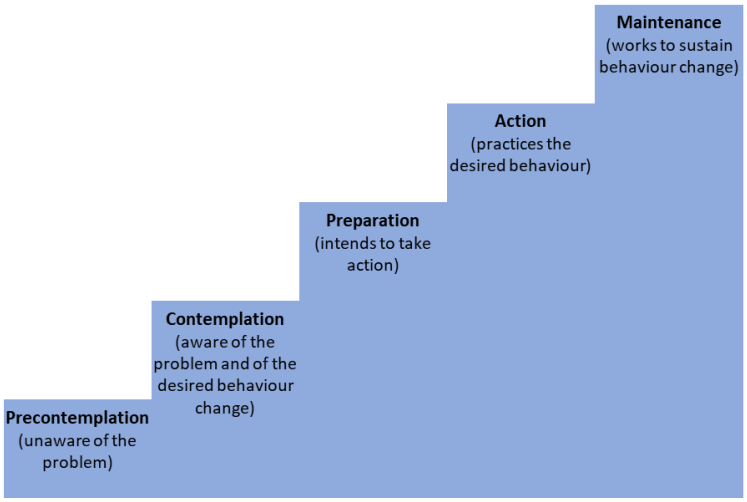
Progression through the trans-theoretical model (illustrated in Figure 34) provides a good starting point. This can be described as follows.

- At the first stage, 'pre-contemplation', people have no intention to change their behaviour, being either unmotivated or even resistant to change. This can be because they are uninformed about the consequences of their current behaviour (i.e. using traditional sources of information leading to no improvement in agricultural performance) or are unaware of emerging opportunities. This stage is typically characterised by acute awareness of the disadvantages of the behaviour in question (e.g. high costs) and an under-awareness of the benefits.
- At the second stage, 'contemplation', people have become more convinced of the benefits of change, and have adopted a positive intention to change their behaviour at some point in the future.

[42] Vodafone, personal communication (November 2018).

- In the 'preparation' stage, people are making plans to adopt a new behaviour, and may have already taken some significant action in the recent past.
- The 'action' stage refers to the time when people make observable changes to their behaviour; in this context, it would be to sign up to the VFC service.
- The 'maintenance' stage refers to the period of time during which people may be tempted to relapse back to their previous practices, i.e. not to re-subscribe to VFC.

Figure 34: Trans-theoretical model of behaviour change

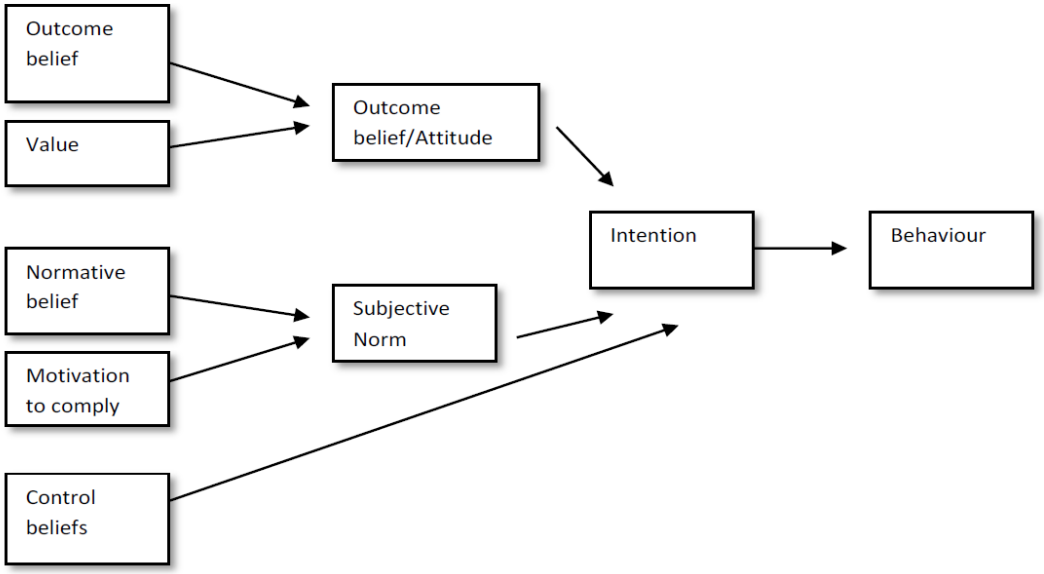


Source: Authors' own (from Prochaska and Velicer (1997))

All programmes must engage in some kind of promotional activity in order to inform their target markets of a new service; this is a prerequisite for progressing from the pre-contemplation stage. Marketing messages typically inform consumers of the benefits of the service (or the disadvantages of persisting with their current pattern of behaviour) and any costs (which may be interpreted as a disadvantage, or as an advantage if they are lower than the alternatives). Indeed, 'consciousness raising' is one of the processes of change needed to move people through the stages detailed above (Prochaska and Velicer, 1997).

Understanding the factors at work in driving intent to change behaviour (in the contemplation stage, and then more firmly established in the preparation stage) and factors that might prevent intent materialising in action (or actual changed behaviour) led to the Theory of Reasoned Action and its evolution into the Theory of Planned Behaviour (TPB) (and others) (Ajzen and Fishbein, 1980). The TPB model is based on beliefs held by individuals themselves (attitudes), the strength of subjective norms (the strength of social pressures on them), and the extent to which they may feel unable to carry out a behaviour (control beliefs) – represented in Figure 35.

Figure 35: The Theory of Planned Behaviour (TPB)



Source: Authors' own.

The theory focuses on the individual's intention to perform a given behaviour: 'The theory postulates that a person's intention to perform (or not perform) a behaviour is the immediate determinant of that action. Barring unforeseen event, people are expected to act in accordance with their intentions' (Ajzen, 1988). Intention is treated as a dependent variable, subject to the influence of two independent determinants:

- The 'attitudes' of the individual to the given behaviour, where an attitude is a combination of belief about the outcome of performing the behaviour, and the individual's assessment of the value of this outcome; and
- The 'subjective norm', which represents the individual's perception of social pressures on them to perform (or not perform) the behaviour. A subjective norm is a combination of the individual's belief about how a given social referent feels the individual should behave, combined with the individual's assessment of their motivation to comply with the social referent.

The TPB was developed to address one of the limitations of relying solely on intentions, which is that this is not good at predicting behaviours over which people do not have complete volitional control. The TPB therefore went on to include perceived behavioural control factors, which explore the influence of perceptions of factors that may facilitate or inhibit execution of a given behaviour. Perceived behavioural control factors may be considered as two types: the first relates to self-efficacy and perceptions regarding confidence in one's ability to execute a behaviour; the second relates to resources and perceptions regarding how difficult or easy it might be to execute a behaviour given the resources at one's disposal.

Only once a consumer is informed of a new service can s/he form beliefs relating to likely outcomes associated with using the service. If, at that point, intent to adopt the behaviour remains weak, then in order to change behaviour it is necessary to change either attitudes or subjective norms (or perceived control beliefs) by changing the underlying beliefs.

VFC is sold to individual farmers, so intention to sign up is determined by outcome beliefs held by the farmer, by social pressures on the farmer to sign up, and by any beliefs held by the farmer that s/he simply cannot do it (perceived control beliefs). For the purposes of illustration, the following beliefs can be inferred from findings from qualitative research carried out with VFC users (Barnett *et al*., 2018):

Outcome beliefs:

- VFC will teach me more about farming
- I will increase yields with VFC
- Information on the correct use of fertilisers / pest control will reduce costs
- Weather information will reduce crop losses
- VFC will provide material support and credit
- The cost of following VFC advice will outweigh the benefits

Subjective norms:

- Extension agents would approve of my using VFC
- Members of my family would approve of my using VFC
- Other farmers (local) would approve of my using VFC

Perceived behaviour control:

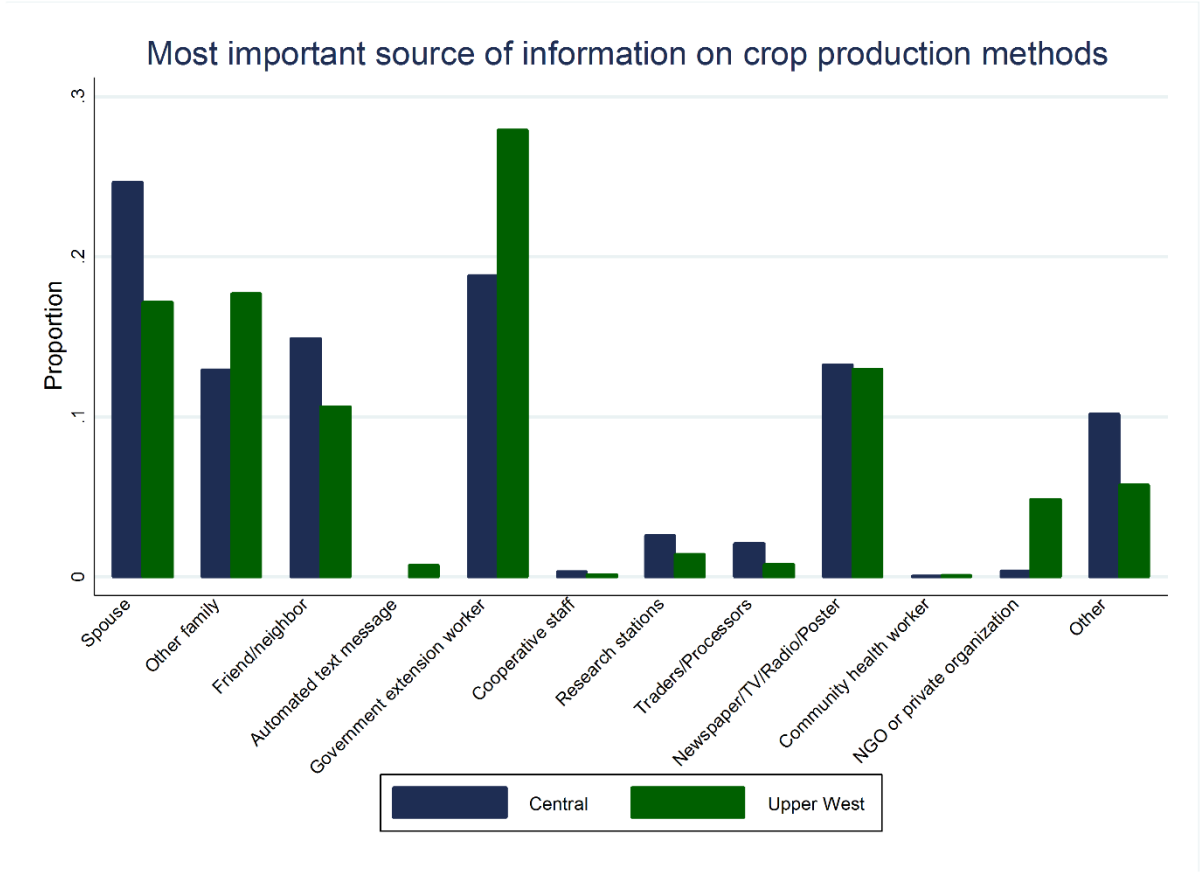
- I can't read (so I won't be able to understand any information)
- There is no Vodafone signal where I live / work
- I won't be able to get it to work (e.g. I can't read, I won't be able to activate the SIM, I don't have a phone, etc.)

Note that outcome beliefs can be both positive (behaviour leads to beneficial outcomes) or negative (behaviour leads to detrimental outcomes), and they can even be false:

> *Beliefs reflect the information people have in relation to the performance of a given behaviour, but this information is often inaccurate and incomplete; it may rest on faulty or irrational premises, be biased by self-serving motives, by fear, anger and other emotions, or otherwise fail to reflect reality.* (Ajzen, 2011).

Subjective norms represent social pressure exerted on the farmer by people they respect (key social referents). The qualitative research has identified social referents commonly regarded as influential in agricultural practice, notably extension agents, but also wider social networks of family, friends, and other farmers. These referents are clearly mirrored in findings from the quantitative research (Billings *et al*., 2017), which identified sources of agricultural information (see Figure 36).

Figure 36: Source of information on crop production, by region



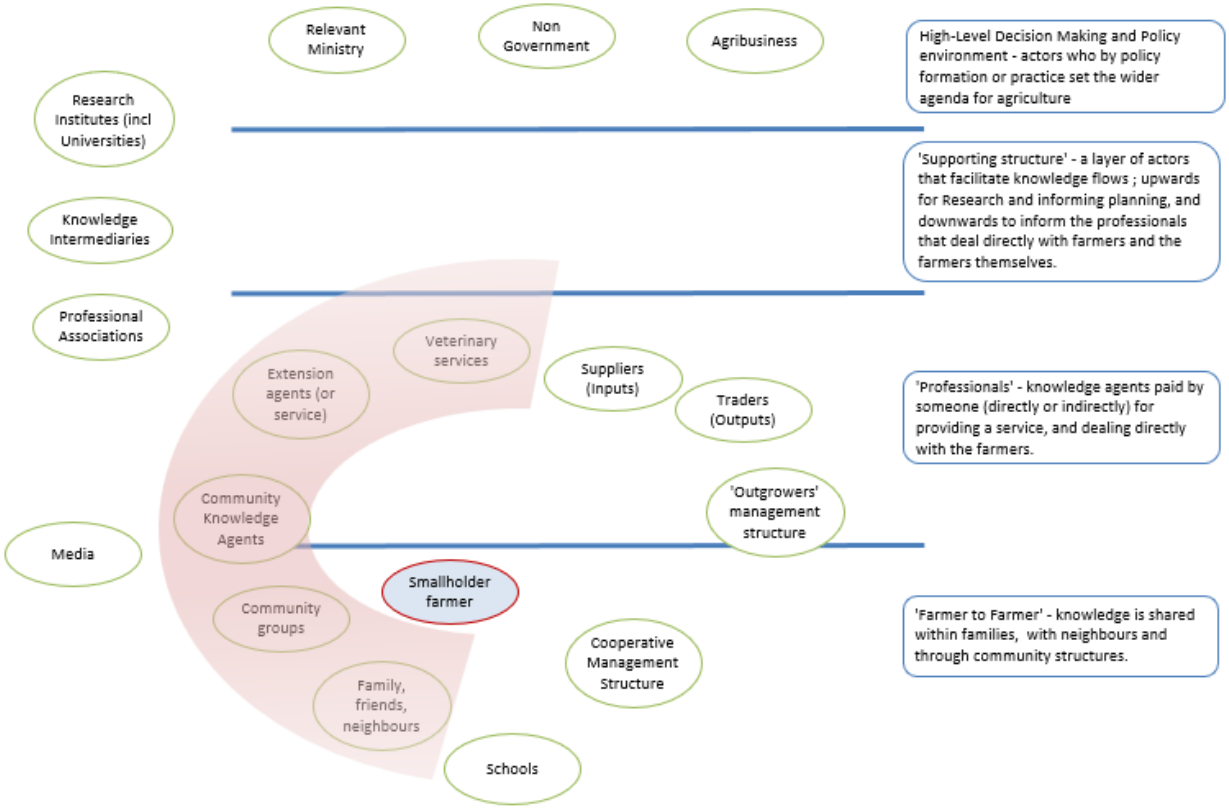
Source: Billings *et al.,* (2017).

When considering the role of mobile phones in agriculture, Batchelor *et al*., (2014) also found that face-to-face contact with extension workers and peer farmers was crucial to the uptake of innovative practice, and proposed an actor-centric model for agricultural information exchange (see Figure 37). The positioning of actors on the diagram represents their distance from a small-scale farmer, and actors have been distributed among four layers:

- high-level political economy;
- supporting structure;
- professional input into farmer exchanges; and
- farmer-to-farmer engagement.

Those actors commonly cited as sources of information are highlighted in Figure 37.

Figure 37: Actor-centric model – highlighting social referents



Source: Batchelor *et al*., (2014).

At this point, several attitudinal features lead to weak intention to sign up to VFC:

- poor understanding of the potential benefits of using VFC;
- misunderstanding of what VFC is and what it provides;
- a lack of trust in VFC (both in the services to be provided and in the value of services, e.g. accuracy of weather information); and
- weak subjective norms – none of the extension agents interviewed in the qualitative research were aware of VFC (Barnett *et al*., 2018), so farmers could not feel any social pressure from extension agents to use the service.

Remember that at the pre-contemplation stage of the trans-theoretical model, people tend to be more acutely aware of disadvantages, i.e. negative outcome beliefs and perceived behavioural control beliefs in TPB terminology.

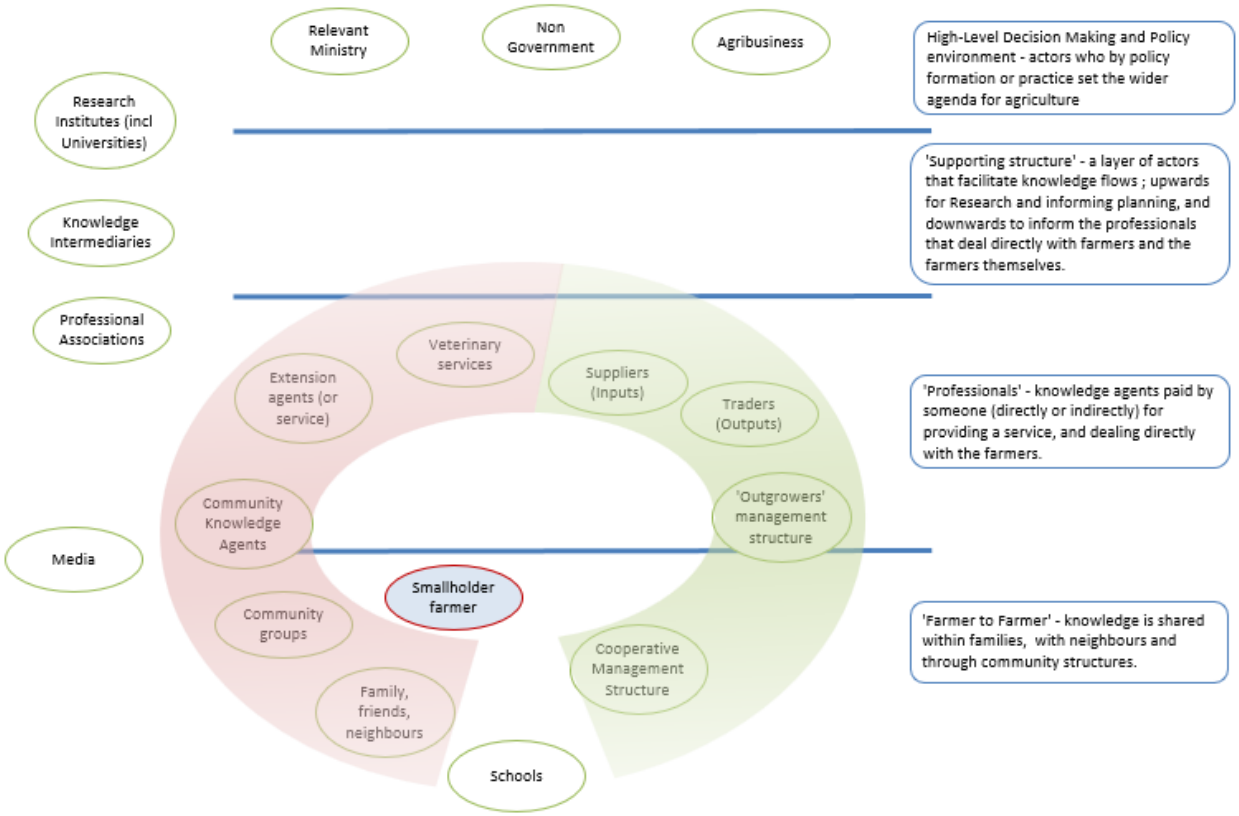
G.3 An emerging model

A number of Ghanaian companies are now offering a range of ICT-based services to clients, mostly agribusinesses and large-scale farmers, such as mapping of farms, profiling of farmers, monitoring, aggregating demand (both for agricultural inputs and for produce), facilitating transactions, and enabling access to finance. In this type of B2B business model, the service provider typically enters into an agreement with an agricultural input supplier or off-taker that wishes to engage with a defined target group of farmers. Agricultural information is usually disseminated as part of a wider package of services. For example, an inputs supplier will want farmers to be familiar with seed varieties and to know how to use fertilisers and pesticides, and off-takers will want their suppliers (smallholder farmers) to adopt best farming practices in order to increase the quality of produce and yields.

In most agreements to date, noting that many of these schemes are still pilots, it appears that the clients tend to pay for a package of services that includes information dissemination. Even though the partner institution may pay for the service, the farmer still has to sign up for the service to receive information and messages via his or her mobile phone. Aside from the cost implications, this model would appear to have several benefits from the point of view of a behavioural change theory.

The key advantage is that it increases the locus of social referents relevant to the farmer's decision to adopt the mobile service – see Figure 38.

Figure 38: Actor-centric model – highlighting an extended circle of social referents



Source: Authors' own.

This has the potential to affect each of the psychological aspects represented in the TPB in a way that strengthens intention.

Outcome beliefs:

> If agribusiness (or a government ministry) at the high-level decision making layer can feed policy down to the layer of the professional, who come into face-to-face contact with the farmer, then farmers will have somebody to talk to about the service, making them better informed. A key finding from the qualitative research was that personal contact was an important factor in building trust in the VFC service, so having a local 'face' would enhance trust.
>
> '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' (Barnet *et al*., 2017). Emerging services are responding to needs such as this, and are providing more complex products, often based on financial services (recall that Vodafone

Cash was only introduced in Ghana in December 2015).[43] By promising to meet perceived needs, such services may attract farmers to sign up, even in the absence of local contacts (i.e. they create strongly positive outcome attitudes).

Subjective norms:

There are two elements to the TPB construct: normative belief (e.g. [social referent] would approve/disapprove of my executing the behaviour) and motivation to comply (e.g. how much to you want to do what [social referent] thinks you should do?). Although by no means a TPB study, the qualitative research suggests that farmers hold extension workers in high regard, so it is likely that motivation to comply with extension workers would be high. Friends, relatives, and peer farmers are also highlighted as key social referents, with whom a farmer is likely to have a high motivation to comply. However, given the current penetration levels of VFC, few will even be aware of VFC, so the normative belief will be weak (how can a spouse approve of signing up for VFC if s/he has never heard of it?).

Extending the social referents strengthens intent in two ways. First, if the farmer enters into some kind of relationship with agribusiness (e.g. accessing credit to buy fertiliser), then the number of relevant social referents increases. The farmer is no longer working on his or her own, but becomes accountable to a third party (in some small way). The extent of this accountability then influences the strength of the farmer's motivation to comply with this social referent.

Perceived behaviour control:

There is little anyone can do about network signals, but knowing that a local trader uses a mobile service may be enough to encourage a farmer to try it. This may be enough to dispel the belief that it does not work. Knowing someone in the agribusiness value chain who can provide assistance may help overcome illiteracy restrictions.

The current models are based on business paying, but if extending the social referents into agribusiness actors can be proven to strengthen intent sufficiently, it may even be possible to share revenue generation by charging farmers directly (as in the current VFC model).

G.4 Motivation

The discussion up to this point has focused on the farmer as an individual and how s/he might progress to the action stage of signing up for an agricultural information service. An emerging set of agricultural services are incorporating additional actors from the value chain, notably agribusiness and finance. Not only do they change the behaviour change dynamics as described above, but they also tend to distribute risks and benefits.

Under the VFC model, all the risk associated with making a subscription and with implementing any change in agricultural practice is taken by the individual farmer. In the same way, all the benefits realised from any change in practice are enjoyed by the farmer. The motivation for a farmer to sign up rests with the farmer (and the service provider).

When a third party is integrated into the model, then costs, risks, and benefits tend to become shared. For example, agricultural inputs supplied on credit may pose a risk to the supplier and/or a finance company underwriting the scheme. A good harvest means that increased revenues are shared between all parties. The motivation for a farmer to enrol in the scheme is shared between

[43] https://www.vodafone.com/news-and-media/vodafone-group-releases/news/mpesa-ghana

the service provider, agribusiness partners, and the farmer. By lowering perceived risk barriers (outcome attitudes), engaging farmers in a relationship (subjective norms), and endorsing a service (perceived behavioural control beliefs), agribusiness actors can ease the progress of farmers to the action stage of signing up for mAgri services.

Annex H Reflections on the evaluation methodology

H.1 Distance of stakeholder relationships

The mNutrition programme has engaged an ambitious range of institutional stakeholders. The differing types of relationship within the programme have resulted in differing degrees of 'engagement', which has had implications for the evaluation study.

For instance, within the programme of work, content partners such as CABI were engaged on a conventional contractual basis to deliver materials required. In contrast, mAgri implementing partners (i.e. MNOs) were awarded grants. The definition of a grant is that payment is not tied to specific deliverables, although the grantor (GSMA) has the right to know that the money is indeed being spent as intended and agreed. This can lead to grey areas in terms of the MNOs' obligations to GSMA. For example, grantees were requested to complete a standard financial report drafted by GSMA, rather than submit separate accounts (which would have been unnecessarily onerous). However, Vodafone struggled to complete these reports comprehensively because they did not align with its internal financial processes.

The nature of these partnership arrangements means that implementing partners have limited and varied accountability to GSMA. Consequently, while GSMA offered to broker relationships and the exchange of information between implementors and researchers, it is not necessarily in a position to enforce compliance.

Due to the dynamic nature of the industry, implementing partnerships are also continually changing and may introduce new partners into the mix that have even less of an obligation to the mNutrition project. For example, in addition to VFC, Vodafone offered products in partnership with Viamo and Farmerline. Discussions on revising VFC centred on creating a more comprehensive package of financial and transactional services, and on consolidating the rural customer base. Even though the ideas were not pursued, a resulting product could have replaced Esoko with a competitor as content provider. In this scenario, the content provider would then have had no contact with, and not benefited from, the mNutrition programme.

The relationship of the independent study team to the rest of the mNutrition project was not clear to implementing partners, while GSMA fully understood the relationship and made every effort to assist the independent study. However, implementing partners have often been confused about the status of the OPM team and its independence from GSMA, especially when the core programme has also included a range of M&E activities (run by another set of institutions). This has required extra effort in building trust, and has led to uncertainty over access to sensitive information.

H.2 Timescales

Any highly rigorous approach involving research into behaviour change takes a long time. Timescales are expanded still further when the behaviours relate to agriculture, which involves annual cycles. In contrast, long timescales are incompatible with ICT-based projects for a number of reasons:

- Short-term operating horizons: Within the telecoms industry, the time for a VAS to become profitable is measured in months, not years (e.g. time for a VAS to recover customer acquisition costs should be less than 12 months). Formative evaluation needs a tight feedback loop to inform product design and implementation.

- Products are rapidly upgraded: Product development has to be agile to fit short-term horizons, and technology means changes can be made at low cost. Therefore, independent UX and qualitative research are of immediate value (formative); long-term experimental studies measure average impact.
- Rapid staff turnover (particularly within MNOs): This means evaluation requires continual effort in relationship building.
- Short-term institutional memory (particularly within MNOs): For example, Vodafone keep call data for only three months, while the VFC financial officer moved on after the end of the project. An evaluation that documents relationships, partnerships, and product development can add value.

H.3 Multiple projects

The mNutrition project has spread resources over a large number of countries and implementing projects. To conduct a rigorous study of all projects would be prohibitively expensive, so two projects have been selected. The VFC project cannot be regarded as representative of all of the mAgri projects supported under the mNutrition programme.

The project selection was made on the basis of a steer from GSMA, along with a collaborative preliminary assessment of the projects. This considered the information available at the inception phase, including the maturity of product development discussions, indications of engagement from implementing partners, marketing approaches, and the strength of partners. For example, there was strong initial interest in the Malawi mHealth project with Airtel, but contractual negotiations dragged on, so the decision was taken to adopt the Tanzania project instead. As it happened, a subsequent change of CEO at Airtel in Malawi meant that arrangements were actually concluded quickly and GSMA state that now Malawi is one of its stronger implementations.

The ‘crystal ball gazing’ involved in project selection is an area of weakness. For example, while VFC appeared to be a good choice because it was one of the earlier projects to roll out, GSMA is now of the opinion that it is not one of the better implemented projects.

The compromise inherent in focusing efforts on the rigorous study of one or two projects means that the ability to compare and contrast experiences and performance across all projects in the portfolio is lost. GSMA implemented a monitoring, evaluation, and learning system that has resulted in a set of comparative case studies, all of which have been published. These studies are based on internal M&E data, different to that gathered by the independent evaluation. The independent evaluation was intended to be a rigorous impact evaluation for deeper learning. The dilemma, then, is that a study comparing multiple projects would be better able to identify ‘critical success’ factors, whereas focusing on a single project is appropriate to study impact in detail.

Annex I Terms of reference

Call-down Contract

Terms of Reference

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

Introduction

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

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

Mobile phone based services have been endorsed by WHO as an effective strategy for behaviour change and for driving adherence to anti-retroviral treatment 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 percent 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 subcontract 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 outputs[44]**:**

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;
- 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.

[44] Exact timeframe of deliverables will be agreed on during the design phase as appropriate.

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 out 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.