Tigo Kilimo

Impact Evaluation

SEPTEMBER 2015

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Executive Summary

Tigo Kilimo is an agricultural value added service (Agri VAS) provided by mobile network operator Tigo in Tanzania. The service offers information for farmers via mobile phone and can be accessed via four mobile channels: Unstructured Supplementary Service Data (USSD), push SMS subscription, Interactive Voice Response (IVR) and a helpline. Tigo Kilimo provides agronomic tips on ten major crops (maize, rice, Irish potato, cassava, onions, banana, citrus, sweet potato, tomato and cashew); market price information on the above mentioned crops for main markets; and 1, 3, and 5 day weather forecasts available for 26 regions of the country. This service was launched in December 2012 and as of December 2014 Tigo Kilimo had almost 400,000 registered users.

Key findings

Repeat users of Tigo Kilimo service are 30% more likely to be growing new crops, using new seeds or new agricultural practices and consequently 39% more likely to report increased income in a given year than those who do not use the service. This is due mostly to their increased use of new crops, often vegetables, which are sold at higher prices than staple crops. Farmers who grew new crops were 60% more likely to report increased income than farmers who did not.

Repeat users are 30% more likely than non-users to be growing new crops or using new seed scattering or land preparation techniques. This is after matching farmers in both user groups according to education, age, location and gender.

Repeat users were however no more likely than non-users to report using new fertilisers, pest control or storage techniques. This may be because these changes require financial investment from farmers.

Users of Tigo Kilimo are largely either young, educated men with several alternative information sources or young women with few alternative information sources. Most of the users (63%) are men and the majority of the user base (69%) are aged under 25 years old. Women and older men who sign up are likely to then become the most frequent users ("Repeat users"), however barriers in service design stop them from registering in the first place.

The farmers most in need of agricultural information are women, uneducated farmers and those with small farms. These users have less access to other sources of information. Users with small farms tend to be pessimistic about farming, less likely to seek information and less able to afford a mobile phone. Women and uneducated farmers face barriers to service adoption due to gender norms and illiteracy.

Farmer attitude determines who joins Tigo Kilimo. Farmers who register for Tigo Kilimo are more positive about farming than most farmers. These farmers actively look for help from sources beyond their network of fellow farmers, extension agents, and agri-businesses; such other sources can include Tigo Kilimo. However, other issues such as gender, age and farm size seem to influence how much they use the service.

61% of all users who access content return to the service becoming repeat users. This is a strong result for the service; the majority of users who reach content see enough value to return. **Using Tigo Kilimo alone is as associated with behaviour change as using any other sole source of information.** Using Tigo Kilimo as a secondary source seems to result in more behaviour change than using any other secondary source.

Having a secondary source of information is correlated with behaviour change, whatever the source of that information.

Access to market information does not necessarily result in farmers' ability to secure better prices, however it influences their decisions about which crops to grow. Repeat users are using market price information to bargain with traders but only if they are wealthy. Traders are often using fixed prices which means that the bargaining is not always successful. Repeat users with less than five acres of land were much less likely to report bargaining with traders than those with larger farms. Repeat users who reported bargaining with traders were no more likely than other repeat users to report increased sale price. There is however a positive impact of this information, as farmers diversify their production and start growing different crops in response to information about market prices.

Users are sharing Tigo Kilimo information if they have used it on their farms. Repeat users who have changed farming practices are more likely to share Tigo Kilimo advice with other farmers than those who have not changed behaviour. This expands the impact of the service as well as bringing new users.

Sustainability of Tigo Kilimo Business Model is still too early to ascertain, however based on qualitative research there is an evidence of increased trust in Tigo's brand among users of the service.

Key recommendations for increasing impact of Agri VAS

To maximise the impact of this service, marketing, service design, content and pricing strategy should be inclusive of women and poor farmers. These users have the greatest need for new information sources. Tailoring content to women and offering some of the voice content for free could help reach these farmers. Using more face-to-face marketing may also help to engage this market segment.

Marketing through other agricultural information services and incentivising users to recruit other farmers to the service could increase uptake. Users tend to organically share Tigo Kilimo advice with other farmers, which could be leveraged for an incentivised ambassador programme.

To fully reach the potential impact of the service it is important to consider that there are barriers to behaviour change, in particular access to finance. **Removal of financial barriers should be considered to enable more farmers to act on the information that the service is providing.** This could be achieved by linking the service to mobile savings, offering inputs discounts to users or providing more advice that is cheap or free to act on, e.g. organic practices.

Service uptake and usage

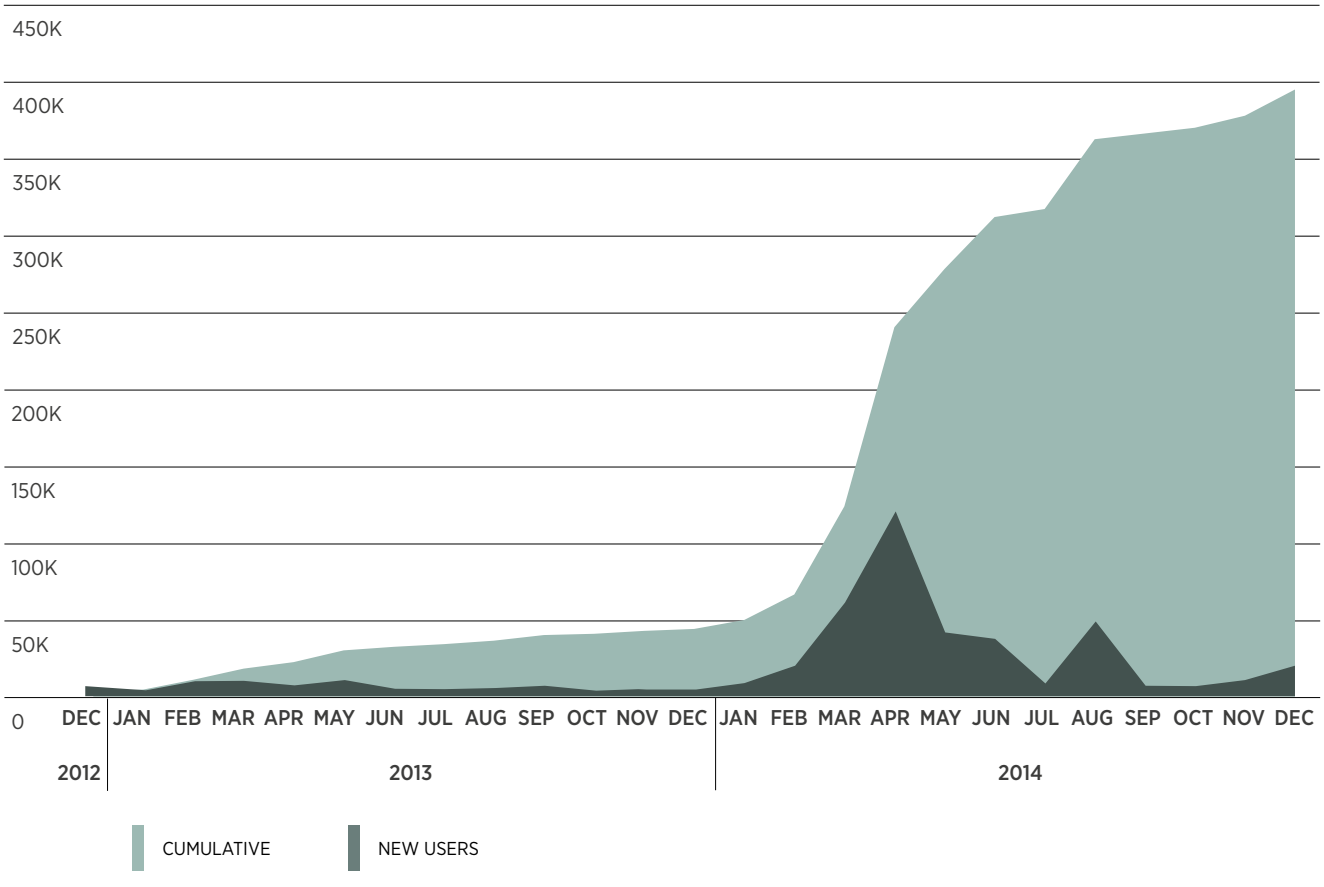
Tigo Kilimo has been gradually gaining popularity, with 398,384 users registered for the service by the end of December 2014. This figure represents 8% of the total number of unique Tigo subscribers in Tanzania at this time.[1] However, only 5% of these users were active during December 2014, representing 0.4% of the Tigo customer base.

Most users were acquired in March – April 2014 during an SMS blast campaign publicising the reduced cost of the text-based service after February 2014. Tigo provides the service for free on text channels in order to increase loyalty of customer base and increase market share in rural areas.

New users on the service dropped between September and November 2014, but began to pick up again in the last month of study.

FIGURE 1

ACQUISITIONS TO TIGO KILIMO FROM LAUNCH TO DECEMBER 2014



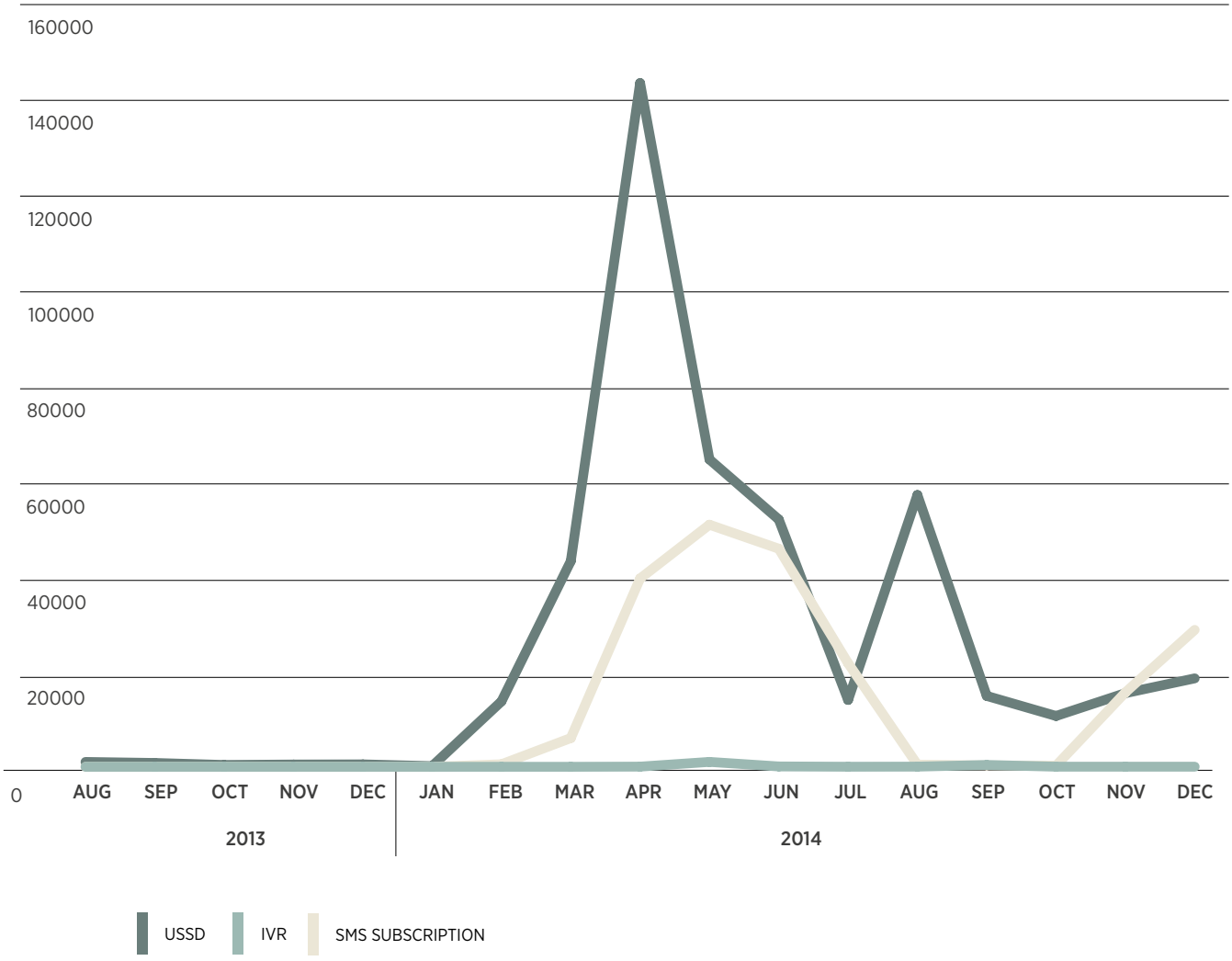
SOURCE: TIGO KILIMO TRANSACTIONAL DATA

1. Calculated from GSMA Intelligence data: number of Tigo Kilimo users/(unique subscriber population * Tigo market share Q1 2015)

The USSD pull channel has been the most popular delivery channel, however subscription SMS started to take over towards the end of 2014 (Figure 2). The dip in successful SMS delivery from August to October 2014 was due to a service side technical issue which has now been rectified.

FIGURE 2

MESSAGES DELIVERED VIA THREE MAIN CHANNELS



SOURCE: TIGO KILIMO TRANSACTIONAL DATA.

The IVR channel remains underused with an average of less than 250 accesses per month. This is partly due to Tigo Kilimo's pricing structure; SMS and USSD are provided free of charge while IVR is charged at 50 TZS (0.03 USD) per access. It should be considered that IVR channel wasn't widely publicised and is only available to those who have registered for the service via USSD. In addition, a certain level of social familiarity with SMS and ability to store the information for later reference make text-based channels more convenient for the end user.

Also available since May 2014 is the Tigo Kilimo helpline charged at 6 TZS (0.004 USD)/second. This channel seems to have gained very little traction mainly due to lack of marketing of the channel. In the five months after its launch in May 2014, the helpline received 109 complete calls from 93 users. During the same period, almost twice as many calls (172) failed due to either technical (poor network, dropped calls) or user-side (low balance, hanging up) issues.

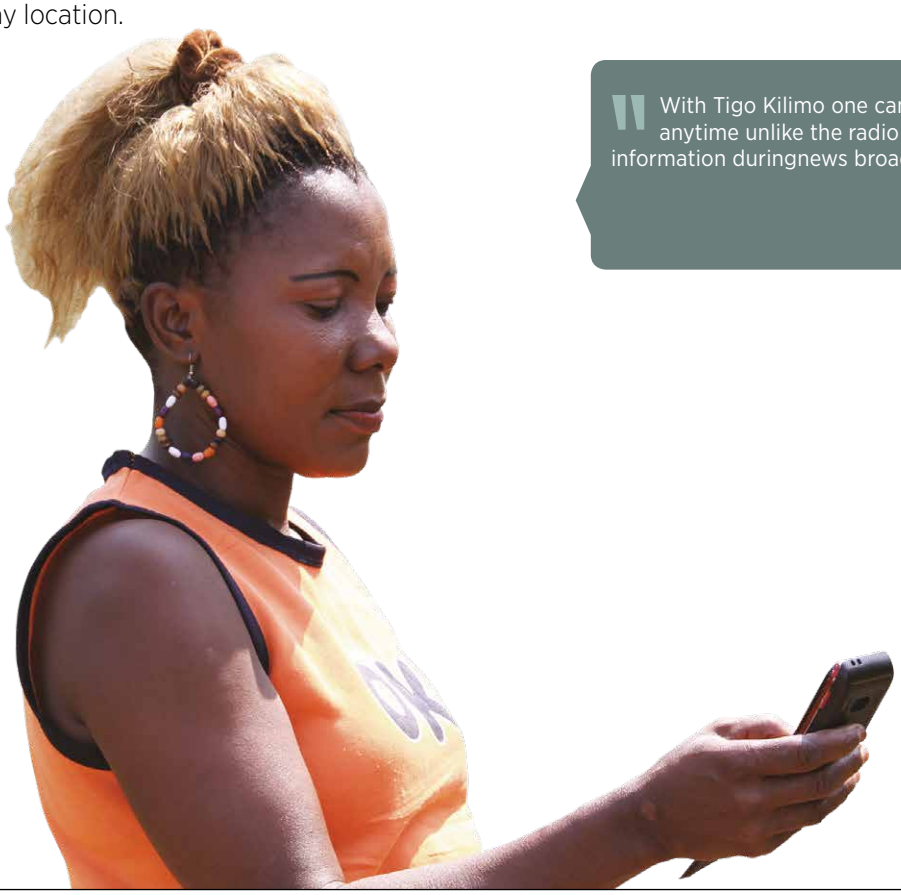
Users are accessing the weather service most frequently, with market and agronomic information being equally popular. Weather information is the most dynamic on the service, changing almost every day, which explains why it generates more repeat use.

When it comes to information on a particular crop, information on maize is by far the most popular on Tigo Kilimo, accounting for 41% of all accesses, followed by rice, which accounted for 24% of user accesses.[2] Information requested on staple crops was mostly to seek market prices, while accesses to less commonly grown crops like cassava were more likely to be for agronomic information. This may indicate farmers seeking price information for crops they can already grow and growing advice for crops they haven't grown before.

Repeat users in the field research said they preferred the service to other sources of information, describing Tigo Kilimo as "reliable" and "accurate".

> "Tigo Kilimo is more accurate than the other sources of weather forecasts."
>
> *Treatment, Joseph, Morogoro, 41 Male*

Through the fieldwork, repeat users reported that the decision to search for particular type of information depends on the task at hand. Farmers reported that Tigo Kilimo was useful because it was available at any time and in any location.



> "With Tigo Kilimo one can get weather forecast anytime unlike the radio where one can only get that information duringnews broadcasting hours."
>
> *Haruni, Magengeni, Kilosa district*

2. Source: Transactional data of all users from service launch to December 2014

The customer journey

The customer journey illustrates how a user's interaction with a service progresses through a series of steps, from becoming aware of the service, through registering, subscribing and trying the service to repeat usage. Customers may get 'stuck' at each stage of the customer journey due to different barriers that at the same time represent areas for service improvement.

- Subscription service users receiving push messages also use the pull channels; subscription provides a consistent reminder and touch point with the service and should be promoted.

- Reminders of the basic steps to access the service including the number to dial and the costs should be sent to the user following signup or following a period of absence from the service. Repeat users access the service after registering on average twice as fast as trial users, which may suggest that the first few of these reminders should occur soon after registration.

- Weather forecasts are the most dynamic content on the service and the most accessed information by repeat users. This service feature should be marketed as a key use-case to encourage repeat use.

- The median age of registered users is 25-40 while the majority of users who access content (trial and repeat users) are under 25. Age is a barrier to service uptake, a finding that has been echoed in South Asian markets.[3] At the same time the young farmers represent the next generation of users and should be treated as early adopters of the service, those who are to become repeat users and facilitate the trickle-down effect.

61% of all users who access content return to the service, becoming repeat users. This is a strong result for the service; the majority of users who reach content see enough value to return. The following sections investigate those who overcome bottlenecks to benefit from the service.

IMAGE COURTESY OF GSMA

3. http://www.telenor.com/media/articles/2015/the-unconnected-senior-citizens-of-asia/

Tigo Kilimo Impact Evaluation

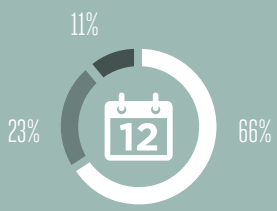
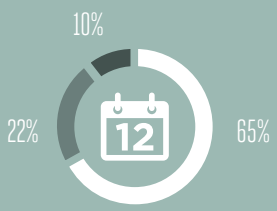
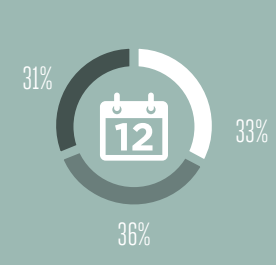
This evaluation looks at the differences in behaviour change between repeat users of the service and those registered users who have never accessed the content.

Repeat users approached for the impact evaluation study have accessed the service at least twice over the course of at least four months, and at least once within the last two months. This segment was chosen for this impact evaluation as, by having accessed the service several times, they can be considered fully exposed to the service. The fact that these users have accessed the service recently means that they are more likely to remember how they used it in both quantitative and qualitative interviews. Users who had been using the service for a significant period were targeted in order to allow time for behaviour change to occur.

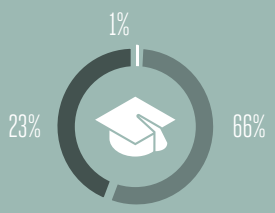
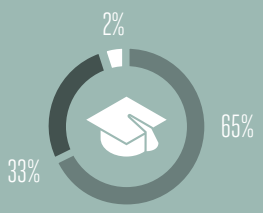
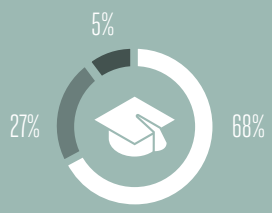
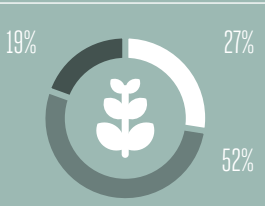
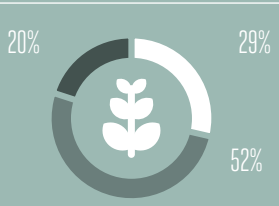
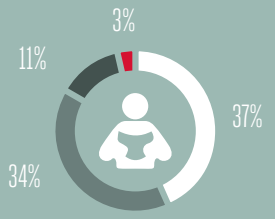
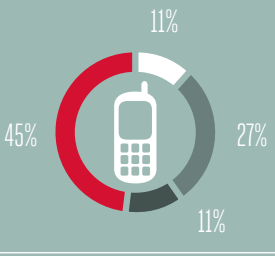
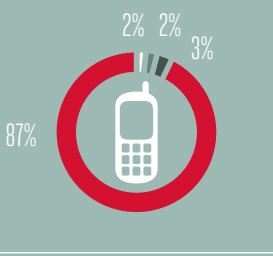
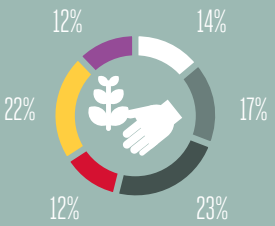
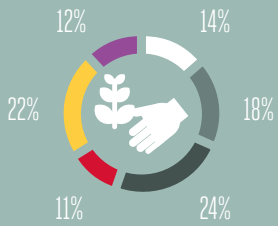
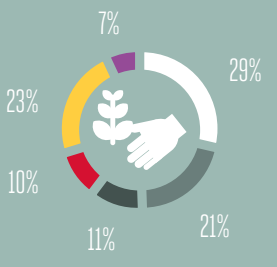
Non-users were chosen as a comparison group as they were more likely to have similar profiles to repeat users, as farmers signing up to use the service differ from average farmers (Table 1). Having not accessed the service at all makes them unexposed to Tigo Kilimo information. By matching similar farmers using the Propensity Score Matching method (outlined in the Methodology) based on gender, education, age and location and comparing outcomes, it was possible to gain a measure of service impact, with differences in outcomes between repeat users and non-users attributed to the service.

TABLE 1

COMPARING PROFILE OF TREATMENT, CONTROL AND MARKET AVERAGE

	REPEAT USERS (TREATMENT)	NON-USERS (CONTROL)	RURAL POPULATION[4]
PROFILE **SEX**[5] FEMALE			
AGE <25 25-40 >40			

4. Based on Census 2012 data (http://www.nbs.go.tz/) for rural population unless otherwise stated
5. Sex and age data from Tigo Kilimo user registration logs

	REPEAT USERS (TREATMENT)	NON-USERS (CONTROL)	RURAL POPULATION[4]
PROFILE **EDUCATION[6]** NO EDUCATION PRIMARY SECONDARY OR ABOVE			
FARM SIZE[7] < 2 ACRES 2-5 ACRES > 5 ACRES			Average size 2-7 acres
MOST IMPORTANT INFORMATION SOURCES[8] EXTENSION TIGO KILIMO OTHER FARMERS NONE			
SECONDARY INFORMATION SOURCE EXTENSION TIGO KILIMO OTHER FARMERS NONE			
ATTITUDE TO FARMING[9] TRADITIONALISTS TRAPPED CONTENTED DEPENDENTS FRUSTRATED ESCAPISTS COMPETENT OPTIMISTS INDEPENDENTS Increased likelihood to change behaviour			

SOURCE: VARIOUS

6. Rural population data not available; total population data provided from Tanzania census 2012 (as above).
7. Population data from http://www.yieldgap.org/tanzania
8. Other information sources referenced were Agro dealer (<10% of both groups), Media (<5% of both groups) and Other (<10% of both groups). "Other mobile service" was stated by 0% of both groups.
9. See Methodology for descriptions of these attitude types
10. Weighted average data from Tanga and Morogoro regions; Listening to the Farmer Voice, Bill and Melinda Gates Foundation (2011); see Methodology

In 2006, 80% of employed women were working in agriculture, making women an important segment for Tigo Kilimo to capture. However women are less likely to register for the service than men. Female users also tend to be poorer; a sampled woman user is 41% more likely to own less than 2 acres and 23% less likely to have a secondary level education than a man. In spite of this disadvantage, the average woman who signs up to Tigo Kilimo is 13% more likely to become a repeat user than the average man. Women report less access to agricultural information; women in a phone survey were 47% more likely to rely on other farmers for advice than men, while men report having access to government extension workers and NGOs.

While distribution between age bands is fairly even in the target population, there is a very strong skew to the younger segment in the treatment group. However, older users are more likely to use the service more regularly. This reflects additional barriers faced by older users in both phone ownership and registering for Agri VAS.

People with no formal education are strongly under-represented in both treatment and control groups. Repeat users are even better educated than non-users; almost half of them have attended some level of secondary schooling. This suggests that Tigo Kilimo is not reaching the least served segments of Tanzanian society. This is partially because both the marketing for the service and the free channels are text based, thereby excluding illiterate potential users.

Most users have average sized farms compared to the population; there are no significant differences between the treatment and control groups in terms of farm size.

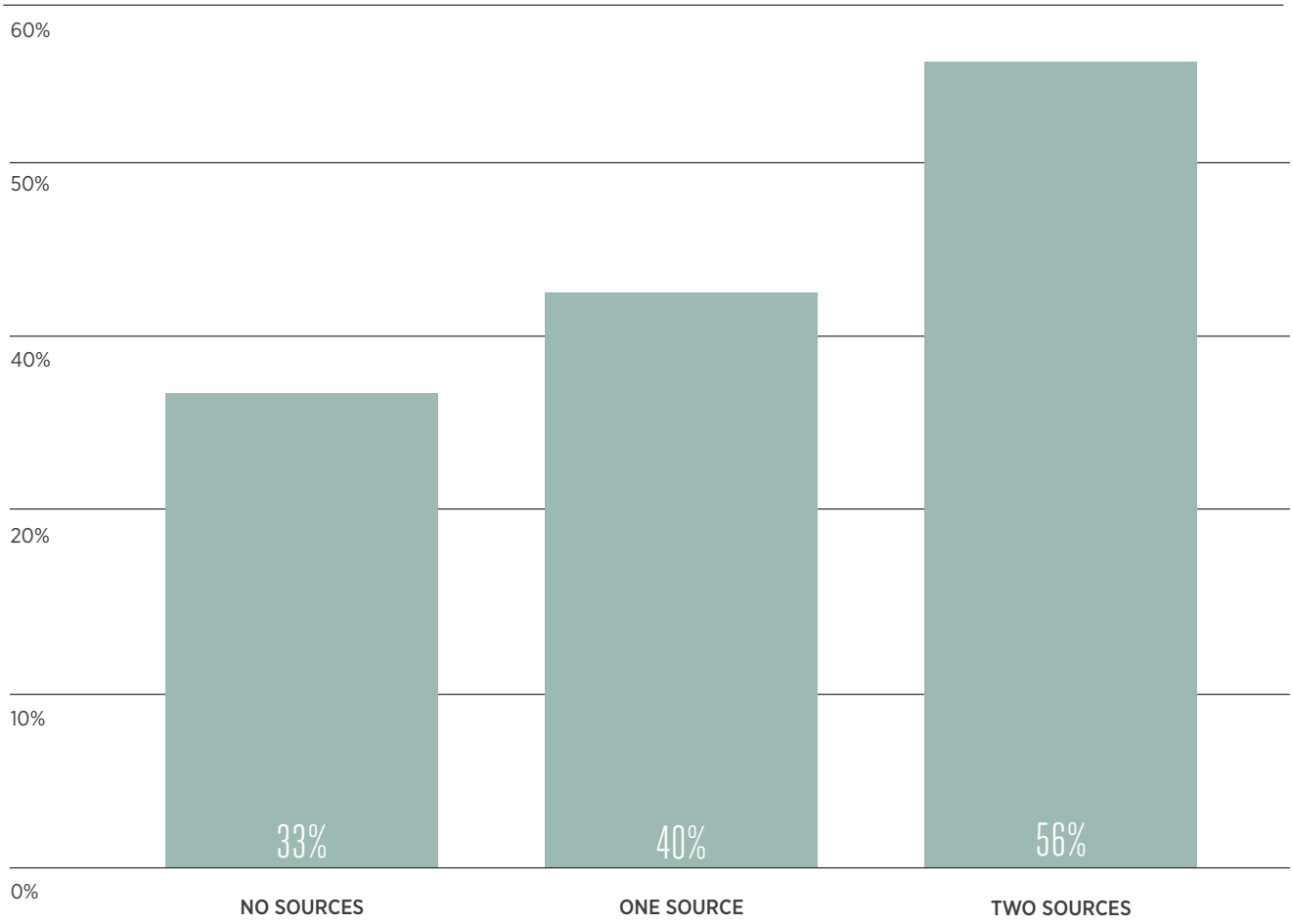
In general, repeat users access a wider range of information sources than non-users, with 55% of repeat users having access to at least two sources of information compared to just 13% of non-users. In particular, non-users are much more dependent on other farmers for information and are around three times more likely to cite fellow farmers as their most important source of information than repeat users.

IMAGE COURTESY OF GSMA

There is a strong correlation between how many sources of information are available to a user and their introduction of new crops over the last 12 months (Figure 3), suggesting that additional sources of information are strong drivers of behaviour change.

FIGURE 3

PERCENTAGE OF BOTH NON-USERS AND REPEAT USERS COMBINED CHANGING TO NEW CROPS VARIES ACCORDING TO THE NUMBER OF INFORMATION SOURCES AVAILABLE TO THEM (LAST 12 MONTHS)



SOURCE: PHONE SURVEY PARTICIPANTS

Repeat and non-users displayed almost no diversity in their distribution across attitude groups, however attitudes vary strongly from the results of another study with farmers in the two areas of Tanzania targeted in the field work.[11] People who sign up for Tigo Kilimo are less likely to be traditionalists and more likely to be contented dependents or independents than the wider audience, suggesting a more positive attitude to modern farming in users who have registered for Agri VAS.

11. Attitude groups taken from Listening to the Farmer Voice, Bill and Melinda Gates Foundation (2011); see Methodology for descriptions of each segment.

Behaviour Change

Due to the relatively short time users engage with VAS (compared with the length of agricultural seasons) the impact of services can be difficult to measure. Analyzing the propensity of users to change their behavior allows us to indicate the level to which users trust the service. Importantly, understanding behavior change as a result of the service is a key step to assess the potential of the service to have real impact on the life of smallholders.

Trust in Tigo Kilimo seems to be high: many repeat users in the field research stated that they preferred the service to other sources of information, describing Tigo Kilimo as “reliable”, “accurate”. Farmers reported that Tigo Kilimo was useful because it was available at any time and in any location.

> Tigo Kilimo [is my first choice of information]- since it is available all the time. It is free and also is accurate with its information.
>
> *Treatment, Neema, Morogoro, 44 Female*

> Tigo Kilimo [is my preferred source of information], because they give special, advanced and organized ways of farming.
>
> *Treatment Prosper, Morogoro, 23*

Amongst repeat users there was no clear relationship observed between the number of times a farmer accessed the service and the likelihood that they would change farming practices – users who had accessed the service many times were no more likely or unlikely to report changing their behaviour than very occasional users.

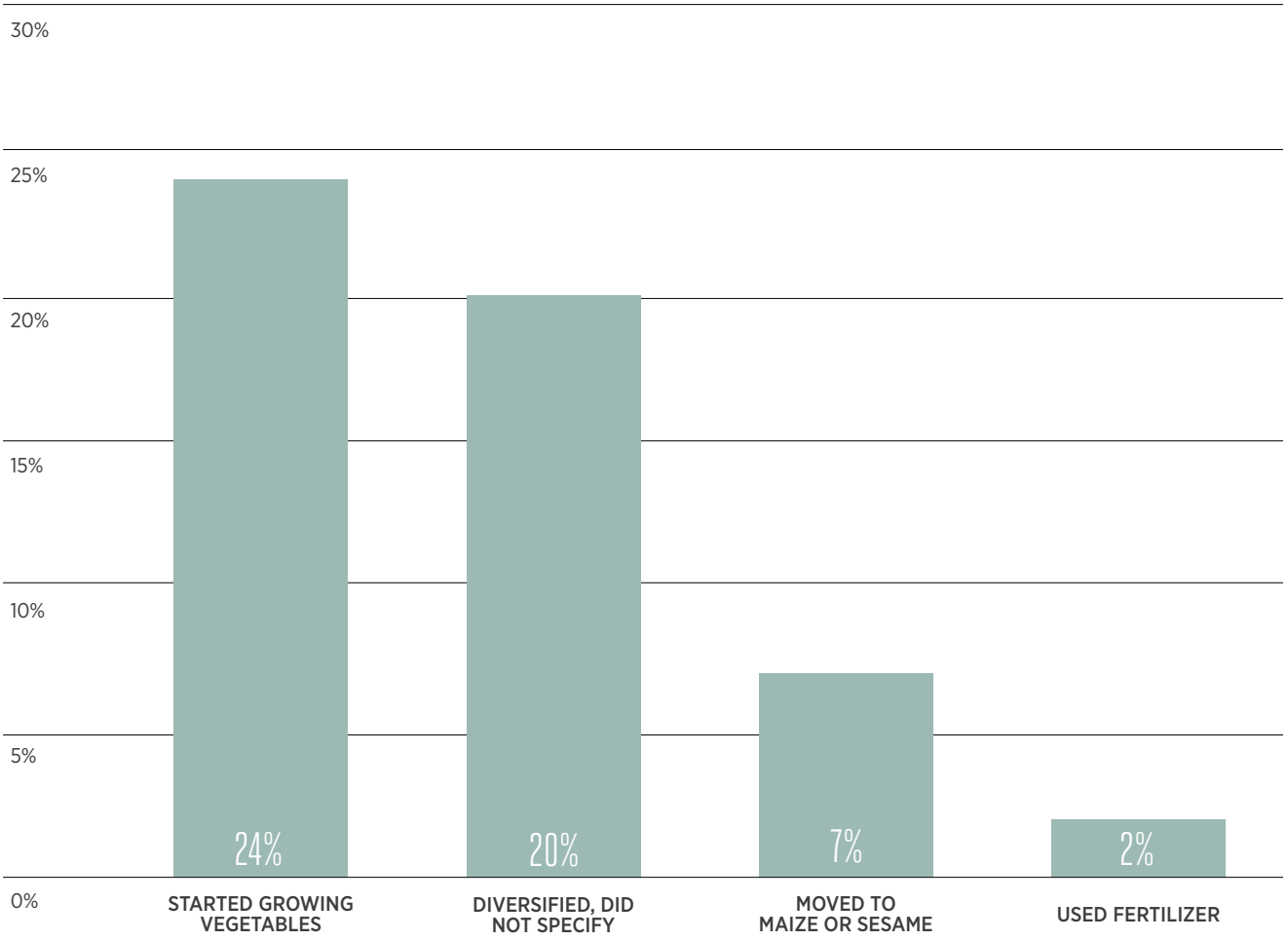
Change in farming practices

Users of Tigo Kilimo report changing their farming practices in a number of ways.

Repeat users are 30% more likely to report growing new crops on their farms in the past 12 months than non-users, after matching on gender, education, age and location. 49% of repeat users reported growing new crops in the past year versus 37% of non-users. The field research highlighted that many repeat users have shifted to growing vegetables, as well as diversifying their farming approaches to grow more varieties of crop and vegetable.

FIGURE 4

BEHAVIOUR CHANGES REPORTED BY REPEAT USERS



SOURCE: FIELD WORK, SAMPLE 57 INDIVIDUALS

> I used to plant maize and beans... but since November last year I changed and started planting Irish potatoes.
>
> *Noel, treatment group, Tanga, 19 Male*

> Tigo Kilimo advises on how to change the type of crops you use instead of engaging in monoculture.
>
> *Salvius, treatment group, Tanga, 19 Male*

Repeat users changed the crops they grew not only in response to agronomic advice, but also in response to information about market prices. Repeat users were 2.4 times more likely to report changing the crops they grow in response to market price information than non-users.

> In the previous year, my income was low because prices were low but this year, I have received advice on what crops to grow and the market prices and hence my income has increased.
>
> *Wilson, treatment group, Tanga, 22 Male*

As well as growing new crops, repeat users were also 39% more likely to change how they prepared their land or scattered their seeds.

> One day I got some [information] regarding selecting the best seeds, and learnt that the quality of seeds you plant determines what you can harvest because of the type of seeds one has.... They told me one can farm every year and not harvest anything because of the poor seeds..."
>
> *Musa, Magengeni, Kilosa district*

The finding that users are more engaged with early stage advice, and less with advice which requires investment, is echoed in other GSMA supported Agri VAS deployments.

Change in farmers' marketing strategy

Tigo Kilimo repeat users are marketing their crops differently to non-users. After matching on profile characteristics, users are:

- 72% more likely than non-users to report having changed their marketing behaviour in some way over the previous 12 months
- 62% more likely to report using price information to bargain with traders
- Twice as likely to report switching to a new market

> I can negotiate with traders. The traders planned to buy for 2000Tsh and I planned to sell for 3000Tsh, but we negotiated and I sold for 2500Tsh per kg.
>
> *Prosper, treatment group, 23 Male*

> [Tigo Kilimo] provides the market prices and yes, I can sell to the markets Tigo Kilimo provides prices for... I normally negotiate with them until we agree on a good price.
>
> *Gerald, treatment group, Tanga, 22 Male*

The majority of repeat users said they could not cooperate with other farmers to sell to larger markets or negotiate with traders. Amongst non-users, 40% said that cooperation was a possibility but something that rarely occurred. 75% of repeat users from the qualitative research cited that their reasons for not cooperating were rooted in a distrust of other farmers relating to price negotiations, reported yield, and feared working with them on these grounds.[12] However, the causal direction of this finding cannot be deduced from this information: it may indicate that as individuals increase their knowledge of the farming market and best practices they are increasingly distrustful of the work of others or that less trusting farmers are more likely to sign up to Tigo Kilimo.

> No, farmers are not cooperative with each other. Each farmer depends on himself or herself. I cannot trust other people to send the crops to the market.
>
> *Jephter, treatment group, Tanga, 46 Male [paraphrased]*

Farmers who were unable to bargain with traders still considered the market price information to be beneficial. Users in the field study reported that the market price information enabled them to verify if traders were under-reporting prices in central markets or whether they were making excessive profit. Even if they did not use it to bargain, farmers found having this information reassuring.

Using weather information to change timing of agricultural practices

32% of repeat users and 28% of non-users in the phone survey reported having used weather forecasts to change their farming practices in the previous 12 months. This difference was not large enough to be statistically significant, which remained the case after matching farmers on profile variables. However, users interviewed spoke of the quality of Tigo weather services:

> Tigo Kilimo is more accurate than the other sources of weather forecasts.
>
> *Joseph, treatment group, Morogoro, 41 Male*

> With TK one can get weather forecast information anytime unlike the radio where one can only get that information during news broadcasting hours.
>
> *Gerald, treatment group, Tanga, 22 Male*

12. From a sample of 41 individuals. We are unable to say that this is representative of larger society based on the sample size, however it is an important consideration due to the frequency of this feedback in the qualitative study.

Barriers to behaviour change

Receiving information is only a first step towards making a life change. Several potential barriers to behavior change have been identified by this and previous studies.

LACK OF ACCESS TO CAPITAL

Farmers need access to capital in order to implement some modern farming techniques. Finance was a barrier for many users, preventing them from acting on Tigo Kilimo recommendations. Half of the treatment group during the qualitative study reported that finance was a significant barrier to being able to implement advice in its entirety.

> I have partially implemented because some of the information is difficult to implement, like the use of two types of fertilizers and use of improved seeds which are very expensive.
>
> *Prosper, treatment group, Tanga, 23 Male*

Repeat users were no more likely to change their storage, pest control or fertiliser practices than non-users. This suggests that users are mostly making changes that do not require significant financial investment. Many reported that there were barriers in terms of capital and costs of transport that prevented them from purchasing the required inputs.

> I needed to raise sufficient capital to be able to buy most of the things as advised by Tigo Kilimo such as insecticides. However, I couldn't due to financial constraints.
>
> *Noel, treatment group, Tanga, 19 Male*

It is recommended that a tiered approach be trialled to encourage behaviour change: i.e. prescribing a best practice option and its likely cost, while describing a low cost alternative. It is important, however, to outline why the low cost alternative is not the optimal solution, and then present a worst case scenario of doing nothing. This approach may need to be implemented through a voice channel, as SMS messages have a character limit.

Many farmers interviewed in fieldwork wanted financial services to be incorporated into the Tigo Kilimo service. They asked for credit to be accumulated through the service, leading to a mechanism for loan dispersal via Tigo Kilimo. Another key area that was mentioned by many users was the need for promotions, subsidies or discounts for Tigo Kilimo users to reward repeat customers and make the inputs recommended by Tigo Kilimo (such as fertilisers, pesticides, and seed varieties) more accessible to users. Adding such features would require significant investment in the platform.

LACK OF VARIETY IN CROP INFORMATION

Repeat users interviewed in fieldwork advised that more information on a wider variety of crops on the Tigo Kilimo agronomy information service was desired by farmers.

> Tigo Kilimo should have a menu where the information about vegetables can be available. Tigo Kilimo should emulate Kenya where there is one network that provides full information on how to grow mchicha from the first stage up to the last.
>
> *Prosper, treatment group, Morogoro, 23 Male*

It is important that the information provided mirrors the increase in vegetable growth as well as 'trending' crops such as sesame.

WEATHER INFORMATION IS NOT ACCURATE ENOUGH

During the fieldwork, many users expressed that Tigo Kilimo's weather forecasts information was insufficiently localised. For example, they reported that the weather forecasts were inaccurate in the mountainous areas and the flat lands.

> "They don't provide the [weather] information at village level but at district level.....I used this information] although it wasn't very accurate."
>
> *Ibrahim, treatment group, Tanga, 18 Male*

This could be rectified through the establishment of more weather stations in Tanzania. Currently only 20 weather stations exist meaning that information is of low granularity. Alternatively, modern satellite based forecasting models could replace this data (e.g. ISKA service in Ghana), although modelling weather in East Africa is notoriously complicated.

Participants also expressed interest in information around climate change adaptation solutions.

LACK OF ACCESS TO MARKETS AND NEGOTIATING POWER

The market prices service currently covers mainly urban markets to which rural farmers have little access.

> "No, most of the markets that Tigo Kilimo talks about are far away. This forces me to sell to other markets where Tigo Kilimo does not provide the market prices..... No, most farmers here do not like sending their crops to larger markets. They are comfortable selling locally. They fear being conned while selling in the far away markets."
>
> *Ibrahim, treatment group, Tanga, 18 Male*

Not all farmers are able to use Tigo Kilimo market price information for bargaining. While women are no less successful at this than men, users with small farms struggled, with users with less than 2 acres of land 43% less likely to report bargaining with traders than those with larger farms. Fieldwork participants reported that traders come to them with fixed prices and so poorer farmers likely lack both the social capital to bargain well and the financial clout to threaten to take their harvest elsewhere. Comparing farmer attitudes, more traditional farmers in particular made few changes to their marketing behaviour: they were 60% less likely to change to a new market and 72% less likely to change trader than other farmers.

Farmers with small farms were no less likely to report changing the market they sold to based on market price information than those with large farms, although some did report in fieldwork that the additional transport costs associated with switching markets were prohibitive. Tigo Kilimo could potentially offer a matching platform in which middlemen compete for trade and advertise the prices that they are willing to offer farmers, and farmers post their goods in order to be seen by buyers. This service has been a valued part of the Vodafone Farmers' Club service in Turkey, where strong impact is reported from opening new markets to smallholder farmers.

TRADITIONAL RELIANCE ON FACE-TO-FACE EXTENSION

Compared to repeat users, the control group were keen for face-to-face contact; they wanted to ask an extension agent or agri-input dealer to come to their farm to see the problem and advise them. They talked of a need for a "professional" who was "close by" and "knowledgeable". Whilst the treatment group valued these possibilities, they were more independent in the value they attribute to different sources and less dependent on face-to-face contact. Many reported Tigo Kilimo as their main source of information. However, they emphasised that their source preference was also dependent on the context of the problem.

Non-users spoken to in fieldwork felt that there was also a need for more Tigo Kilimo branded face-to-face services. Suggestions included a Tigo Kilimo farming centre, Tigo Kilimo farming groups, Tigo Kilimo seminars, and visits to repeat users to reward them with one-on-one advice about their crops. This keenness for more Tigo Kilimo branded information was particularly evident in the behaviour of the participants of the qualitative interviews, who came with notepads and pens keen to write down Tigo Kilimo agricultural advice.

> "Tigo Kilimo should establish a permanent centre where farmers can get training about farming activities and also support farmers with materials such as seeds and fertilizers."
>
> *Gerald, treatment group, Tanga, 22 Male*

LACK OF UNDERSTANDING OF PRICING MODEL

Some users from the control group lacked any understanding about how the service is priced, changing their perspective on the value proposition.

> "I have ignored the service since I'm not aware of the Tigo Kilimo service or whether it is free or not."
>
> *Michael, control group, Tanga, 42 Male*

> "I know that is very expensive to get information from Tigo Kilimo."
>
> *Rehema, control group, Morogoro, 18 Female*

Insight: Smallholders' decision making is a family-driven process

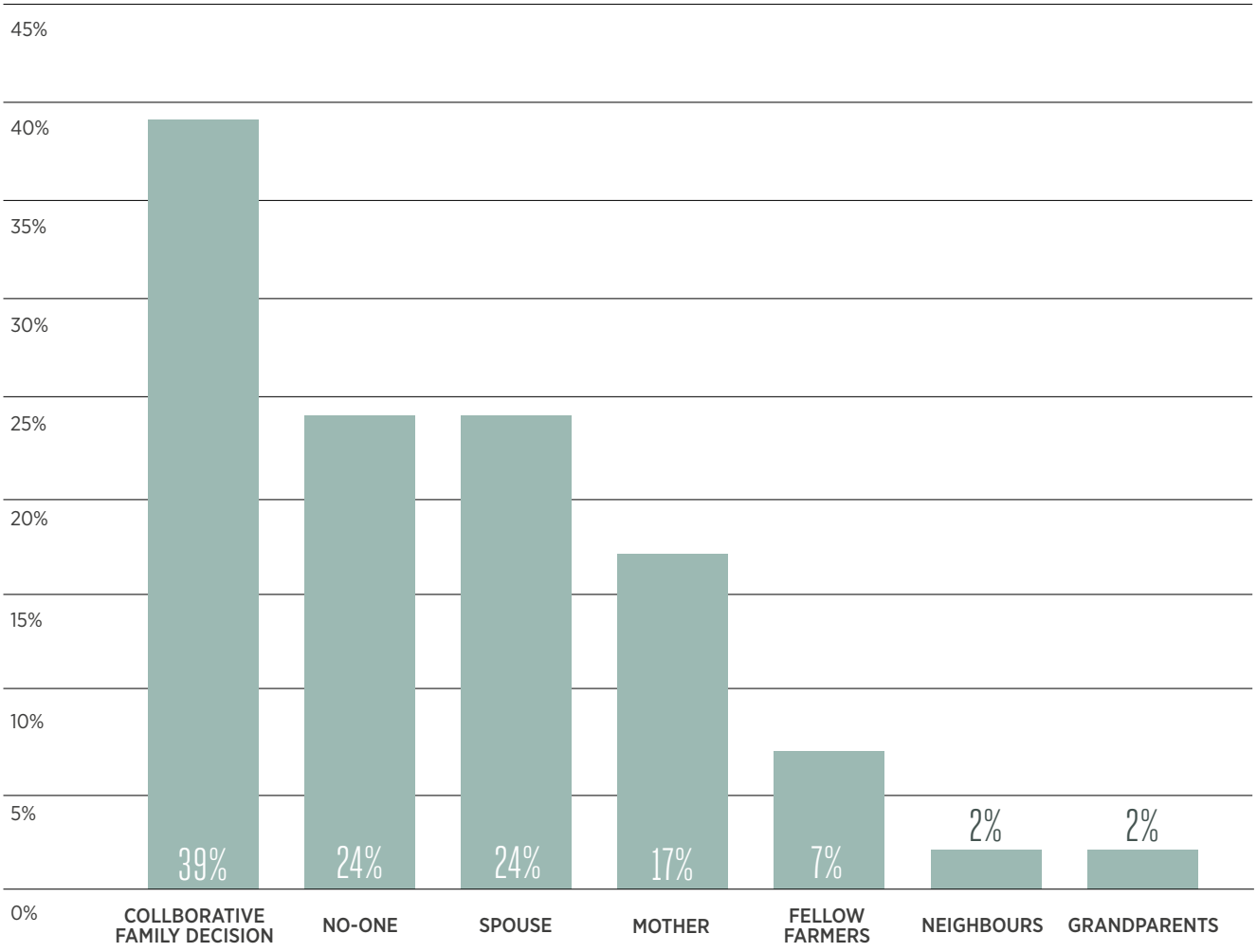
Community decision making is very important in rural Tanzania. Less than a quarter of farmers surveyed in fieldwork reported making farming decisions on their own, and 39% reported that farming decisions are made collaboratively within the family (figure 5).

While women are not strong decision makers on their own, 17% of users interviewed in the fieldwork said that their decisions on changing farming practices had first to be approved by their mothers. This was consistent across both repeat users and non-users and suggests that women, or at least farmers' mothers, had significant say over final decisions, although they would not be the ones to seek information on the changes or recommend them to other farmers.

> First, we discuss with my mother about it. From that discussion, I am now able to make the decision. We have to discuss the new idea with my mother first so that we can come up with the right decision.
>
> *Peter, control group, Tanga, 20 Male*

FIGURE 5

PEOPLE WHOM REPEAT USERS CONSULT BEFORE TAKING A DECISION ON THEIR FARM*



* CATEGORIES HAVE BEEN CHOSEN TO MATCH PARTICIPANT RESPONSES RATHER THAN BEING UNIQUE CATEGORIES. FOR EXAMPLE THE PROFILE OF 'SPOUSE' AND 'MOTHER' MAY BE INCLUDED ON OCCASION WITHIN FAMILY, HOWEVER THE FARMER RESPONSE USED 'FAMILY' AS A CATCH ALL TERM.

SOURCE: FIELDWORK

Marketing could illustrate a family using the service as one of the use-cases to show Tigo Kilimo as inclusive of other family members, rather than position itself as a radical disruption

Outcomes and Impact

User level impact

Differences in reported livelihood outcomes are observable between the treatment and control groups. However, after controlling for variance in outcomes caused by age, gender, location and education level, most of these differences were cancelled out, with one notable exception: Tigo Kilimo users were 39% more likely to report increased income over the previous 12 months than non-users.

It may be that repeat users need more time to see benefits for their harvests. External factors such as pests, drought or unpredictable rainfall have a significant impact on farming to the point that it is hard to measure the impact of such services. This is supported by the quotes from repeat-users, which highlight that rainfall was a big barrier to seeing an increase in harvest. These issues are discussed further in the methodology section of this report.

> "Income increased this year compared to last year... the surplus increased due to good weather conditions."
>
> *Wilson, treatment group, Tanga, 46 Male*

> "Two years ago income was higher, compared with last year. [Last year] rainfall was unpredictable."
>
> *Eric, treatment group, Tanga, 53 Male*

USER PRODUCTIVITY

43% of repeat users report increased harvest compared to that of the previous 12 months, while 35% of non-users report this.[13]

> "Tigo Kilimo also advised that I should mix crops in my farm... the change resulted in an improved harvest."
>
> *Eric, treatment group, Tanga, 53 Male*

However, when matching repeat users to non-users based on their age, location, gender and educational level, the differences in harvest disappear. This is principally due to educated users being more likely to enjoy greater harvests whether repeat users or not, and so this increase in repeat user harvest is due to repeat users being better educated than non-users. Educated repeat users were no more likely to report increased harvests than educated non-users.

USER INCOME

18% of repeat users achieved higher prices for their produce this harvest compared to the previous 12 months, while 14% of non-users saw this. The same proportion of repeat users and non-users (28%) reported selling

13. Phone surveys asked participants their views on their outcomes from the most recent harvest compared to the previous 12 months.

more produce in the recent harvest than in the previous 12 months. 35% of repeat users reported increased income from the most recent harvest compared to 12 months prior, compared with 25% of non-users.

However, as above, when matching repeat users to non-users based on their age, location, gender and educational level, the differences in harvest and prices disappear.

One outcome difference did remain between repeat users and non-users after matching similar farmers: *repeat users were 39% more likely than non-users to report increased income than non-users. This increase in income is largely due to farmers using new crops; farmers who grew new crops were 60% more likely to report increased income than farmers who did not, likely because these new crops had higher market value.*[14]

> In the previous year, my income was low because prices were low but this year, I have received advice on what crops to grow and the market prices and hence my income has increased.
>
> *Gerald, treatment group, Tanga, 22 Male*

Farmers who tried to negotiate with traders were no more likely to report increased prices than those who did not. This suggests that while Tigo Kilimo had the positive effect of making more farmers negotiate based on its market price information, most farmers were unsuccessful in these negotiations. This was confirmed by repeat users in fieldwork, 70% of whom reported that traders were unwilling to change prices in response to attempts at negotiation.

> I negotiate, but it is difficult since when they came to me they have already planned their prices but sometimes we can reach a new price.
>
> *Gladness, control group, Morogoro, 37 Female*

Wider Impact

TIGO KILIMO IS EVEN MORE VALUABLE WHEN SUPPORTING OTHER INFORMATION SOURCES

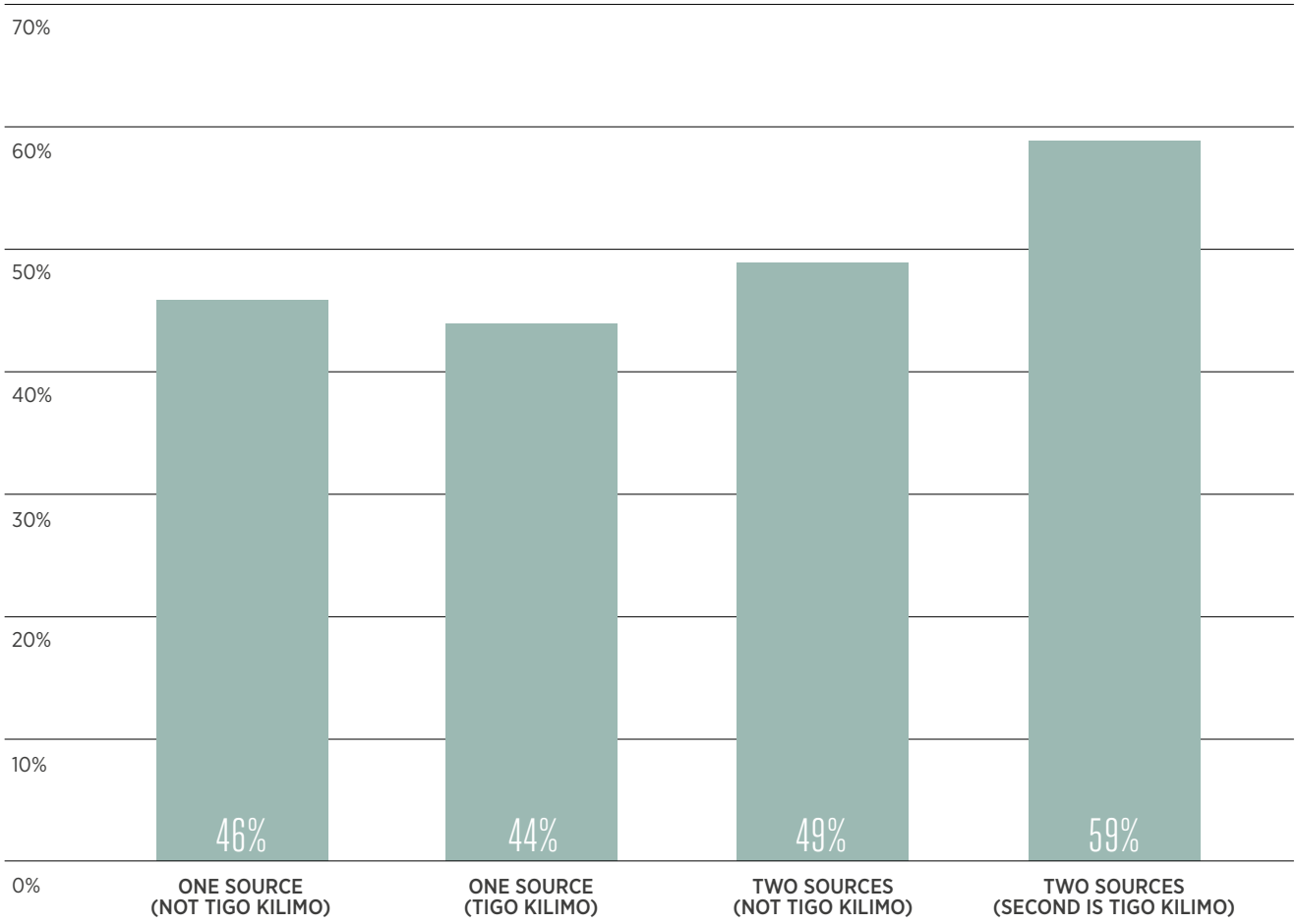
Having a mix of information sources played a significant role in influencing increased crop diversity that has led to increased user incomes. 56% of repeat users who cite Tigo Kilimo as an information source consider it their most important source of information, with the remaining 44% seeing it as their second most important source. Those who use Tigo Kilimo as their most important source tend to rely on it alone; repeat users who cite Tigo Kilimo as their main source of information are 40% less likely than other repeat users to have a second source of information. Many of those using Tigo Kilimo as a secondary source seem to be complementing or validating advice they have received from extension officers.

Using Tigo Kilimo as a sole source of information is no less associated with behaviour change than any other sole source (figure 6) and using Tigo Kilimo as a secondary source seems to result in more behaviour change than using any other secondary source.[15]

14. The fact that farmers did not report higher prices may be due to how they interpreted this question; they only reported changed prices if they were still growing the same crop and did not do this for new crops whose price they were unaware of during the previous harvest.
15. The phone survey sample size was only large enough to state this with 87% confidence, however it can be stated with over 95% confidence that Tigo Kilimo was at least no less effective a primary or secondary information source at promoting behaviour change than the other sources available.

FIGURE 6

PERCENTAGE OF REPEAT USERS REPORTING GROWING NEW CROPS IN THE PAST 12 MONTHS



SOURCE: PHONE SURVEY

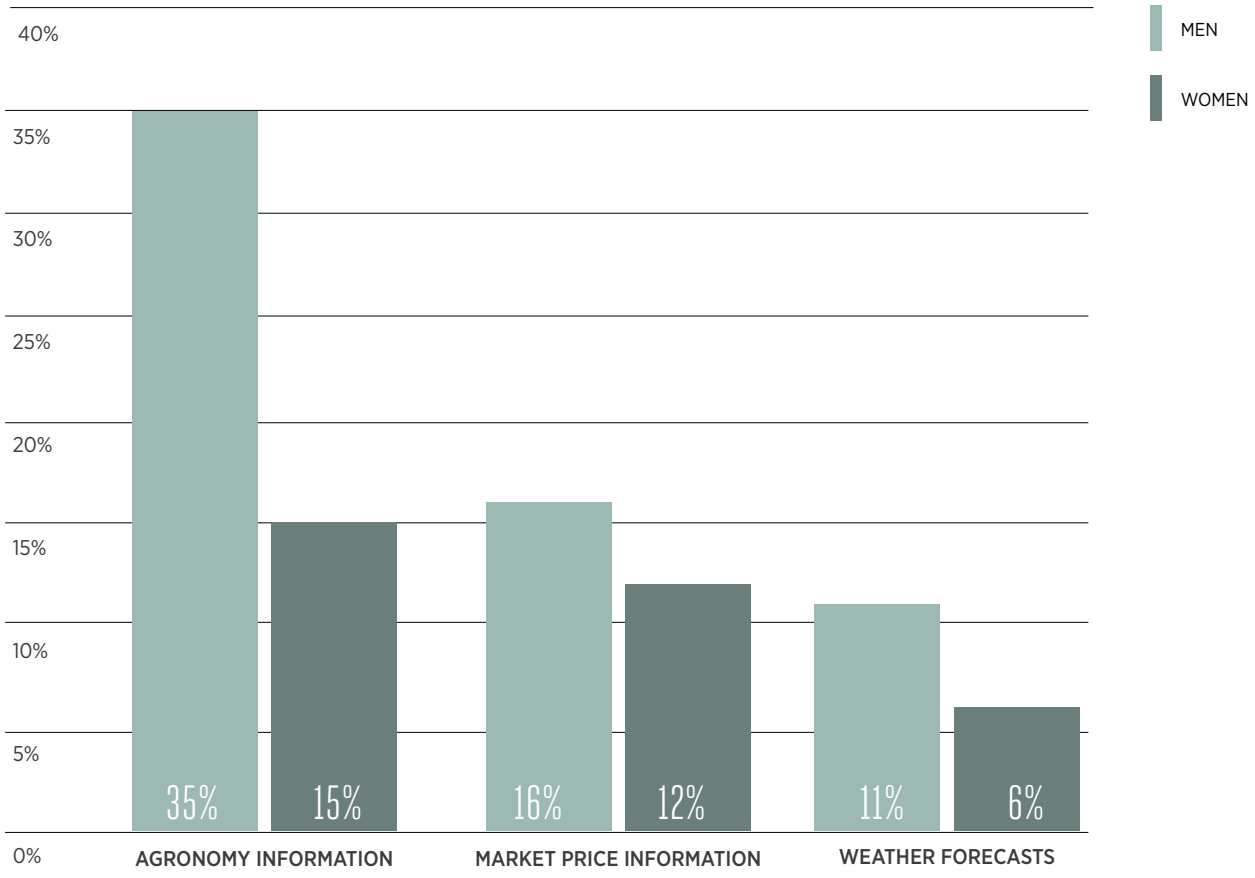
SHARING TIGO KILIMO INFORMATION WITH FELLOW FARMERS

Many Tigo Kilimo users report sharing information with other farmers; the size of this network effect is not measurable at present, but 47% of repeat users reported sharing information from Tigo Kilimo with a wider audience.

The phone survey found that repeat users over the age of 40 were twice as likely to share information from Tigo Kilimo as younger users, and women were 80% less likely to share information than men. Overall, agronomic information was the most shared (but the least accessed) content, shared by 29% of farmers. In contrast market price information was shared by 15% and weather information was shared by 9% of repeat users.

FIGURE 7

INFORMATION SHARING BY MALE AND FEMALE USERS



SOURCE: PHONE SURVEY

Repeat users who had demonstrated a behaviour change on their farms were the most likely to share with other farmers. Those who used new crops or seeds were 35% more likely to share Tigo Kilimo information than those who didn't. Those who changed the way they used their land, through new land preparation or sowing techniques, were 46% more likely to share Tigo Kilimo information than those who didn't.

Impact on operator business

As the most used parts of the service are offered for free, Tigo generates negligible direct revenue from the service. It was previously found that 80% of repeat users would be willing to pay for service.[16] However, it is important to recognize that by providing the service for free, Tigo Kilimo:

1. Demonstrated high demand and need for this type of information solutions among smallholders
2. Allowed farmers to try before they buy, which proves an opportunity for freemium services
3. Could provide tailored mobile financial services to the existing user-base of customers that contains information about farmer profile, crops grown and their location

16. Tigo Kilimo midline study, GSMA mAgri (2014)

> Tigo Kilimo should continue providing its services, even if there will be some charges I will be able to pay it.
>
> *Noel, treatment group, Tanga, 19*

The operator currently provides the Agri VAS in order to receive indirect benefits such as higher loyalty to the SIM-card comparing to other networks.

> After I have discovered Tigo Kilimo, I don't use other operators' services. Look at my phone – it is a dual-SIM handset, however the second SIM slot is empty, simply because I don't use any other network, only Tigo.
>
> *Moses, Morogoro interview, 2014*

GSMA Intelligence calculates that Tanzanian mobile subscribers own an average of 1.6 SIMs, suggesting that dual SIM use is prevalent. Tigo's business would benefit from their customers using core service on Tigo, rather than on other networks.

From the qualitative research it was found that farmers saw a value in Tigo Kilimo with many asking for more Tigo Kilimo services, suggesting that users trust and value the Tigo Kilimo brand.

The number of users who have ever registered for Tigo Kilimo is equal to 8% of Tigo's total subscriber base in Tanzania. The impact of a service which promoted loyalty in the user base would therefore be significant. Though there is evidence of strong interest in and appreciation for agricultural services among the user base, GSMA does not have access to sufficient data to prove increased customer retention on the Tigo SIM. However data suggests that repeat Agri VAS users stay on the service (and subsequently the network) for over 60 days on average, while power users (those who access the service at least 10 times) use the service for on average 120 days.

Conclusion

Tigo Kilimo plays an important role for repeat users, alongside validating a suite of other information sources, in influencing the decisions about growing new crops, new land preparation techniques and new sowing techniques. The adoption of new crops in particular leads to repeat users earning greater income. Tigo Kilimo plays a particularly important role for women, who have fewer other sources of information. Those who sign up for Tigo Kilimo, regardless of usage intensity, tend to feel positively towards farming and acknowledge that they need help to improve.

Tigo Kilimo is prompting users to bargain with traders using market price information. However, only farmers with large farms are successful, with traders often insisting on fixed prices. Access to market prices has a longer and more prominent effect on communities as it decreases information asymmetry. Furthermore, market prices allow farms to make better decisions about types of crops to grow in response to the market demand and get higher incomes as a result of market driven decisions.

Methodology

This impact evaluation employs a mixed-methods approach and makes use of data from three sources; Tigo Kilimo user and transactional data, a phone survey and fieldwork.

The impact evaluation employed a 'post-project comparison'[17] design, collecting data on key outcomes for both a treatment group and control group, with repeat users acting as the treatment group and non-users acting as a control group. Using non-users as a control group rather than just selecting any farmers at random meant that the treatment and control groups were more comparable. It likely takes a wealthier farmer with greater initiative and literacy to use a mobile service and so comparing repeat users to non-users, rather than the wider farming population, means that the two should be more similar. This enables service impact to be determined from the differences between the two groups. The downside to this approach is that while it provides a measure of impact on current repeat users, it may not be a good prediction of the service impact on other current users or on future users, should the service increase greatly in popularity. This is because these lighter current users have not had the same level of exposure to the service and because any new wave of adopters may differ in profile from the early adopters and so may have a different experience of the service. As such this methodology principally provides a measure of impact on repeat to date, rather than necessarily the likely impact of the service on those who have used it less or those who will use it in the future, if these users are different to current repeat users.

USER REGISTRATION AND TRANSACTIONAL DATA

Tigo Tanzania provided registration and transactional data for all registered users which were analysed by GSMA. ALINe conducted further analysis of all 6787 repeat users' logs. These logs were fully anonymised, with no farmers identifiable from their data. User log analysis, which included user age, sex and location, allowed the identification of users for further interview and for examining trends in service usage. GSMA analysis was conducted with SQL and Microsoft Excel and ALINe analysis was conducted with Stata.

PHONE SURVEYS

505 Tigo Kilimo users were successfully surveyed by phone in March 2015. 293 of these were non-users, those who had registered for the service but not accessed any content, and the remaining 211 were repeat users. Contacting repeat users who had recently accessed the service made it most likely that they would remember using it and that, in a market with high user churn, they would still be using the same SIM card. All interviews were conducted in Swahili, the official language of Tanzania and the primary language of Tigo Kilimo content (though 5% of users choose to access the service in English on registration).

Users were sampled in the Tanga and Morogoro regions. These locations were chosen for having the highest density of repeat active users of Tigo Kilimo in the country. Tanga had 21% of repeat users on the service, and Morogoro had 33% of repeat users.

The analysis of phone survey results makes use of propensity score matching, a statistical technique to allow the impact of an intervention to be measured in a treatment/control study design. Using profile characteristics (age, location, sex and education) repeat users were matched to similar non-users. This matching was conducted by generating a "propensity score" for each participant, which used their profile characteristics and the average profile characteristics of both repeat users and non-users to calculate the probability that they would be in the repeat users group. Each user in the repeat group was matched to someone in the non-

17. Phone survey participants were asked about how their outcomes from the most recent harvest compared to the previous 12 months.

users group who had the same propensity score. The impact of the service on users could then be determined by looking at the average difference between the matched pairs. This study had significant sample sizes yet differences between gender and age relating to service interaction were not apparent.

There are several limitations to this study design. As only users in two regions were interviewed, this study cannot be generalised to the whole population, although the two regions do represent over half of Tigo Kilimo users. Propensity score matching assumes that between two matched users, the only difference in outcomes between them must be due to the service as they would otherwise be identical. However, while it is true the users with the same age, sex, location and educational level will have quite similar outcomes, this study found significant differences between repeat users and non-users in their access to other sources of information. It is difficult to conclude that differences between repeat and non-users are therefore due to Tigo Kilimo or due to repeat users' greater use of these other information sources. Due to the timing of the survey, during seasonal rain, many famers called were busy in their fields and unable to speak to researchers.

Users interviewed for both the phone survey and fieldwork were chosen for having used the service in the past 2 months, which means that they may not have had the time to use the Tigo Kilimo advice, or to have seen any impact yet on their farms.

The phone surveys replicated the questions in the Gates 2011 study on the Farmer Voice. These questions were:

"I would now like to read out some statements about farming as a livelihood, and ask you whether you agree with these statements. For each of these statements, could you tell me whether you disagree strongly, disagree somewhat, neither agree nor disagree, agree somewhat, or agree strongly.

1. I would prefer if my children do not end up working as farmers
2. There is no hope for poor farmers like us to improve.
3. If I had a choice I would not be a full time farmer.
4. There is no better investment than farming
5. God meant me to be a farmer/it is my destiny to be a farmer
6. I am proud to be a farmer.
7. Any farm method that saves me time is worth paying for.

The seven questions above were used to segment the user base into 6 main attitude types for Tanzanian farmers:

TRADITIONALISTS	Love the farming ethos, but are very low on information focus and don't look for change. These are the laggards. They believe it is their destiny to be a farmer, and they have no problem with that. To them, there is no point finding information out to try to change. They are somewhat negative and don't want people telling them what to do on their farms.
TRAPPED	Do not enjoy farming, exhibit negativity towards farming and sees little hope in farming. Does not want his/her children to follow him/her. Would rather get out of farming since they see no hope of improvement, but probably can't. Would not want their children to be farmers but don't have any idea of what to do about it. Are not interested in collecting information or making change.
COMPETENT OPTIMISTS	Seek information and networks with others very independent and truly enjoys farming
FRUSTRATED ESCAPISTS	Looking to make the best out of farming and improve him/herself but if a better alternative came up he would easily stop farming. Probably sees his/her future elsewhere. Do not believe their destiny is in farming.
INDEPENDENT	Generally savvy user of information. Not very experienced in farming and not engaged and derives no excitement in farming. Has no problem with change and seeks information, has hope, does not think that farming is their destiny. Don't want people telling them what to do.
CONTENTED DEPENDENTS	Has very positive attitude towards farming but feels he/she requires the assistance of others. Are optimistic that things can improve and don't mind being a farmer – after all, it is their destiny, but the only way of improving is to enlist the help of others like NGOs and other people. May lack confidence due to past failure.

These questions were designed by TNS and the Gates Foundation to conduct market research and to try to better identify famers that were likely to use the service. However, these questions have culturally variable interpretations and may only provide MNOs with a broad overview of attitudes rather than being able to identify potential users or provide information concerning specifics about potential users, such as gender, income, location etc. In addition, this tool was designed in 2011 and it is uncertain whether it is still reliable in identifying potential users.

The results of this study are unpublished; for more information, contact melissa.baker@tnsglobal.com

FIELD WORK

This qualitative component provides formative and descriptive data consisting of testimonials, case studies, and insights into the internal and external factors that facilitated and restricted behaviour change by farmers. Originally, it was intended that 40 one-to-one interviews would be conducted followed by 6 focus group interviews. However, conducting these focus groups was not possible as farmers priorities at the start of the rainy season prevented them from turning up as they were busy planting new crops in their fields to coincide with the rain.

These 57 interviews were compiled into a grid outlining the most salient findings. From this 8 treatment interviews and 4 control interviews were written up verbatim. These were chosen through random sampling. These interviews were then analysed by a specialised qualitative consultant, extracting the main themes and points of critical importance.

The rainy season also hampered consultant access to participants to deliver the surveys, and the roads in Morogoro were washed out. This meant that the Morogoro interviews were conducted as phone surveys. The qualitative consultants reported that participants were much less willing to explain their answers when engaged in a phone interview rather than a face-to-face interview, this was largely because participants had been asked a similar set of questions already as part of the phone survey. On occasion participants even distorted their answers reporting answers about the weather that didn't correspond to the quantitative findings, it was felt that this was said as it was an easy answer.

Gaining a 50:50 male to female spread for the face-to-face interviews was also problematic with many women unable to travel, feeling uncomfortable at the prospect of being interviewed, or unable due to other commitments in the household. As such, whilst striving for a 50:50 split, only 25% of respondents were female for this study. The women who responded had to travel and leave their homes to go to a face-to-face interview with a stranger that was a man. As such the data collected reflects a certain profile of woman, one that is more liberal and has fewer constraints imposed upon them by their spouse.

The field-based consultants also reported that there were significant differences between farmers that were based close to the markets and those that were in more rural locations, with them noting that they suspected that those in more rural locations found more value in the service and were more likely to be regular users of the service. Whilst this wasn't supported by the quantitative data, with more time it would have been interesting to see if there were differences in the self-reported changes between geographical locations of farmers.

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

For more information, please visit the GSMA corporate website at www.gsma.com. Follow the GSMA on Twitter: @GSMA.

Mobile for Development

Mobile for Development brings together our mobile operator members, the wider mobile industry and the development community to drive commercial mobile services for underserved people in emerging markets. We identify opportunities for social, economic impact and stimulate the development of scalable, life-enhancing mobile services.

mAgri

mAgri catalyses scalable, commercial mobile services that improve the productivity and incomes of smallholder farmers and benefit the agriculture sector in emerging markets. The GSMA mAgri Programme is in a unique position to bring together mobile operators, the agricultural organisations and the development community to foster sustainable and scalable mobile services that improve the livelihoods of smallholder farmers. This report is part of the mFarmer Initiative, launched by the GSMA mAgri Programme in 2011 in partnership with USAID and the Bill & Melinda Gates Foundation.

For more information about GSMA mAgri Programme visit our website at:
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Authors: Tegan Palmer & Natalia Pshenichnaya

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Contact us for the research methodology and case study reports: mAgri@gsma.com

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For further information please contact
magri@gsma.com
GSMA London Office
Floor 2,
The Walbrook Building,
25 Walbrook,
London EC4N 8AF
T +44 (0) 20 7356 0600