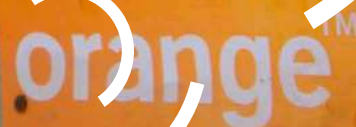
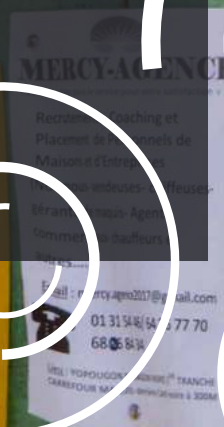




The Value of Pay-As-You-Go Solar for Mobile Operators

Insights from customer journeys in Benin and Côte d'Ivoire





The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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MTN and Orange were the mobile operator partners for this study, in Benin and Côte d'Ivoire respectively. The study would have not been possible without their collaboration, and the authors are grateful to all the staff who contributed to the analysis of call detail records and the research design of this report.



This initiative has been funded by UK aid from the UK government and is supported by the GSMA and its members.

The views expressed do not necessarily reflect the UK government's official policies.

GSMA Digital Utilities

Utility services such as energy, water, sanitation, waste management, and transport are essential to life. The Digital Utilities programme enables access to affordable, reliable, safe, and sustainable urban utility services for low-income populations through digital solutions and innovative partnerships. Inclusive utility services support urban resilience, which allows cities in low- and middle-income countries to better withstand challenges related to rapid urbanisation, climate change, and inequality.

For more information, please visit www.gsma.com/mobilefordevelopment/digitalutilities/

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17 Triggers and MCYA were the research partners in this study.

17 Triggers is a behaviour change lab using human-centered design to solve real problems. 17 Triggers worked with the GSMA to design and conduct the behaviour change analysis for this study.

Cabinet d'étude MCYA is a research and consultancy firm based in Abidjan. MCYA worked with the GSMA to conduct interviews with end users in Benin and Côte d'Ivoire.

Foreword

I feel honoured to have been asked by GSMA to write the foreword to this important report on the value of PAYGo solar for Mobile Operators. We often see GSMA as our big sibling, who have shown us in several ways how to grow an impactful industry that serves customers in emerging markets – responsibly, sustainably, profitably.

In 2022, GOGLA will celebrate ten years of being the global association for the off-grid solar industry. It has been a decade marked by phenomenal growth. One in which our sector has provided the quickest, and most affordable, route to energy access for hundreds of millions of people. A decade in which a collection of emergent start-ups has transformed into a maturing global industry, attracting hundreds of millions of dollars each year.

Sustaining that early growth has however proven difficult. To deliver the full potential of our industry, we need more and deeper partnerships, including more public-private partnerships. Representing the off-grid solar industry, last year we launched the 'Power 1 Billion Lives by 2030' Energy Compact, calling on all sector stakeholders to align their goals and efforts. We were encouraged to receive endorsements from some 125 partner organizations so far, including GSMA.

Already, we've seen numerous successful partnerships between PAYGo solar companies and mobile network operators. GSMA and GOGLA also recognized the potential for cooperation early on. For several years, we jointly worked on promoting practical experiences, creating new research insights or convening our stakeholders.

Yet, it is clear to us that the full potential of cooperation between our industries is yet to be realized, and many opportunities still remain untouched. As the off-grid energy sector develops further, the potential value of these partnerships can only grow.

The GSMA's research has been immensely useful in clearly evidencing, and quantifying, the value of such partnerships. This paper deepens our understanding of exactly how off grid energy companies and mobile operators can jointly serve their customers better, and how they can best benefit from doing so. It highlights the importance of both connectivity and energy access to end users, and how deeply these two services work together.

At GOGLA we have worked on developing a set of standard key performance indicators for the sector. The PAYGo PERFORM platform, developed in partnership with the IFC and CGAP, helps to make financial performance of the sector more transparent. These standards help ensure that as the sector grows it does so on a firm footing, that the sector can credibly articulate its wide-ranging social and commercial value, and that it will be a reliable partner in cooperation.

We are grateful to work with such inspiring and strong partners as GSMA. It is the quality of such partnerships that gives us confidence that, in another ten years, we will once again look back on an amazing decade of growth and impact.



Koen Peters,
GOGLA Executive Director



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Abbreviations

ARPU	Average Revenue Per User
CDR	Call Detail Record
CGAP	Consultative Group to Assist the Poor
COM-B	Capabilities, Opportunity and Motivation-Behaviour
GDP	Gross Domestic Product
GOGLA	Global Off-Grid Lighting Association
GSM	Global System for Mobile Communications
IFC	International Finance Corporation
M2M	Machine-to-Machine
M4D	Mobile for Development
MMPI	Mobile Money Prevalence Index
PAYG	Pay-As-You-Go
SHS	Solar Home System
SMS	Short Message Service
USSD	Unstructured Supplementary Service Data



Executive Summary

Pay-as-you-go (PAYG) technologies, combined with mobile payments, have enabled a new wave of consumer asset financing for low-income customers. PAYG locking technologies, built on machine-to-machine communication, enable service providers to manage credit risk for low-income and unbanked customers. While the growth of mobile money has enabled cost-effective payment collection from remote customers.

PAYG solar has emerged as one of the strongest use cases for this technology, and the sector has matured from a handful of pilots to a global industry in under a decade. There are now over 420 million people using solar products for energy and lighting. The industry has also seen a dramatic rise in investment. Since 2012, \$1.9 billion has been invested in the sector, and \$1 billion of that in the last three years. In the last three years debt accounted for 61 per cent of investment and equity 34 per cent.

The synergies between mobile operators and PAYG solar providers have been clear from the start. Mobile operators provide the fundamental ingredients for PAYG through mobile money and connectivity. On the other side, PAYG solar boosts operator revenues from mobile money transactions and other services. Additionally, association with a core utility service allows mobile operators to strengthen their value proposition and gain customer trust.

In May 2020 the GSMA published the first quantitative analysis of the impact of mobile customers adopting PAYG solar on their mobile usage. That study, conducted in partnership with eight operators in five markets,

analysed data for over 200,000 PAYG/mobile operator customers. The study compared the use of mobile services of the PAYG customer to a comparison group of other customers with similar profiles and found:

- On average, the average revenue per user (ARPU) increased nine per cent as compared to the comparison group;
- Across markets, 21 per cent to 31 per cent of PAYG customers were new to mobile money or reactivated accounts; and
- Customers increase their mobile money transactions between 27 per cent to 113 per cent depending on the market, and this increase was for transaction types beyond bill payment.

While the previous research clearly demonstrated the benefits quantitatively, it did not shed light on how and why people changed their behaviour. In order to explore these questions, in partnership with MTN in Benin and Orange in Côte d'Ivoire, we conducted a follow-up qualitative study.

This study repeated and updated the quantitative analysis done in the previous research. We then conducted a series of 120 in-depth interviews with end users, focused on understanding the reasons behind their behaviour change. This report presents ten key reasons why people change their behaviour, and explores the questions of how, when, and for whom behaviour changes.

This study reinforces the deep synergies that exist between mobile and PAYG energy services. With new energy access, via SHSs, we see all aspects of customer behaviour shift. These changes reflect the transformation in peoples' lives that comes with reliable energy access.

Many mobile operators and SHS providers have established partnerships. However, there are many markets where the PAYG solar sector is still developing, and in developed markets diversification is creating new opportunities. As such, there is still a huge amount of scope for the two sectors to work together.

PAYG solar companies have become increasingly well-positioned to provide consumer credit to low-income and remote customers. This is thanks to the payment histories these companies are generating, that the solar kit remains a lockable asset that can be used as collateral, and that these companies are increasingly specialised and ever increasing their reach.

We are seeing a clear trend in the market for PAYG solar providers to broaden their product and service offering. PAYG solar companies now offer products and services including smartphones, loans and other financial services, cookstoves, water pumps, and much more.

The rapid expansion in product and financial service offerings by PAYG solar companies underscores the fact that their operating model is best thought of as a 'market-creating' innovation, rather than simply another product or service. The broadening of the product offering also underscores the fact that these partnerships remain relevant in developed solar markets, perhaps even more so.

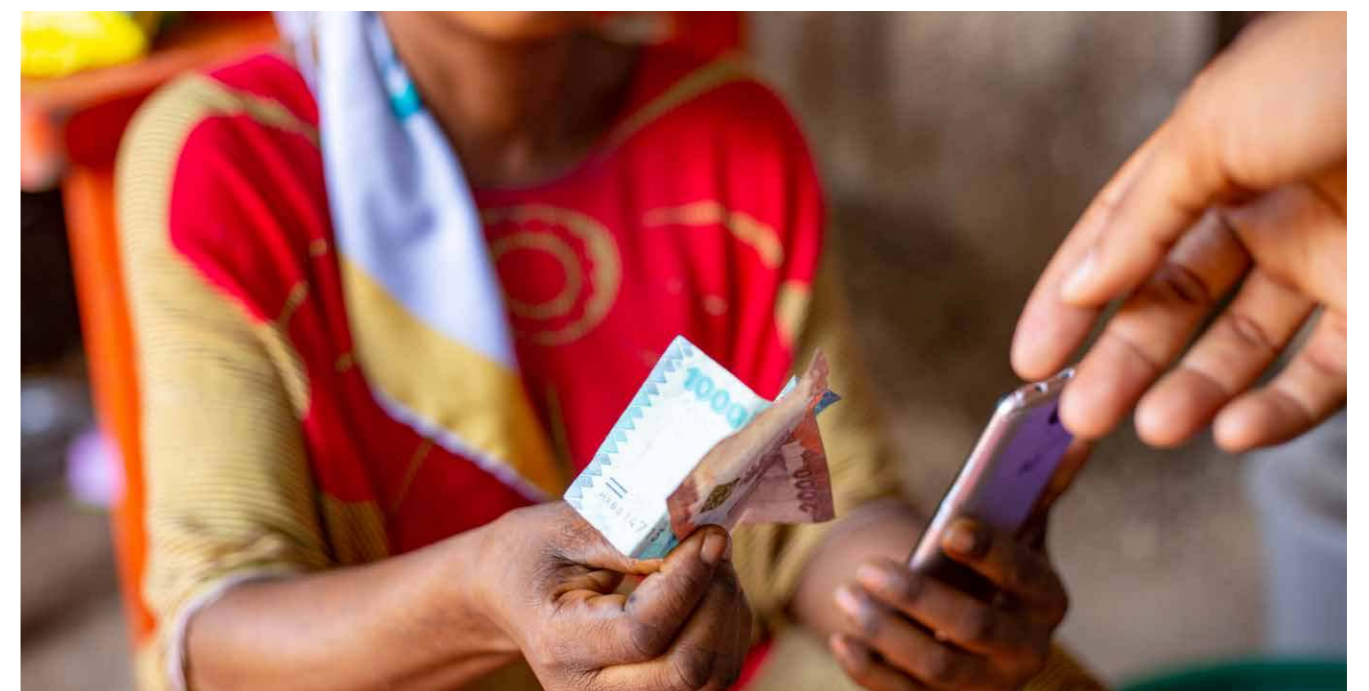
Mobile operators are well-positioned to leverage their technical platforms, making them widely accessible to a range of innovative utility service providers. Despite this win-win, many PAYG utility providers still face lengthy administrative and technical barriers working with mobile operators to set-up seamless mobile money integration with real-time notifications. Those mobile operators that seize this opportunity are likely to reap

the benefits of increase brand recognition and value, and customer loyalty.

Scaling PAYG solar, or other PAYG products, depends on specialised sales and customer support which differs significantly from existing mobile operator agent network and customer support activities. Unlike the sale of mobile services, the success of PAYG solar depends on targeting the 'right' customers who likely have the ability and willingness to repay the loan. Incautious lending will quickly kill any asset financing business. PAYG providers' specialisation in this area creates the opportunity for mobile operators to reach particular customer segments with critical, and 'sticky', services, and without bringing consumer debt onto the balance sheet.

The PAYG opportunity beyond solar is enormous, again reflecting the need and the extent of pent-up demand for affordable pathways to access essential goods and services. PAYG provider and mobile operator partnerships are central to meeting this need. Each side brings value the other does not, PAYG models have mobile services at their core, and PAYG providers have capabilities and a reach that many mobile operators do not.

Deepening these partnerships brings value to both sides, and ultimately results in reaching end users with products and services they have traditionally been excluded from.

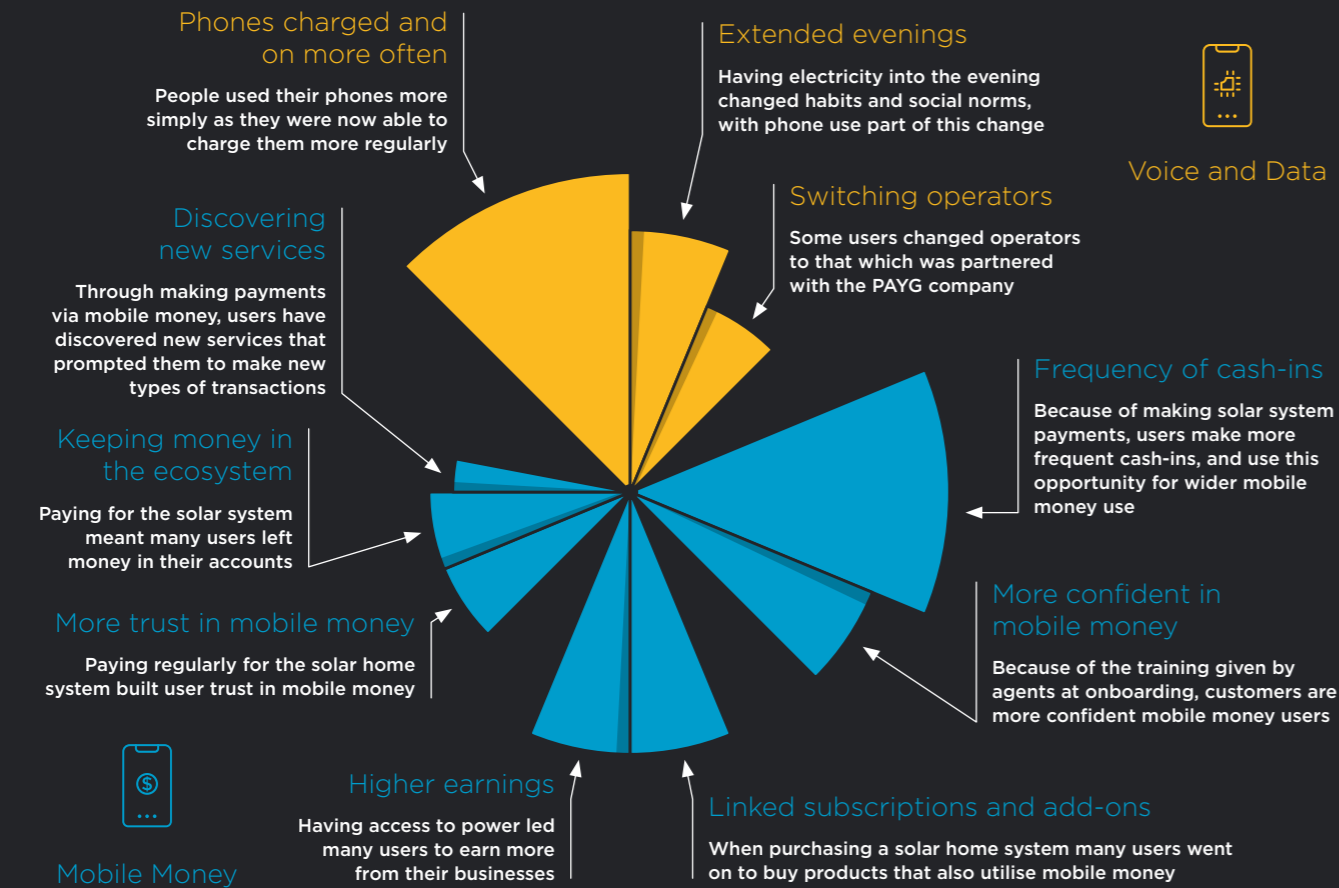


1. All investment data from <https://www.gogla.org/access-to-finance/investment-data>



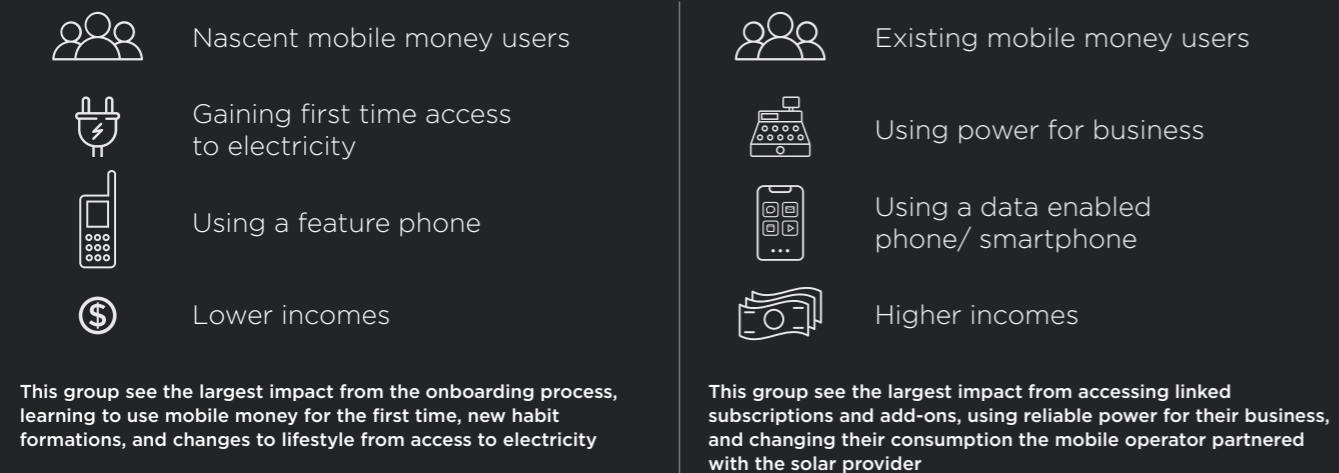
Key reasons why people changed their behaviour

The research identified 10 key reasons why people changed their behaviour. These are categorised by if they primarily affected mobile money usage, the use of voice and data services, or both. The size of the factor indicates how significant it is.



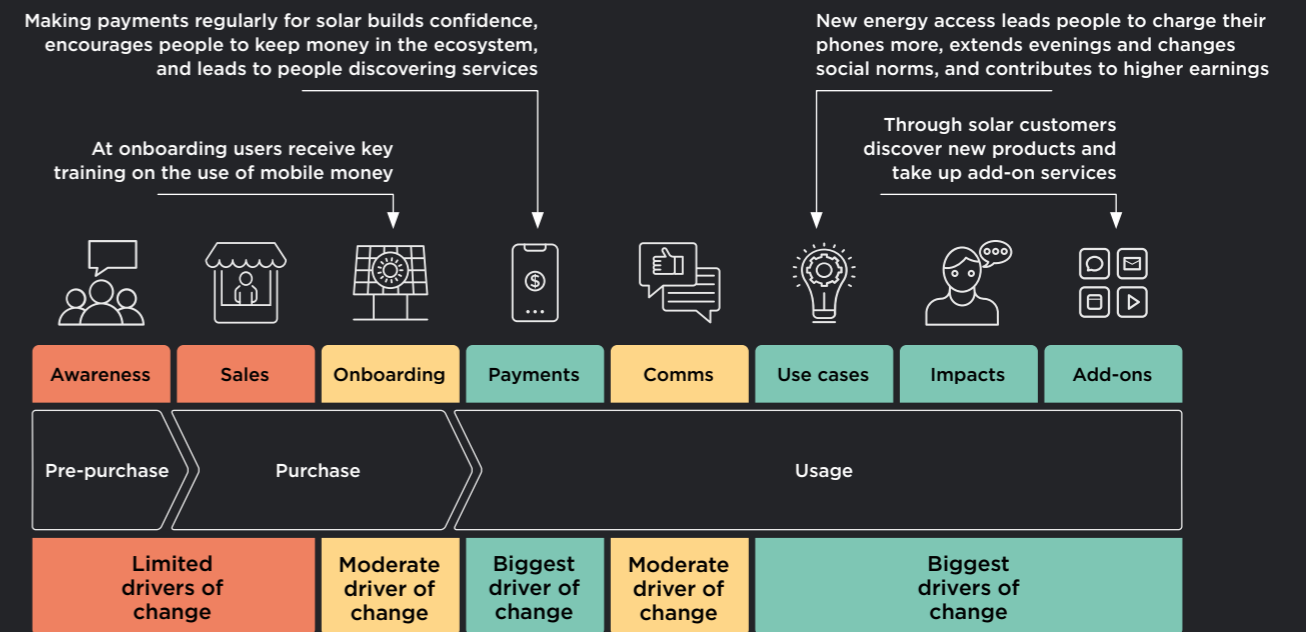
Who changes their behaviour?

We identified two key persona groupings



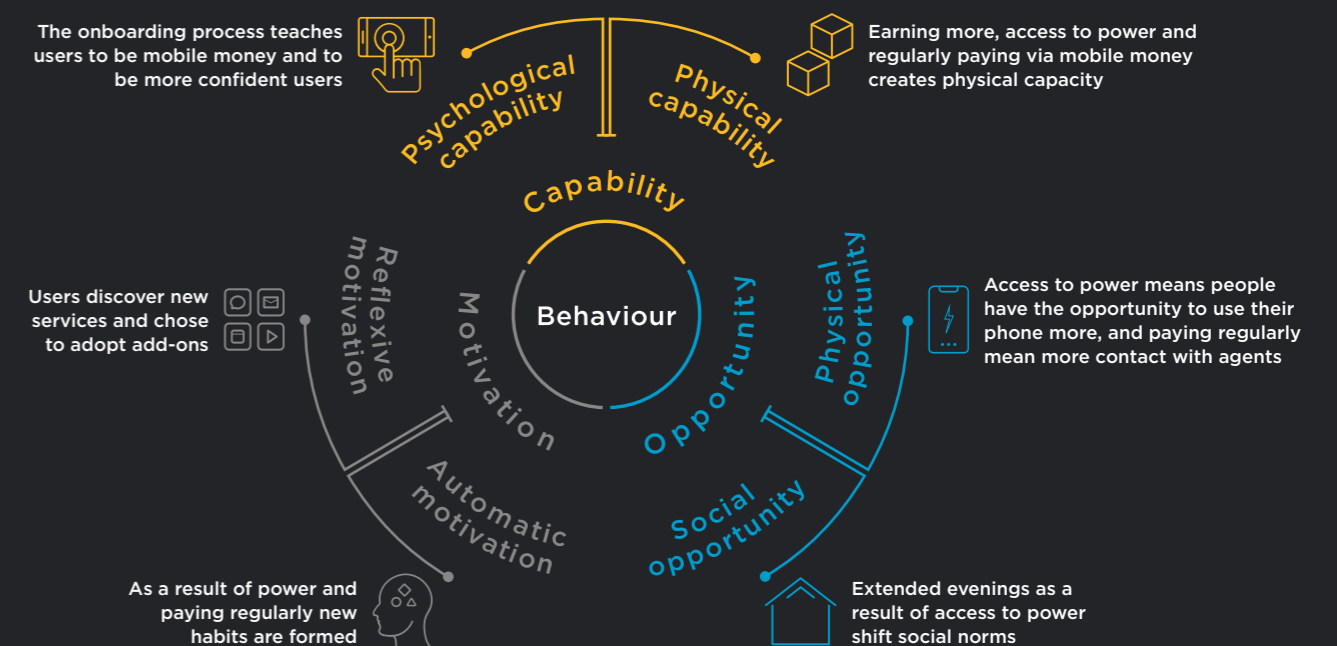
When does behaviour change occur?

We have identified the key moments of behaviour change on the solar home system customer journey. This mapping highlights which moments are most significant, and where partnerships are most relevant.



How does behaviour change?

For behaviour to change capabilities, opportunity, and motivation need to come together. The figure below highlights how these are influenced by PAYG solar adoption



Introduction



Pay-as-you-go (PAYG) technologies, combined with mobile payments, have enabled a new wave of consumer asset financing for low-income customers. PAYG locking technology, enabled through mobile machine-to-machine (M2M) communication, has opened access to essential services for low-income and unbanked customers, provided opportunities for them to build a credit history, and made it cost-effective and less risky for service providers to collect and manage payments from remote customers.

PAYG solar has emerged as one of the strongest use cases for this technology. In less than a decade, the PAYG solar sector has matured from a handful of pilots to a global industry of diverse and growing companies. PAYG technology is increasingly being used for smartphone financing, cookstoves, water meters, solar water pumps and other solutions. This trend is only set to accelerate in the years and decades to come.

PAYG solar providers and mobile operators: Natural allies

The synergies between mobile operators and PAYG solar providers have been clear from the start. Mobile operators provide the basic ingredients for PAYG – mobile money and connectivity – while PAYG solar boosts operator revenues from mobile money transactions and other services, aided by reliable phone charging. Association with a core utility service also allows mobile operators to strengthen their value proposition and gain customer trust.

Mobile operators seeking to engage with the PAYG solar sector have a range of options depending on their strategic objectives and appetite for risk:

- **Basic engagement** – mobile operators allow PAYG companies to integrate with their mobile money platforms;
- **Intermediate engagement** – operators may work more strategically with partners by leveraging their brand or agent/storefront network for distribution; and

- **High engagement** – operators seek to gain more value by leading their own PAYG services. Even if they outsource their products from vendors, by leading the business model and strategy, operators take on all ownership and risk.

The emergence and growth of the PAYG solar sector

Since 2013, the Mobile for Development (M4D) Innovation Fund has awarded grants to mobile-enabled off-grid energy services, including several frontier companies that provide PAYG solar home systems (SHS). The Fund has awarded grants to both PAYG solar companies working with mobile operators and, in a few cases, directly to mobile operators.²

The PAYG solar sector has grown rapidly over the last few years and now provides hundreds of millions of people with clean electricity. As of 2020, it is estimated that off-grid solar provides lighting and energy services to more than 420 million people.³ With this growth has come increased investment in the sector. When the GSMA began awarding grants for PAYG solar in 2012–2013, annual investment in the sector was \$20 million per year. This has since risen to more than \$300 million per year by 2020. Since 2012, \$1.9 billion has been invested in the sector, \$1 billion of which in the last three years.⁴

From PAYG solar to PAYG everything

The World Bank estimates there is a total potential market of 1.8 billion people for off-grid energy products and that there will be 823 million users by 2030 based on current growth.⁵ There is therefore plenty of room for the off-grid solar sector to grow and diversify its product offerings.

2. Some previous grantees include (date of award in parenthesis): M-KOPA (2013), Mobisol (2013, later acquired by Engie), Lumos (2013), Fenix International (2014, later acquired by Engie), PEG Africa (2013), D.LIGHT (2015), Gham Power (2015), SunCulture (2015), Solshare (2015), Orange Energie (2017), Brighterlight (2017), Altech (2019), Bboxx (2019) and EarthSpark, among others. Grants from 2019 onwards were exclusively for trialling models in humanitarian contexts.

3. Lighting Global. (2020). *Off-Grid Solar: Market Trends Report 2020*.

4. All investment data from: <https://www.gogla.org/access-to-finance/investment-data>

5. Ibid.



FIGURE 1
PAYG retail and lending value chains

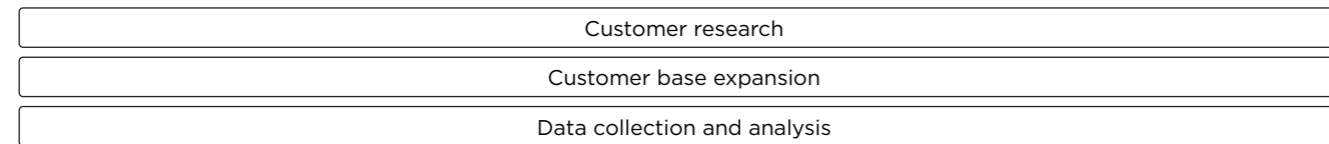
Retail (durable goods) value chain



Lending/leasing value chain



Supporting activities



Source: Adapted from Sotiriou, Alexander G., Pepukaye Bardouille, Daniel Waldron, and Gianmaria Vanzulli. (2018) *Strange Beasts: Making Sense of PAYGo Solar Business Models*. Washington, D.C.: CGAP.

As the off-grid solar sector has matured, companies have begun specialising in different parts of the value chain, from developing and manufacturing proprietary hardware to sales, distribution and consumer financing. According to a report by CGAP and the IFC,⁶ many PAYG solar companies started out as vertically integrated businesses that heavily integrated their retail and lending arms out of necessity. However, these two sides of the business have very different value chains, business operations and risks (Figure 1), and while many companies remain highly integrated, others have specialised in different parts of the value chain or focused on only one value chain.

By specialising over time, many PAYG SHS companies have acquired deep expertise in asset financing for low-income consumers. Additionally, previously unbanked consumers have been able to build a credit history through repayment of their loans. The combination of these two factors is allowing PAYG solar companies to offer a wider range of products and financial services, including smartphone offerings, which are of particular interest to mobile operators. That the solar home system remains a lockable asset means that this wider offering can include goods without locking technology as the solar system can be used as collateral.

For example, M-KOPA's product range has grown to include smartphones, televisions, refrigeration, cookstoves and loan and insurance products.⁷ Similarly, Bboxx has launched a partnership with the Government of Togo to provide PAYG smartphones to accelerate digital adoption.⁸ An earlier example is Fenix International's trial use of SHS as collateral for other loans, whereby they offered school loans secured against a locking SHS.⁹

The value of PAYG solar for mobile operators: Past research

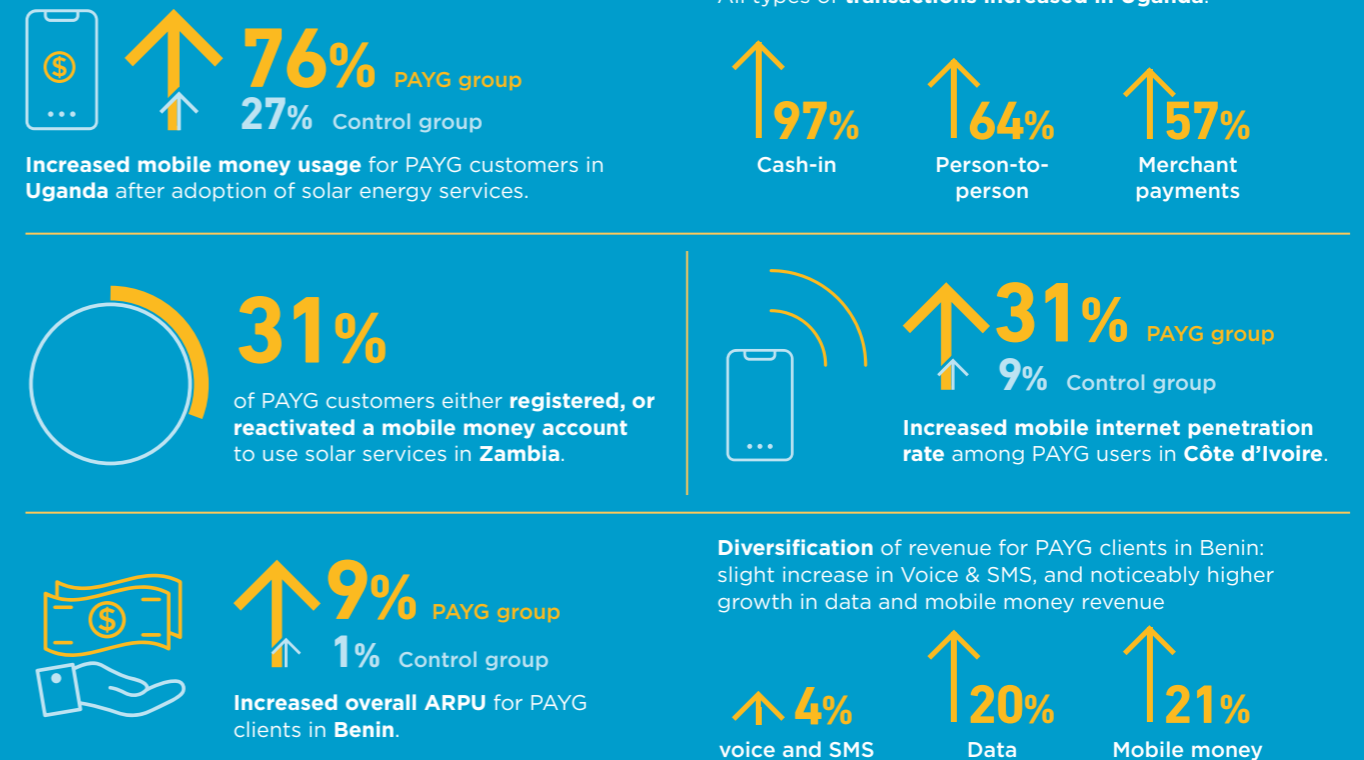
In May 2020,¹⁰ the GSMA, in partnership with eight mobile operators, conducted a quantitative study to explore the connection between customer uptake of PAYG solar and engagement with mobile services. The study looked at the impacts of PAYG uptake on the use of mobile money, airtime, data and financial services.

The study analysed call detail record (CDR) data for the six months before and after a new PAYG SHS was

6. Sotiriou, A. et al. (2018) *Strange Beasts: Making Sense of PAYGo Solar Business Models*. Forum 14. CGAP and IFC.
7. See: <https://m-kopa.com/products/>
8. Bboxx. (27 September 2021) *Bboxx and Government of Togo sign first ever MoU to sell smartphones*. Press release.
9. See: <https://www.cgap.org/blog/grid-solar-company-helping-customers-pay-school-fees>
10. GSMA (2020) *The Value of pay-as-you-go solar for mobile operators*

FIGURE 2
The value of PAYG solar for mobile operators

Key Results:



Increased usage goes **beyond solar** payments. All types of **transactions increased in Uganda**.

Increased mobile money usage for PAYG customers in Uganda after adoption of solar energy services.

31% of PAYG customers either **registered, or reactivated a mobile money account** to use solar services in Zambia.

Increased mobile internet penetration rate among PAYG users in Côte d'Ivoire.

Increased overall ARPU for PAYG clients in Benin.

Diversification of revenue for PAYG clients in Benin: slight increase in Voice & SMS, and noticeably higher growth in data and mobile money revenue

activated. This analysis was conducted for cohorts of customers adopting PAYG solar by month, and was completed by analysts at the mobile operators. The results for SHS adopters were then compared with a comparison group of customers (selected by mobile operators) who had a similar customer profile at the time the SHS was adopted.

Data on more than 200,000 PAYG customers of eight mobile operators in five markets¹¹ were analysed. Among other findings, the data revealed that:

- **PAYG solar customers became higher value customers for mobile operators.** The average revenue per user (ARPU) was nine per cent higher than the comparison group.

- **PAYG solar customers opened or reactivated mobile money accounts.** Across the five markets, 21 to 31 per cent of PAYG customers were new to mobile money or had reactivated accounts.
- **PAYG solar customers increased their mobile money usage.** This increase ranged from 27 to 113 per cent.
- **PAYG solar customers used mobile money more frequently and for transactions other than energy.** In Benin, there was an increase of 65 per cent (excluding solar transactions) and in Uganda there was a 60 per cent increase.

Source: GSMA (2020) *The Value of Pay-as-you-go Solar for Mobile Operators*

11. Benin, Côte d'Ivoire, Rwanda, Uganda and Zambia

The value of PAYG solar for mobile operators: New insights



Earlier GSMA research clearly demonstrated the value of PAYG solar for mobile operators. However, it did not shed light on the reasons customers changed their behaviour. To understand why, how, when and which customers changed their behaviour, the GSMA partnered with two mobile operators from the previous study to conduct more in-depth qualitative research on the customer journeys of PAYG solar clients.

The study was conducted in Côte d'Ivoire and Benin in partnership with the mobile operator and corresponding PAYG solar provider:

- In Côte d'Ivoire, this was Orange (operator) and its in-house SHS provider, Orange Energie; and
- In Benin, this was MTN (operator) and independent SHS provider Engie Energy Access (Engie), previously called Fenix.

An updated second round of quantitative analysis and additional in-depth qualitative interviews with customers identified the drivers and barriers to increased use of mobile services, and generated recommendations for how partnerships could unlock the most value. The remainder of this section outlines the methodology for the qualitative research, including the research frameworks used and the sampling and interviewing of respondents.

Methodology: Sampling and respondents

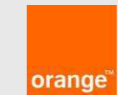
The methodology for the study involved two key stages. In the first stage, the analysis of the CDR data was repeated and updated for recent SHS customers. Details of this methodology can be found in the previous GSMA report.¹² In the second stage, a sample of customers were selected for in-depth interviews.

In each of the two markets, 60 PAYG solar customers were selected based on changes to their use of mobile services. Grouping these customers as 'doers' and 'non-doers' and first-time and super users (see Table 1) allowed us to identify customers that had changed their behaviour after adopting an SHS.

¹² GSMA. (2020). *The Value of Pay-as-you-go Solar for Mobile Operators*.

FIGURE 3

Mobile operator and SHS partners



Côte d'Ivoire:
Orange Energie and Orange

Orange Energie

Orange Energie was founded in 2018 and has 10,000 customers that it has reached via four Orange Boutiques and partnerships with Société Ivoirienne De Télédiffusion (IDT) and others, including 10 kiosks and 72 mini-kiosks and door-to-door agents. They offer two primary kits that are paid off over three years, after which the customers own them. Optional add-ons include radios, torches, additional lights, fans and an additional two-year guarantee.

Orange Côte d'Ivoire

Orange is Côte d'Ivoire's largest mobile network operator. Their mobile money platform, Orange Money, has more than four million active clients who have access to both mobile wallets and savings, loans, insurance and remittance products.



Benin:
Engie Energy Access and MTN

Engie Energy Access

Engie Energy Access (previously known as Fenix) was founded in 2018 and has quickly grown to service 120,000+ solar home customers via their 40 branded stores, 50 partner distribution stores and 1,000 door-to-door agents. Their nine different SHS kits include a variety of add-ons, and they offer two-year loans, after which customers own the equipment with an additional two- to three-year guarantee.

MTN Benin

MTN has more than six million customers, 2.8 million of which are actively using mobile money. Through its network of 54,000+ agents, MTN Mobile Money customers are accessing the platform's cash-in, cash-out and bill payment services. In addition, the platform offers insurance and remittance services with future expansion planned for savings and lending products.



TABLE 1
Qualitative sampling groups

Group	Definition	Sample
Group 1 <i>Mobile money doers</i>	SHS customers that increased their mobile money use (number of transactions) by more than 80% in the six months after SHS adoption compared to the six months before.	<ul style="list-style-type: none"> Benin: 12 Côte d'Ivoire: 11
Group 2 <i>Mobile money super users</i>	SHS customers that increased their mobile money use (number of transactions) by more than 120% in the six months after SHS adoption compared to the six months before.	<ul style="list-style-type: none"> Benin: 12 Côte d'Ivoire: 13
Group 3 <i>Voice and airtime doers</i>	SHS customers that increased their voice/ airtime usage (revenue from voice) by more than 80% in the six months after SHS adoption compared to the six months before.	<ul style="list-style-type: none"> Benin: 8 Côte d'Ivoire: 8
Group 4 <i>Data doers</i>	SHS customers that increased their data consumption (volume of data used) by more than 80% in the six months after SHS adoption compared to the six months before.	<ul style="list-style-type: none"> Benin: 8 Côte d'Ivoire: 8
Group 5 <i>First-time data users</i>	SHS customers that used data (any amount) in the six months after SHS adoption but had not consumed any data in the six months prior to adopting the SHS system.	<ul style="list-style-type: none"> Benin: 8 Côte d'Ivoire: 8
Group 6 <i>Non-doers</i>	SHS customers that did not increase their use of mobile money, voice or data in the six months after SHS adoption compared to the six months before.	<ul style="list-style-type: none"> Benin: 12 Côte d'Ivoire: 12
	Total	<ul style="list-style-type: none"> Benin: 60 Côte d'Ivoire: 60

In each market, the mobile operator (Orange and MTN) recruited customers via SMS or by calling them. Their consent was obtained to be contacted for the study.

To eliminate the risks associated with COVID-19, interviews were conducted by telephone. These interviews generally lasted between 45 and 60 minutes.

In Côte d'Ivoire, the vast majority of interviews were conducted in French (98 per cent) and one in Baoulé (two per cent).

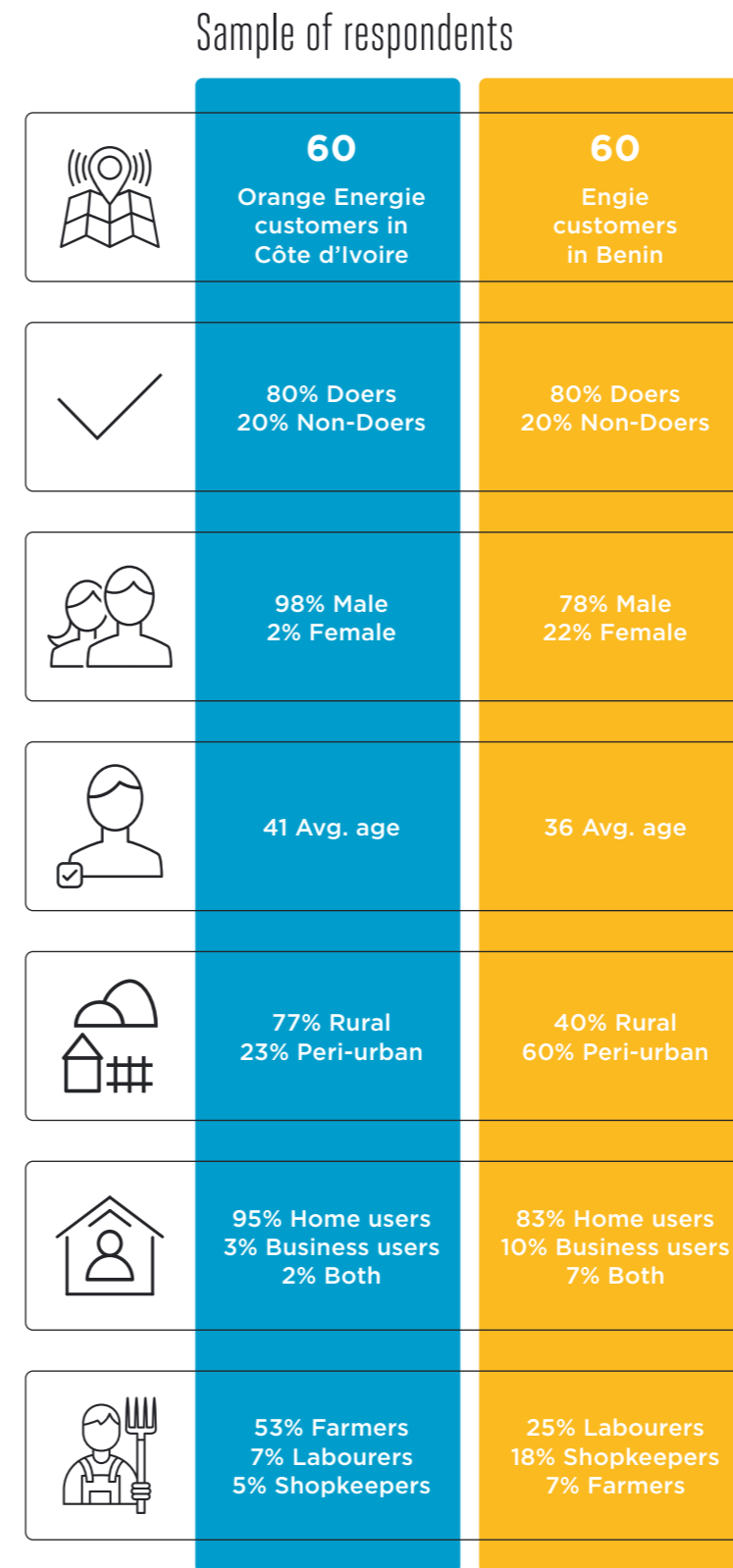
In Benin, the interviews were conducted in a mixture of Fon (50 per cent), French (47 per cent) and Goun (two

per cent). The interviews were recorded, transcribed and translated prior to analysis.

The interviews were conducted in July and August 2021 with customers that had started using their SHS in the last three to four months of 2020.

The profiles of respondents differed slightly in each market. In general, respondents in Côte d'Ivoire were more rural and there was a higher proportion of farmers. A slightly higher number of respondents in Benin used their SHS for business purposes. In both markets, respondents were overwhelmingly male. This was because respondents were identified based on

FIGURE 4
Profile of respondents



the phone number used to pay for the SHS. It is a weakness of the research that findings were not able to be disaggregated by gender, and future research in this area would be valuable.

Analysis of the interview transcripts revealed key drivers of behaviour change. These were identified in two ways: i) by confirming or refuting hypotheses developed in advance of the data collection (see the Appendix for details); and ii) through an exploratory analysis that identified common themes in the transcripts. Three research frameworks were used to examine the key drivers of behaviour change, which are outlined below.

Methodology: Understanding behaviour change

To understand customer behaviour, three frameworks were used to examine three dimensions of behaviour change:

1. When was behaviour change triggered? This was explored using the SHS Customer Journey Framework.
2. How did each driver change behaviour in mobile use? The motivations of customers were examined using the Capabilities, Opportunity and Motivation Behaviour Change (COM-B) framework.
3. For whom is each driver changing behaviour? This was examined by considering the characteristics of customer personas most relevant to behaviour change.



When: The SHS customer journey

Although the customer journey of each SHS provider differs slightly, a customer journey framework was developed by industry researchers that studied PAYG SHS customers in Rwanda.¹³ Our research team adapted that journey, as shown in Figure 5, to highlight key points

in the pre-purchase, purchase and usage stages where SHS may be able to drive behaviour change. It should be noted that while the customer journey has been simplified into a linear graphic, customers often move along this journey in non-linear ways. Overall, Orange Energie and Engie share a very similar journey, although there are some key differences, as shown in Figure 5.

13. Kizilcec, Vivien; Parikh, Priti; Bisaga, Iwona (2021) *Examining the journey of a pay-as-you-go solar home system customer: a case study of Rwanda*. Loughborough University. Journal contribution.

FIGURE 5
The SHS customer journey

			Shared customer journey features between Orange and Engie	Unique features
Pre-purchase	Awareness	Roaming agents Radio / TV / SMS Word-of-mouth / In-store Social media	Engie relies more heavily on door-to-door agents and demos while Orange relies more on radio.	
	Sales	Self-branded stores Self-branded agents Authorised distributors Call centres	Engie agents often frame cost as a daily amount. Orange agents often frame cost as a monthly amount.	
	Onboarding	In-person training: - How to use SHS - How to pay	Engie follows up with an in-person visit three days after installation. Orange follows up by phone.	
Purchase	Payments	Mobile money only	Although both offer similar flexible options, Engie customers tend to pay smaller amounts more frequently. Orange customers tend to pay weekly or monthly.	
	Comms	SMS pay reminders Call centre	Payment reminders are sent by Engie more often since their customers make smaller, more frequent payments.	
	Use cases	Lights Phone charging TV	All Orange SHS packages include TVs, but Engie only includes TVs in top-tier packages. Engie uniquely offers packages with hair clippers and speakers.	
Usage	Impacts	Quality of life More time at work Extra earnings/New businesses/jobs Extended study hours	No major differences between Orange and Engie.	
	Add-ons	Orange and Engie both offer TVs, but it is standard in all packages with Orange whereas it is an add-on with Engie.	Orange offers fans as future add-ons. Engie offers fewer add-ons, but more diverse bundles overall.	

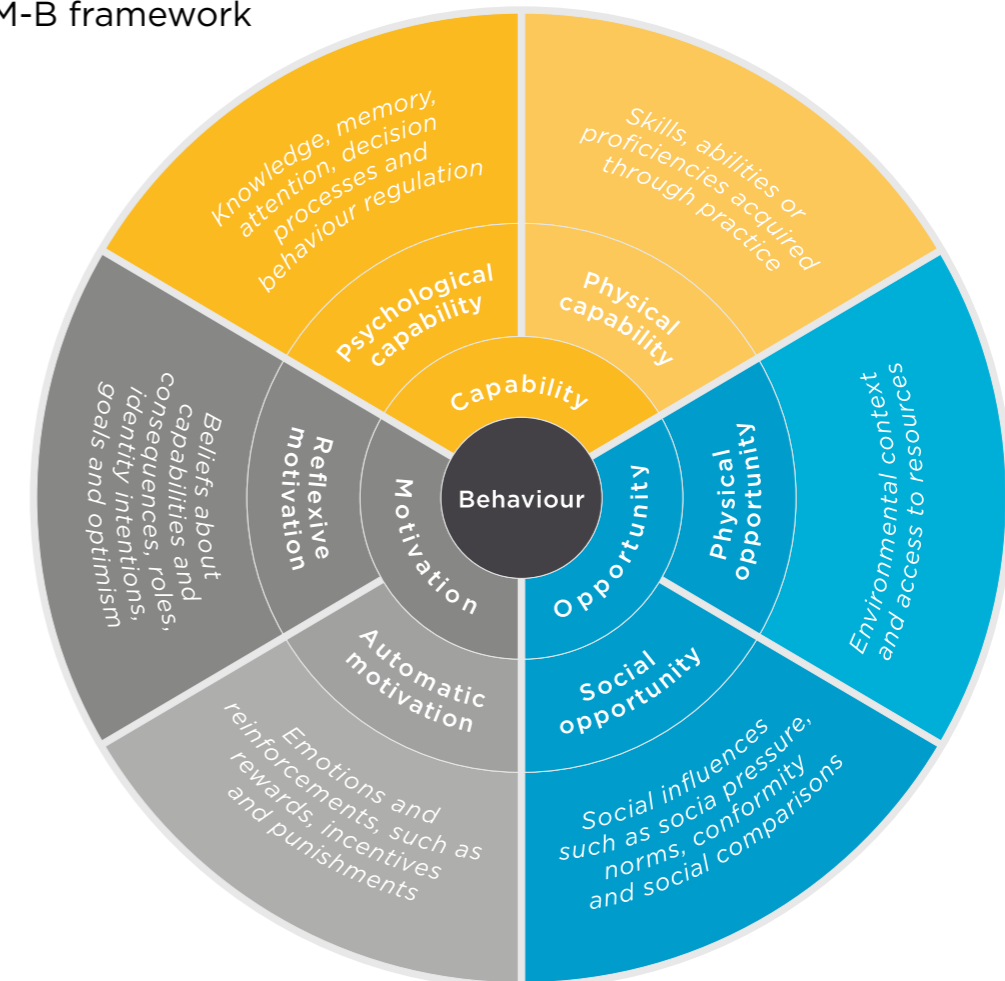
How: The COM-B behaviour change framework

The COM-B¹⁴ behaviour change framework explores how capabilities, opportunities and motivations influence behaviour choices. These categories help to isolate how drivers of behaviour change are working and to identify strategies that promote behaviour change. Each of the three categories is further divided into two subcategories, as shown in Figure 6.

- Opportunities
 - Physical: Opportunities involving resources (money/time); and
 - Social: Opportunities involving other people/ organisations.
- Motivations
 - Reflective: Conscious thought processes (plans, choices, risk management); and
 - Automatic: Subconscious motivators (desires, habits).
- Capabilities
 - Physical capability involving a person's physique/body; and
 - Psychological: Capability involving one's mental function.

14. See: Michie, S., van Stralen, M.M. & West, R. (2011) *The behaviour change wheel: A new method for characterising and designing behaviour change interventions*. Implementation Sci 6, 42.

FIGURE 6
The COM-B framework





Who: Developing customer personas

Like many companies, PAYG SHS providers may observe that customers with similar profiles exhibit similar behaviours. These similarities may be based on demographics and lifestyle, behavioural or attitudinal factors. These groups are often referred to as 'personas' or segments of users who are clustered together to

better understand existing behaviour or to target them for behaviour change interventions.

In this research, direct engagement with providers and interviews with SHS customers revealed several characteristics that may influence whether they are likely to change their mobile usage behaviour. Six of the most important characteristics used in the analysis are highlighted in Figure 7.

FIGURE 7

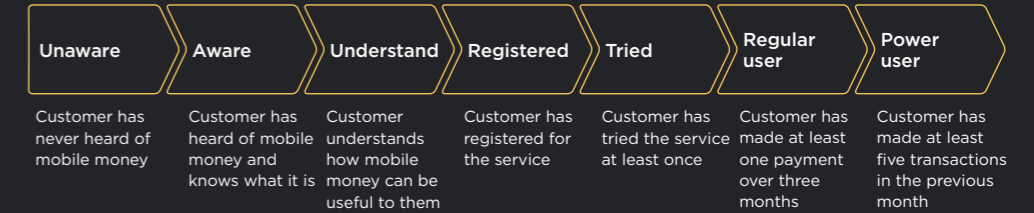
Key characteristics of SHS customer personas



Mobile money journey

Where the customer was on their mobile money journey prior to SHS adoption

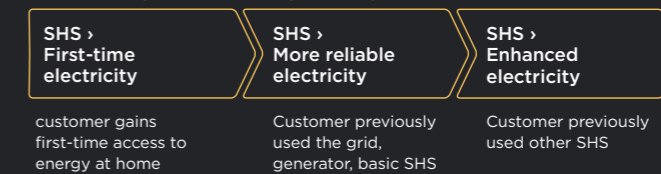
Mobile money customer journey



Electricity journey

Electricity access the customer had prior to SHS adoption

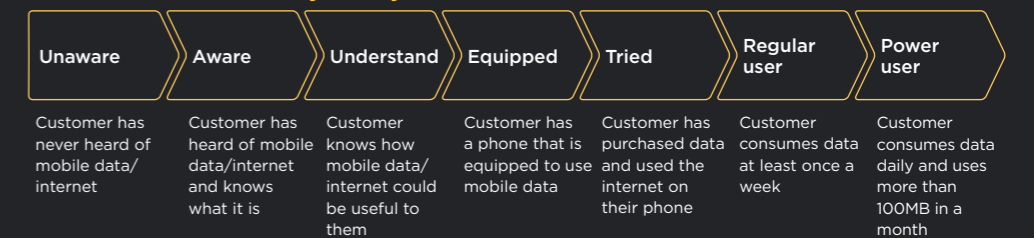
Electricity customer journey



Mobile data journey

The mobile data usage patterns of the customer prior to SHS adoption

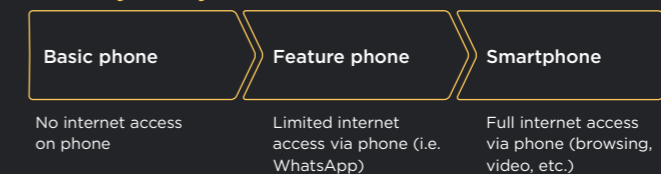
Mobile data customer journey



Mobile device

How data-equipped is the customer's mobile device is

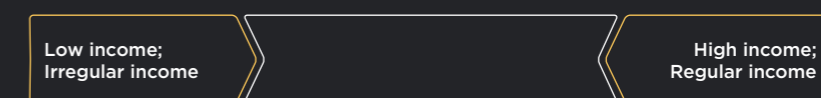
Device journey



Income

How much and how regular the customer's income is since they started using their SHS

Income



Proximity to a mobile money agent

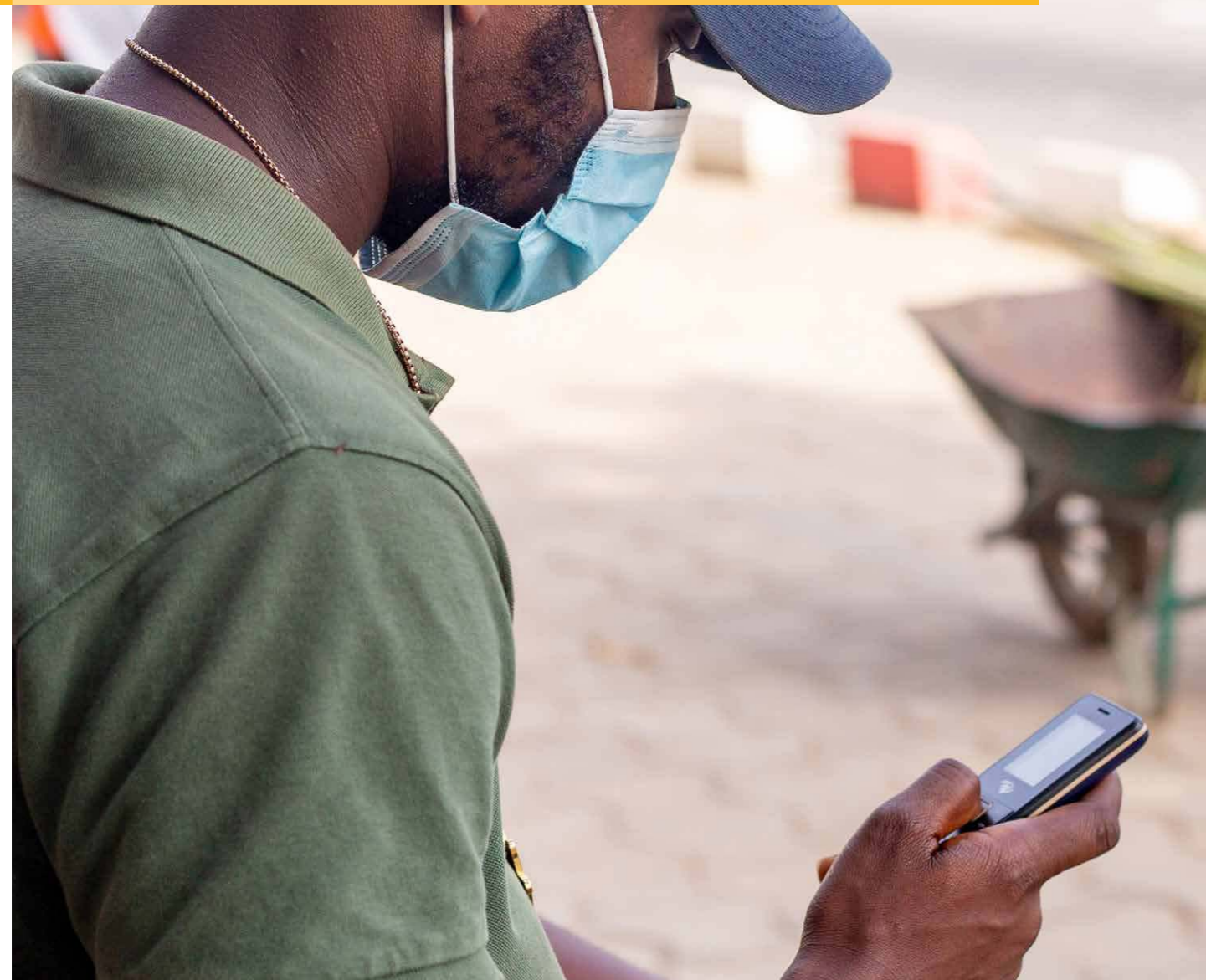
How close an SHS customer lives to a mobile money agent

Proximity to mobile money agents





Key factors driving behaviour change



This section discusses the 10 key factors driving behaviour change or, in other words, why SHS customers changed their behaviour. Each of these factors is discussed individually and addresses when, how and for whom this behaviour changed. This section also presents an updated analysis of mobile operators' CDR data for recent solar customers.

The 10 drivers of behaviour change are grouped by the two main changes observed in mobile use: increased voice and data consumption and increased use of mobile money (see Figure 8).

While interviews indicated that each of these drivers primarily influenced one of these behaviours (voice/data or mobile money), there was some overlap and the drivers may influence both.

- **Phone charged and on more often:** Could also influence mobile money use, although interviews did not reveal uncharged phone as a primary barrier to mobile money uptake.
- **Extended evenings:** Could also increase mobile money use, especially when mobile money agents are open later.
- **Higher earnings and Keeping money in the ecosystem:** Additional money stored in mobile money accounts can be used to purchase more voice/data.

Voice and data usage

The analysis of CDR data shows that in both Benin and Côte d'Ivoire, voice and data usage jumped sharply for SHS customers after adoption. This is also reflected in increased ARPU across services:

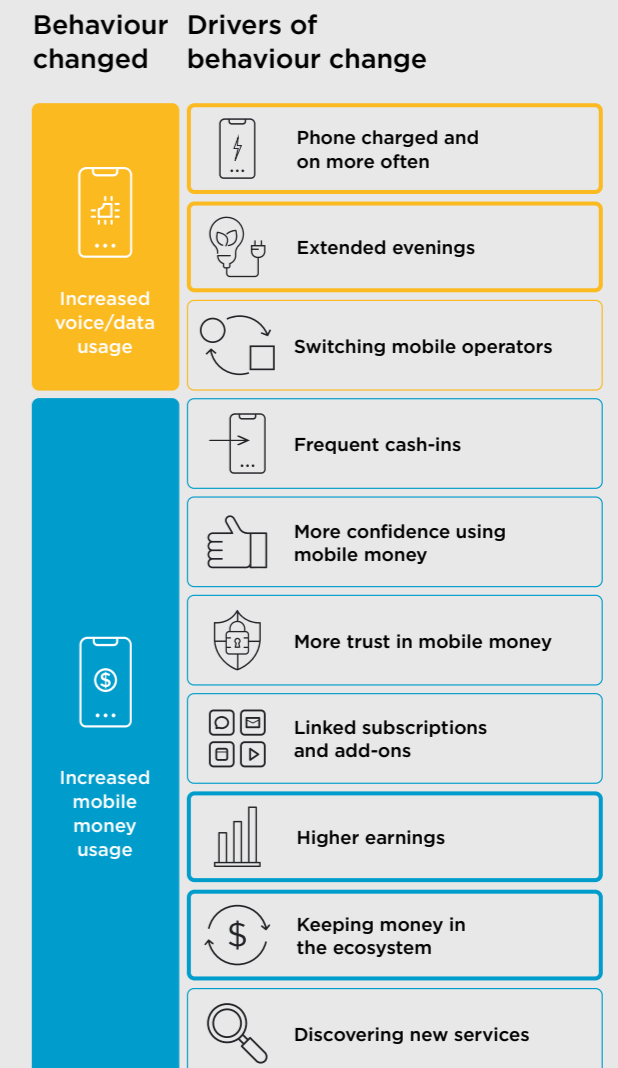
- In Côte d'Ivoire, revenue from all sources increased by nine per cent in the six months after SHS adoption compared to the six months before. By contrast, there was a one per cent drop in revenue for the comparison group; and
- In Benin, ARPU for SHS customers increased by 17 per cent overall, with a 10 per cent increase in voice and SMS revenue and a 24 per cent increase in data revenue.

The following drivers were identified as having the biggest impact on customer behaviour changes in voice and data usage:

- Customers were able to charge and have their phones on more often;
- Lighting products extended people's evenings; and
- In some cases, SHS adoption meant that customers switched mobile operators and began using their services more.

FIGURE 8

Key drivers of behaviour change





Phones on and charged more often

By far the greatest impact on increased data and voice usage is that SHS allow users to charge their phones more easily and, therefore, use their phones more often.

Prior to having a SHS, many users would have to travel to access electricity, either through friends and family or by paying to charge their phones. These barriers prevented people from using their phones more often and more extensively. Phones were more likely to remain out of power for extended periods. Other times, people would intentionally switch off their devices to preserve remaining battery life for important calls or activities later.

PAYG SHS allow people to use their phone for more hours in a day and without having to worry whether certain uses, such as data consumption, would deplete the battery too quickly. Greater availability of powered devices therefore also translates into greater use of data and voice services.

73% of 'doers' in Côte d'Ivoire said they charge their phone more



"I used to go 2-3 days without my mobile phone on. Now I have it in my hand 24 hours a day."
Celine, Côte d'Ivoire

"I used to charge my phone at people's houses. I left it there for charging and I would miss calls. I can charge at night and in my own house."
Imourana, Benin

"I buy more data because I know my phone stays on more now."
Christophe, Côte d'Ivoire

"It is thanks to the solar panel that I no longer stay out of the coverage area; my phone is always on."
Codjo, Benin

Extended evenings

SHS users often have more leisure, social and work time later in the evenings since their homes are now powered with electricity. This extra time is often spent on activities that consume data and voice services.

With more light, households are also awake later in the evening, often engaging with family and neighbours. Likewise, for SHS users who purchased a TV, family and friends often gather late into the night to watch news, sports and entertainment programmes.

As behaviours and social norms shift due to newfound electricity, activities that rely on mobile data become more mainstream. For example, users with smartphones reported downloading music and movies.

Those who may have rarely used the internet before sign up for social media accounts and connect for the first time online with others through photos, videos and messages. Together, these changes in lifestyle organically lead to more data use for those who can afford it. In communities where PAYG SHS are present, there is a 'snowball' or 'herd' effect whereby other households also start to desire electricity, entertainment and information like their peers.

90% of doers in Benin said they have more time at night thanks to SHS

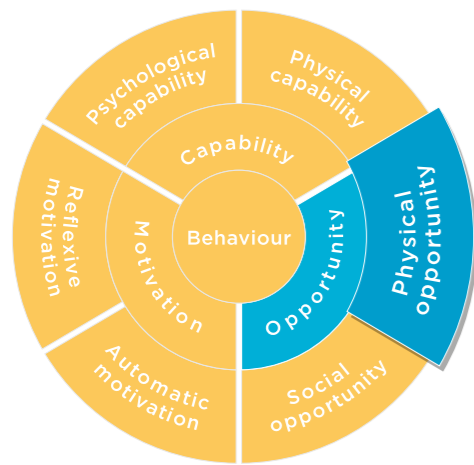


"We use the phone more at night for things like entertainment on social networks. Some days we sit outside at night because of the light and everyone is focused on their phone."
Arolle, Benin

"I use more data now because I need an internet package to download movies."
Dahouda, Benin

"Anytime when I'm not sleepy at night I get up, put the connection on and browse."
Yacouba, Côte d'Ivoire

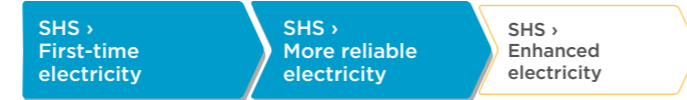
How is behaviour changed? (COM-B)



Physical opportunity: Thanks to new charging access in their homes, SHS create opportunities for increased usage.

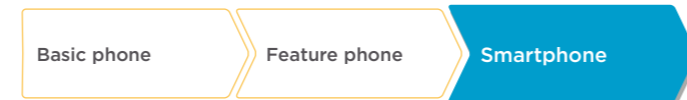
Who changes their behaviour? (Customer characteristics)

Electricity customer journey



Those at an **earlier stage of their electricity customer journey** are likely to change more as home charging is introduced for the first time.

Device journey



Those with more **advanced devices** stand to gain the most as their devices discharge more quickly than basic phones.

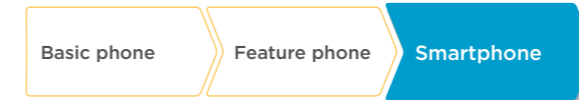
Who changes their behaviour? (Customer characteristics)

Electricity customer journey



Those at an **earlier stage of their electricity journey** stand to change more as evening light is introduced for the first time.

Device journey



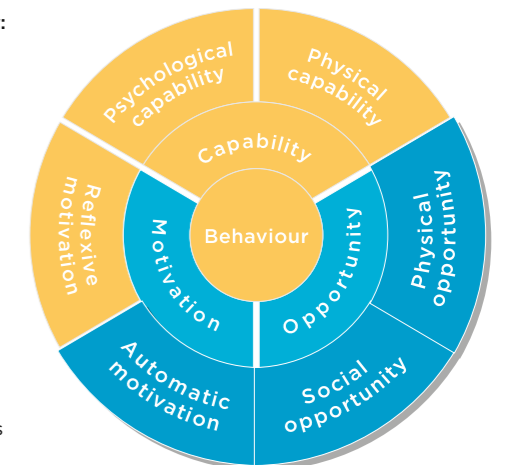
Those with more **advanced devices** stand to increase their data consumption most.

How is behaviour changed? (COM-B)

Physical opportunity: Thanks to extended light, customers can stay up and socialise later.

Social opportunity: SHS shift a community's social norms, encouraging more technology and data use.

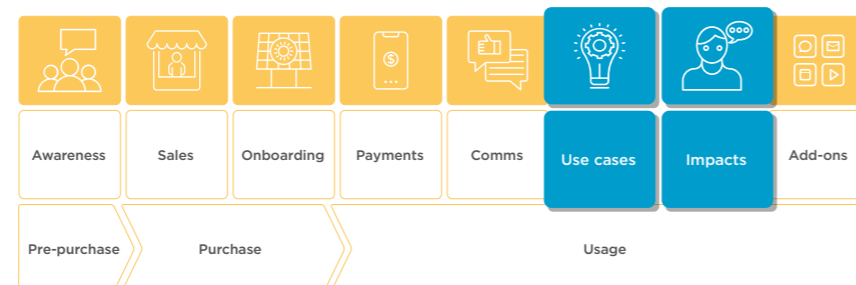
Automatic motivation: As customers have later evenings, they naturally form habits that result in higher data use.



When do we see behaviour change from SHS? (SHS journey)

Use cases: New electricity from the SHS allows users to charge and keep their phones on more often.

Impacts: Secondary impacts from SHS also drive users to keep their phones on more often.

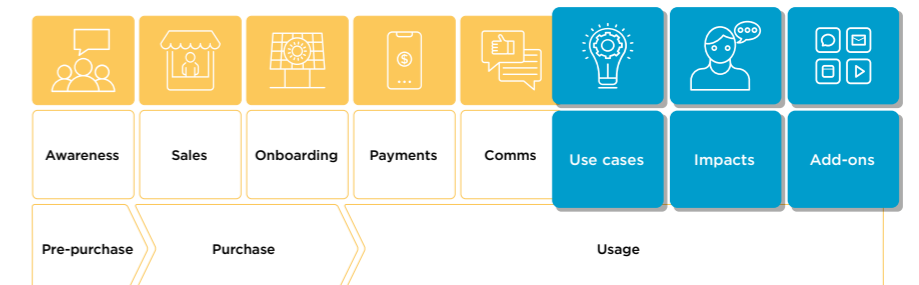


When do we see behaviour change from SHS? (SHS journey)

Use cases: New light and electricity create opportunities for more phone usage.

Impacts: More social time thanks to SHS drives changes in habits and social norms.

Add-ons: Those who upgrade to higher-level appliances like TVs stand to see even more impact.





Changing mobile operators

After purchasing an SHS, some users shift their data/voice business from one mobile operator to another. In some cases, users start engaging with a new mobile operator primarily because of their SHS. One user in Benin who had primarily used another operator before signing up for Engie, switched to MTN because of his SHS. After trying out data bundles purchased via mobile money, he started shifting his internet use to the new network, discovering that their service was more suited to his needs.



"We had MTN before, but only started really using the SIM card when we got Fenix [Engie]"
Firmine, Benin

"Since I bought Fenix [Engie], I've started using MTN Mobile Money more. I used to use a competitor's internet but now I buy it from MTN"
Edouard, Benin

How is behaviour changed? (COM-B)

Psychological capability: Using a mobile operator platform for SHS enables customers learn how to purchase other services, such as data.

Reflective motivation: Exposure to new product/purchase options can motivate SHS customers to consider alternatives to current services.

Automatic motivation: As SHS customers get in the routine of regularly paying for SHS via mobile money, they can likewise get in the habit of purchasing mobile services from the associated mobile operator.



Who changes their behaviour? (Customer characteristics)

Mobile money customer journey

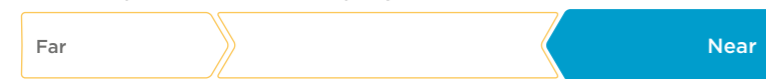


Mobile data customer journey



Those at an **earlier stage of their mobile money and mobile data journeys** are more likely to switch to competitor networks.

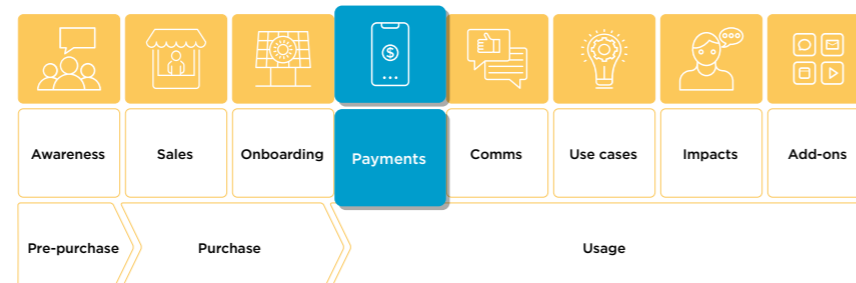
Proximity to mobile money agents



Those who are located **closer to mobile money agents** are able to take advantage of more frequent cash-ins.

When do we see behaviour change from SHS? (SHS journey)

Payments: Customers appear to primarily discover new products/services in the process of making payments via mobile money menus.



PERSONA 1

Emmanuel: Farmer and traveller



Gender: Male
Age: 40
Family: Wife and six kids; 13 living in household
Lives in: Rural camp (and small town)
Job: Cacao and rubber farmer

His SHS story: Emmanuel splits his time between farming in a rural 'camp' and his more permanent home in a town about 45 minutes away.

When he and his family are at the camp, they rely on their SHS for entertainment and to keep their phones charged more easily. Lights also provide an extra layer of security. At night, his wife and kids often watch TV (for which he subscribes to a satellite TV provider) while he reads the news on his smartphone and occasionally browses YouTube videos to learn about a new business he wants to start. Because of this he knows he's spending more each month on data.

He's been using mobile money for quite some time as he finds it safer than travelling with cash when he goes back to town. Because there isn't an agent close by in camp, he usually pays once a month when in town, or sometimes for two to three months at once after he sells his harvest.

- PHONE CHARGED AND ON MORE OFTEN
- EXTENDED EVENINGS
- LINKED SUBSCRIPTIONS AND ADD-ONS
- KEEPING MONEY IN THE ECOSYSTEM

Key characteristics

- Mobile money (pre-SHS):** Regular user; deposits money when travelling between the camp and town for safekeeping
- Electricity (pre-SHS):** No power in the camp, but limited grid power in town.
- Mobile data (pre-SHS):** Uses his smartphone data regularly to keep up on news and entertainment
- Proximity to mobile money agent:** Uses his smartphone data regularly to keep up on news and entertainment
- Income:** His farming income is seasonal, but he has multiple other jobs to smooth out income
- Device:** Has a smartphone

Increased mobile money usage

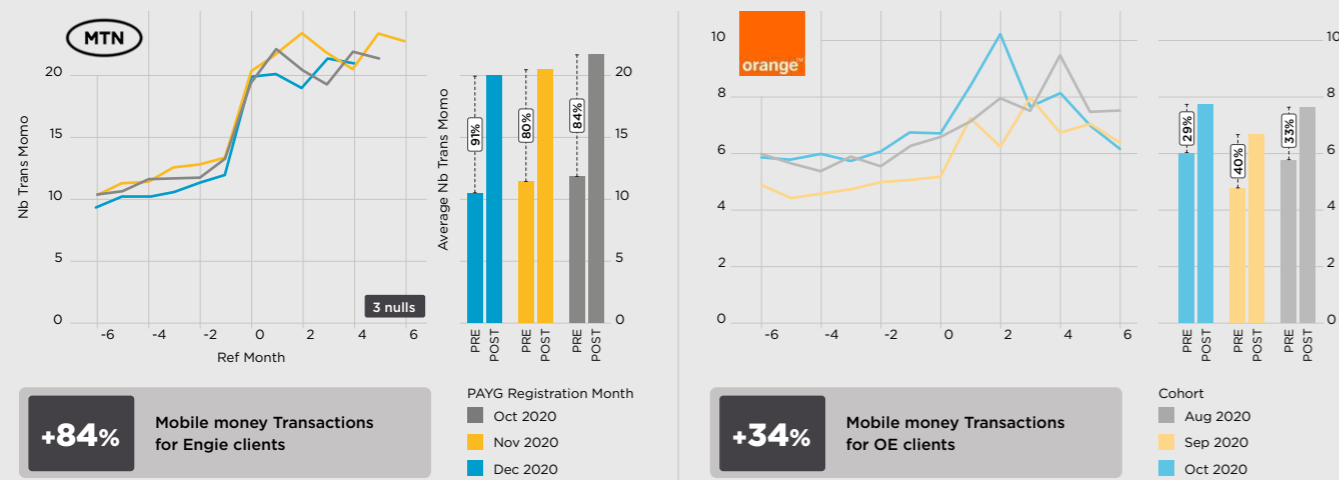
In both Benin and Côte d'Ivoire, mobile money usage by SHS customers jumped sharply after they adopted their systems. In Côte d'Ivoire, the average number of monthly transactions jumped by 33.8 per cent after adoption versus just 11.5 per cent in the comparison group, and in Benin by 84 per cent.

Importantly, data from both Benin and Côte d'Ivoire show an increase in mobile money use for all transaction types after SHS adoption. This clearly indicates that the change in the overall number of transactions is not simply due to paying for the SHS, but is also a much broader change in behaviour related to mobile money use.

The seven following factors explore the key drivers of behaviour change related to mobile money. Once again, each driver is discussed in terms of when, how and for whom behaviour has changed.



FIGURE 9
Impact on mobile money transactions



Frequency of cash-ins

Since many users make frequent SHS payments, they are also making more mobile money deposits.

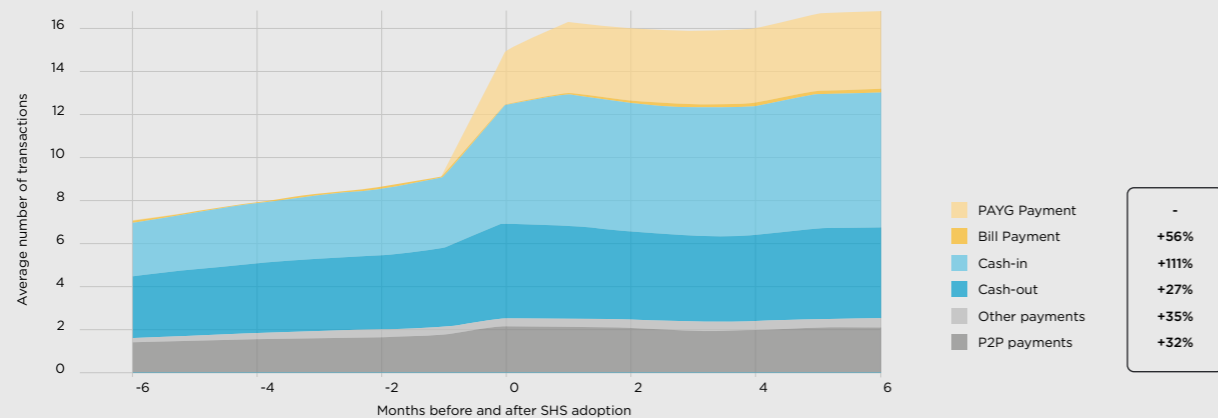
56% of doers in Benin make more than two SHS payments a week

In Benin, the majority of users interviewed were depositing and immediately paying Engie multiple times per week in very small amounts. In Côte d'Ivoire, users paid less frequently – often weekly or monthly – and in larger amounts. However, in both countries, most SHS payments were closely preceded by mobile money deposits, rather than being made using money saved in mobile money accounts over time.

GG
"I deposit money every two days now to pay for my solar panel, whereas before I wouldn't touch my account for days at a time"
Felix, Benin
"Without Fenix [Engie], I rarely used mobile money. It is because of my daily Fenix [Engie] payments that I now often go to deposit with MTN...and have come to know the importance of mobile money."
Claude, Benin

The difference in payment behaviour between the two markets is likely because incomes in Benin are lower and more irregular than in Côte d'Ivoire. Users there often mentioned they would pay for their SHS when they could find the money. "We used to pay 10,000 francs at once, but because times are hard we now pay 2,000 every few days," noted one user. Another shared, "If I have money, I put a little on Fenix [Engie]. If I don't, I don't". In Côte d'Ivoire, where respondents indicated having fewer financial challenges, SHS is a service that more users can pay for in larger amounts. It is also worth noting that the sample of respondents in Côte d'Ivoire was more rural and would likely have higher transaction costs due to a lower density of mobile money agents.

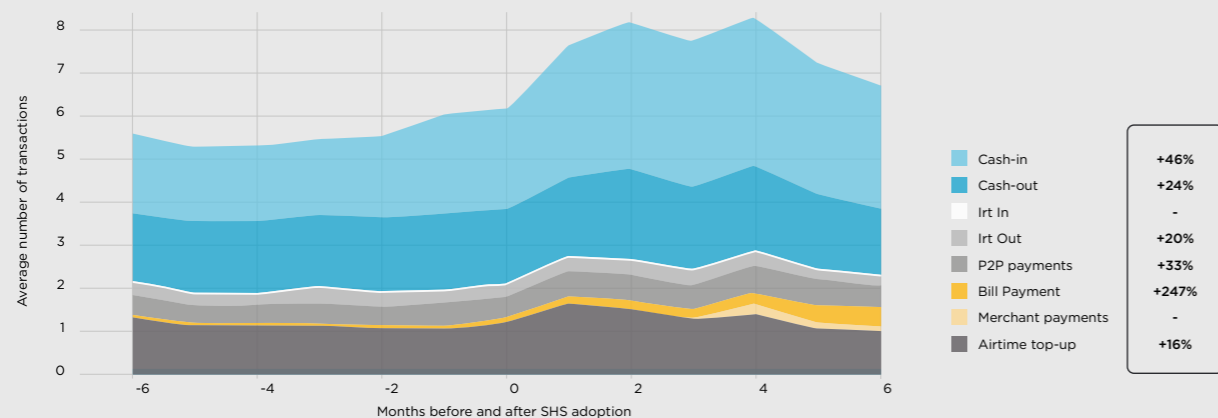
FIGURE 10
Impact on mobile money transactions: Insights from MTN Benin



Agent density is a critical factor in both mobile money uptake and financial inclusion, and the findings of this research confirm that it drives behaviour with PAYG solar. According to 2019 figures from the GSMA,¹⁵ a mobile money agent has approximately seven times the reach of ATMs and 20 times the reach of bank branches, but it can differ substantially within and across countries. In 2019, the density of the agent network averaged 228 active mobile money agents per 100,000 adults, a three-fold increase since 2014. Meanwhile, commercial bank branches in the same markets averaged 11 per 100,000 adults, a figure that did not change substantially between 2014 and 2018.

Past research by BFA Global¹⁶ has highlighted the importance of payment flexibility to the central value proposition of PAYG solar, as it drives financial inclusion and access to services. In both countries, payment flexibility is an option, but where incomes are lower and payments are more frequent, certain norms appear to form around how agents explain payments to customers. In Benin, more respondents noted that agents explained that the SHS functions for a daily price – the more you pay, the more days of electricity you receive. In Côte d'Ivoire, however, it appears that pricing was framed more in terms of a monthly amount with the option to accumulate over time.

FIGURE 11
Impact on mobile money transactions: Insights from Orange Côte d'Ivoire

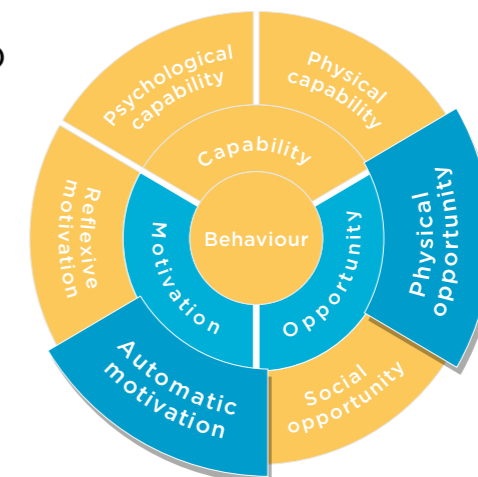


15. See: *The power of flexibility: How innovative payment models can expand access to energy services* (blog post by Jacob Winiecki)
16. GSMA (2019) *State of the Industry Report on Mobile Money*

How is behaviour changed? (COM-B)

Automatic motivation: SHS drives habitual payments via mobile money in return for a basic need: electricity.

Physical opportunity: Because of the requirement to pay for SHS via mobile money, an opportunity is created for customers to engage more with the platform.





Who changes their behaviour? (Customer characteristics)

Income



Those with **lower and more irregular incomes** are more likely to take advantage of small, frequent payments.

Proximity to mobile money agents



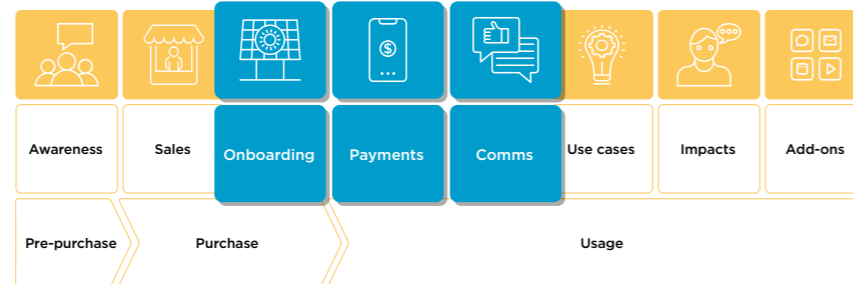
Those who are located **closer to mobile money agents** are able to take advantage of more frequent cash-ins.

When do we see behaviour change from SHS? (SHS journey)

Onboarding: Agents that frame the SHS price as a daily amount can encourage more frequent cash-ins.

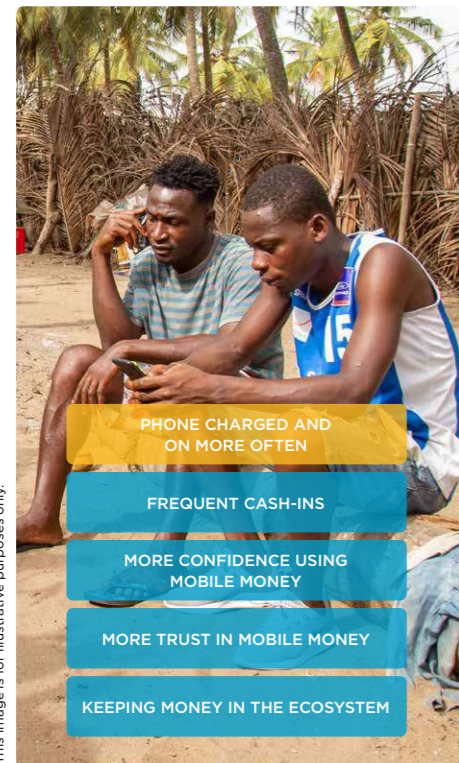
Payments: As SHS require payments via mobile money, this drives corresponding cash-ins.

Communications: Payment reminder messages can encourage more frequent cash-ins.



PERSONA 2

Felix: Mobile money maturer



This image is for illustrative purposes only.

Gender: Male
Age: 28
Family: Wife and two children; four in household
Lives in: Rural town
Job: Carpenter

His SHS story:
 Felix has been using MTN Mobile Money for a while to receive payments from clients from time to time, after which he would withdraw the money and spend it.

Since he started using his SHS, Felix says he is engaging much more frequently with his mobile wallet: "I deposit money every two days now to pay for my solar panel, whereas before I wouldn't touch my account for days at a time. Since I have been sending money to Fenix [Engie] with MTN, it has never failed. I have more confidence in it. It's because of the solar system that I got used to using it. Now, if somebody sends me money on my mobile wallet, I might leave it on my account now because I know I can use it to pay for Fenix [Engie] in a few days."

His family primarily benefits from light in the evenings, which his kids use to study. While he's not a data user, he wants to save up to buy a smartphone.

Key characteristics

- Mobile money (pre-SHS):** Occasional user, but mostly cashes out once he receives a P2P payment
- Electricity (pre-SHS):** Limited grid power, but it is expensive and unreliable
- Mobile data (pre-SHS):** Aware, but has never used it
- Proximity to mobile money agent:** Around the corner
- Income:** Earns money as a construction worker when he can find work
- Device:** Has a basic mobile phone with no internet

More confidence using mobile money

Thanks to the onboarding they received for their SHS and the frequency with which customers pay for their SHS through mobile money, they have become more confident mobile money users.

Before acquiring their SHS, many customers were nascent mobile money users, lacking the confidence to conduct transactions on their own. Many, especially in Benin, reported they did not use mobile money very often, primarily used it to receive and withdraw funds and did not have a good understanding of the wider system.

When installing SHS, agents for both Orange Energie and Engie show customers how to pay using mobile money and almost always leave behind a piece of paper with the USSD code on it. This helps customers understand and gain confidence in paying for their subscription. As they make these transactions more regularly, they often become more confident in using mobile money for other types of transactions and on their own, rather than relying on an agent for assistance.

68% of doers said they felt more confident using mobile money

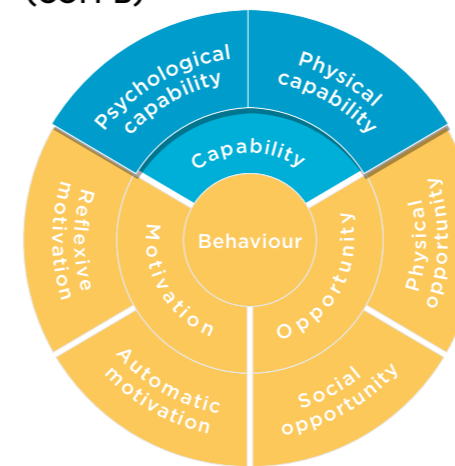


"I didn't have a good grasp of the system before, but now with Fenix [Engie], I understand it better."
 Gisele, Benin

"Because Orange Money teaches us how to do this kind of thing: how to pay the CIE bill, how to pay the electricity bill, they send us messages for that. How to take out a loan, how to repay a loan, how to top up your account, how to pay for packages, all that."
 Sidoine, Côte d'Ivoire

"Yes, it has strengthened my confidence because I make the payment, I am told that your bill is paid and I also see that there are no worries."
 Adama, Côte d'Ivoire

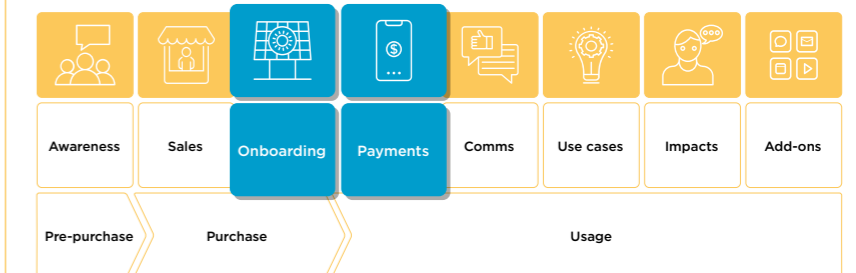
How is behaviour changed? (COM-B)



Physical capability: As a result of making SHS payments, users gain skill and proficiency in navigating mobile money menus.

Psychological capability: As a result of making SHS payments, users gain more knowledge of mobile money menus and products.

When do we see behaviour change from SHS? (SHS journey)



Onboarding: SHS agents demonstrate how to pay via mobile money and leave payment instructions behind.

Payments: The requirement to pay for SHS via mobile money reinforces the onboarding training.

Who changes their behaviour? (Customer characteristics)

Mobile money customer journey



Those at an **earlier stage of their mobile money journey** stand to gain the most confidence.



More trust in mobile money

Prior to having a SHS, many users did not fully trust mobile money. However, after using mobile money regularly for their SHS payments, they have developed more trust in the platform. There are numerous reasons for this lack of trust. Some cited instances in the past where they felt they had lost money from their mobile money accounts. Others, especially in Côte d'Ivoire, noted there are many instances of scammers trying to take advantage of mobile money users. Others simply did not trust mobile money because they had limited experience using it.

Because SHS users are frequently depositing funds, paying their bill and seeing their transactions result in regular electricity, they now experience mobile money working as it was designed. Receiving a confirmation SMS after depositing funds into mobile money accounts and making an SHS payment plays a big role in building customer trust. Experiencing the speed and convenience of mobile money also strengthens their trust. This was most evident among users who said that when they first got their SHS, they made small daily payments to test the system. Over time, many of these users became more confident and shifted to larger weekly and monthly payments (if they could afford it).

58% of doers said their trust in mobile money has increased.



"With Orange when you charge it's done, it does not change - your money comes same amount. I see that there is a lot of confidence with them, Orange."
Victor, Côte d'Ivoire

"When I make a deposit, they send you a message directly from Orange to tell you to be careful with scams. When it's like that, it even encourages me. Before, I was working with my MTN chip, now I work more with Orange because I trust Orange more."
Desire, Côte d'Ivoire

"I am afraid of scammers. When it comes to Fenix [Engie], it's a different story. They have a code and when you dial, the money goes to them. I trust them."
Euphreme, Benin

Linked subscriptions and add-ons

When purchasing an SHS kit that includes a TV, many users add on satellite TV services that are also paid for via mobile money. Additional SHS appliances also increase transactions. An obvious reason for increased mobile money transactions among SHS users who purchase TVs is that they also subscribe to satellite TV services, often through the same agents that sell them the SHS. Canal+ and Star Times are the two leading TV providers in Côte d'Ivoire and Benin.

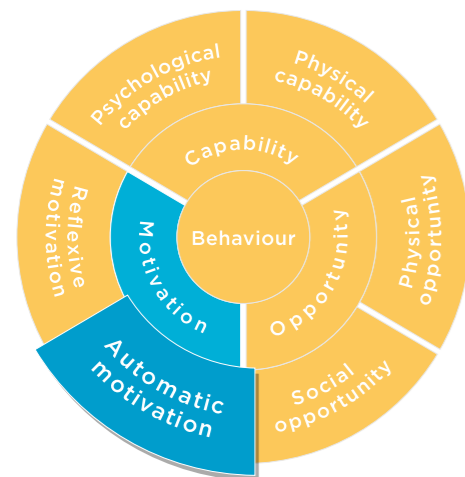
The impact of these linked products has been most pronounced for Orange Energie, which include a TV in all their packages. In Benin, meanwhile, many users opted for packages without TVs because they were more affordable or the lowest level entry into SHS ownership.

Mobile money transactions also increase when SHS providers offer add-ons beyond their main kits. For example, Orange Energie allows users to add fans that they pay for separately.

25%

of doers in Côte d'Ivoire subscribe to a paid TV service

How is behaviour changed? (COM-B)



Automatic motivation: As regular payments for SHS become a habit, users see and feel that mobile money is working well and develop trust in the system.

When do we see behaviour change from SHS? (SHS journey)



Payments: The requirement to pay for SHS via mobile money fosters trust.

Communications: As SHS providers sent payment confirmation messages, trust is strengthened.

Who changes their behaviour? (Customer characteristics)

Mobile money customer journey



Those at an **earlier stage of their mobile money journey** stand to gain the most in terms of trust.

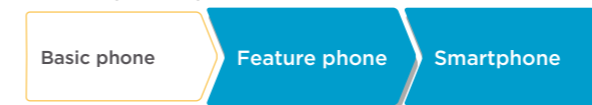
Who changes their behaviour? (Customer characteristics)

Income



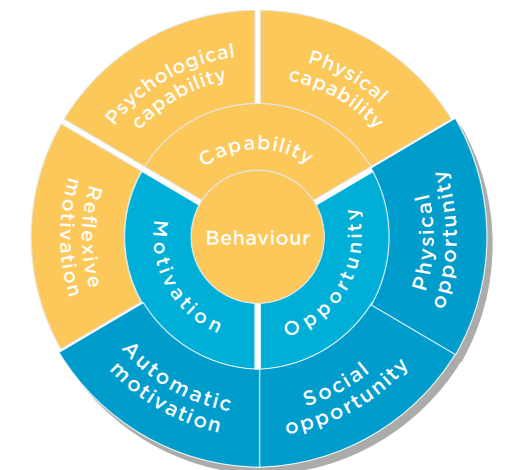
Those with **higher incomes** have the ability to take advantage of additional subscriptions more than those with lower incomes.

Device journey



Those with **more advanced devices** are more likely to take advantage of additional subscriptions. For example, a smartphone owner may opt for music or video streaming add-ons.

How is behaviour changed? (COM-B)



Automatic motivation: SHS often drives a desire for growth in related assets, such as fans and satellite TV.

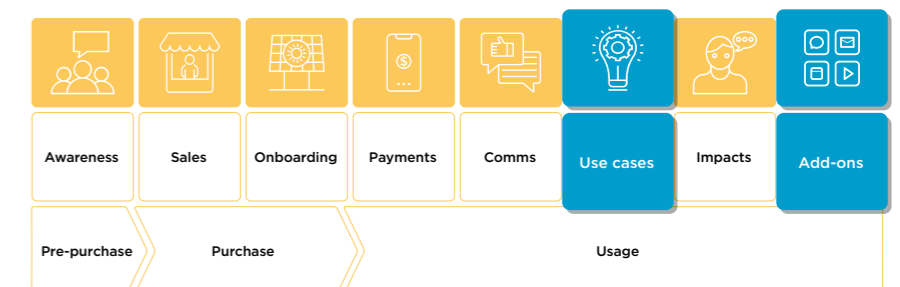
Social opportunity: Social norms start shifting in areas where SHS are prevalent as people want a TV to 'keep up' with their neighbours.

Physical opportunity: TVs and other appliance add-ons are physical channels through which new payment opportunities are created.

When do we see behaviour change from SHS? (SHS journey)

Use cases: The products offered by SHS providers can drive linked subscriptions (i.e. TVs in bundles).

Add-ons: The add-ons offered both by SHS providers and mobile operators can drive additional mobile money usage.





PERSONA 3

Clement: Solar upgrader and barber



Gender: Male
Age: 23
Family: Single; lives with family
Lives in: Small town
Job: Barber

His SHS story:
 Clement decided to purchase an Orange Energie SHS after one year with another SHS provider. His other provider offers a hair clipper kit, which he uses to cut hair when his on-grid connection goes off. He decided to add Orange because of the TV, which his customers can watch while waiting for a cut (thanks also to his Canal+ subscription). His new SHS also allows his customers to charge their phones and brings in a little extra cash.

Clement views his new purchase as part of his growth as a business owner. The extra light that he uses in the evening at home also helps him save more, as it is cheaper than public electricity.

He was a power mobile money user before so he hasn't seen much change since purchasing the SHS.

LINKED SUBSCRIPTIONS AND ADD-ONS

HIGHER EARNINGS

Key characteristics

- Mobile money (pre-SHS):** Power user doing five to 10 transactions a day
- Electricity (pre-SHS):** Has one other SHS from a competitor and an on-grid connection (although spotty)
- Mobile data (pre-SHS):** Regular user; consumes \$2/week for data
- Proximity to mobile money agent:** 5-minute walk
- Income:** Business is steady and he has expanded over the past 12 months
- Device:** Smartphone

Higher earnings

For many SHS users, longer business/working hours are allowing them to earn and save more money, which often ends up in mobile money accounts.

This finding is in line with industry research that has found evidence of how access to electricity affects income. A 2018 GOGLA study in five African markets¹⁷ found that more than a third of new solar users increased their income by at least \$35 per month – a figure equivalent to more than half the monthly GDP per capita of those countries.

Several users who were interviewed indicated they believe their SHS has allowed them to increase their business revenues, primarily by extending their hours at night or by avoiding lost revenue during power cuts. This is especially true for shopkeepers/traders, barbers and mobile money agents. Not only are agents earning more money, but they are also facilitating more mobile money transactions for their community members later in the evening, creating a multiplier effect. Those who are earning more often shared examples of how this money finds its way into their mobile money accounts, whether via savings in the accounts or sent to family/friends via P2P transfers.

92%
 of those using their SHS for their business say they now earn more money

GG

"The lighting allows my mobile money kiosk to stay open later at night and I do many more transactions."
 Dominique, Côte d'Ivoire

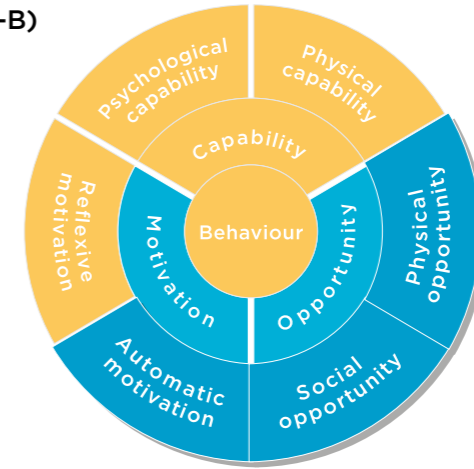
"When the power cuts out, I used to have to close my barber shop. Now with the clippers and solar panel, I can stay open and have earned a lot more money."
 Olivier, Côte d'Ivoire

How is behaviour changed? (COM-B)

Physical opportunity: SHS are providing opportunities for users to earn more financial resources.

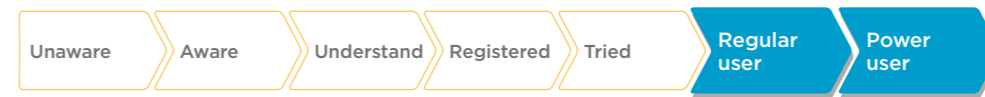
Social opportunity: SHS can shift social norms in communities since people are out later in the evenings conducting business transactions.

Automatic motivation: SHS users start to habitually work longer as a result of light created by SHS.



Who changes their behaviour? (Customer characteristics)

Mobile money customer journey



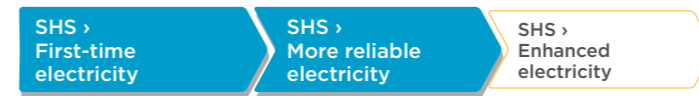
Those more **advanced in their mobile money journeys** are typically more likely to deposit additional earnings in their mobile wallets.

Proximity to mobile money agents



Those who **live closer to mobile money agents** are more likely to move additional earnings in their mobile wallets.

Electricity customer journey



Those who own businesses and are at an **earlier stage of their electricity journey** stand to gain the most.

When do we see behaviour change from SHS? (SHS journey)

Use cases: Light and electricity generated by the SHS allow businesses to operate more frequently.

Impacts: Secondary impacts from SHS drive additional income and savings.

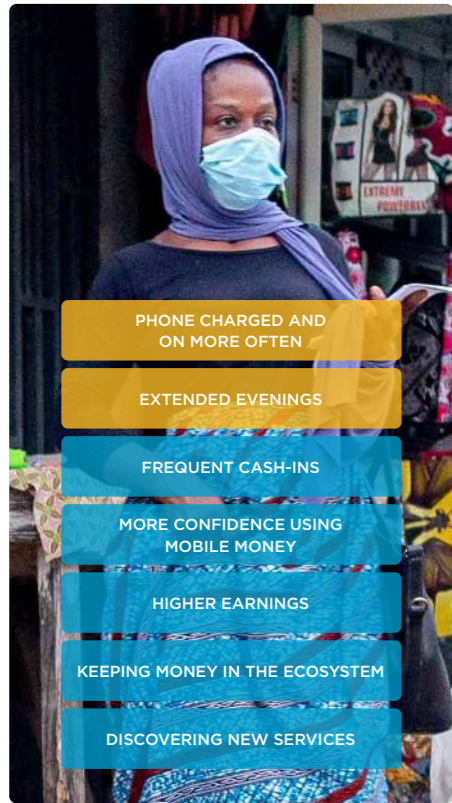


17. GOGLA (2018) Powering Opportunity The Economic Impact of Off-Grid Solar



PERSONA 4

Hermine: Working later, earning more



Key characteristics

Gender: Female
Age: 36
Family: Husband and four kids; seven living in household
Lives in: Village
Job: Sells household products from her home

Her SHS story:
 Hermine heard about Engie when an agent came to her village. Her sister had purchased a similar system last year and encouraged her to buy one. This is the first time Hermine's family has had electricity. Before, when it got dark they relied on candles and flashlights, but now they have three lightbulbs.

Hermine uses the light to keep her store open for two to three extra hours each night. While working, she's busy chatting on WhatsApp with friends and family. She used to worry that using her phone at night would deplete the battery and she'd miss important calls, but now she knows she can recharge anytime.

Thanks to her extended business hours, she's earning more overall. "I've more than doubled my contributions to my tontine (savings group) since I got my lights," she notes. "I also started sending a little money to my mother via MTN when I go to make my deposit for Engie. It saves me a trip and I feel confident I can make the payment on my own."

- Mobile money (pre-SHS):** Has tried it, but rarely uses it except to receive funds from family now and then
- Electricity (pre-SHS):** No electricity access; candles and torches used for lighting
- Mobile data (pre-SHS):** Uses WhatsApp to chat with friends and customers
- Proximity to mobile money agent:** 10-minute walk
- Income:** Business is OK, but the economy has not been great in the past year
- Device:** Has a feature phone

This image is for illustrative purposes only.

Keeping money in the ecosystem

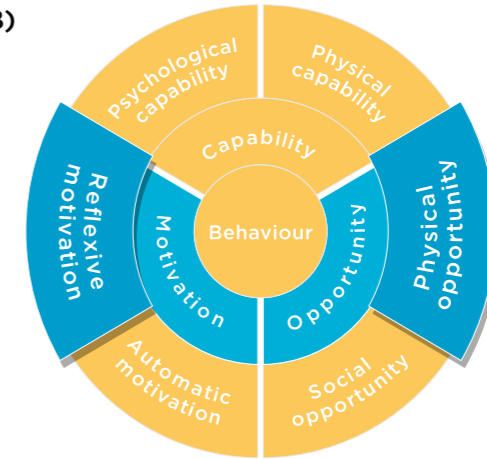
Whereas mobile money users may have previously withdrawn funds from their mobile money accounts, more are now leaving those balances on their phones to pay for their SHS. Keeping money in the ecosystem is vital to strengthen it. As highlighted in the GSMA *State of the Industry Report on Mobile Money 2021*¹⁸ as of December 2020, \$23 billion was circulating in the mobile money ecosystem.

Very few SHS users reported depositing more money in their mobile money accounts to save for their SHS payments. Instead, most opted for deposits followed by immediate SHS payments. However, it was observed that users may reduce the number and value of cash-outs they make to use their account balance for SHS payments. This was especially true for users who received peer-to-peer transfers from friends and family or payments from customers. Some users may be shifting more of these types of transactions onto the mobile money platforms used by SHS providers. All these actions deepen user engagement with the mobile money ecosystem.



"If someone wants to send money to me, I tell them to deposit into this account so that I can use it for my solar payments."
 Rigobert, Benin

How is behaviour changed? (COM-B)



Physical opportunity: SHS is providing an opportunity for customers to store money in their mobile wallets for future payments.

Reflective motivation: SHS users consciously choose to leave money in their mobile wallets to make solar payments.

Who changes their behaviour? (Customer characteristics)

Mobile money customer journey



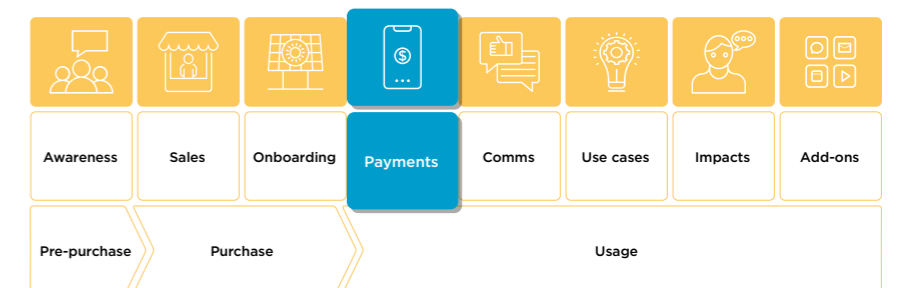
Those more advanced in their mobile money journeys are more likely to keep money from other transactions in their mobile wallets for SHS.

Income



Those with higher incomes are more able to save money in their mobile wallets rather than withdraw for other expenses.

When do we see behaviour change from SHS? (SHS journey)



Payments: Because mobile money is required for SHS payments, money is kept in wallets longer.

18. GSMA (2021) *State of the industry report on mobile money*



Discovering new services

Because they must make their SHS payments via mobile money, many users have discovered new services or conveniences that prompted them to use mobile money for new types of transactions. Several interviewees shared stories of how their mobile money usage expanded organically as they engaged more with the platform. For example, some users who visited the platform frequently to deposit money for their SHS payment began adding other types of transactions, such as paying other bills or sending money to friends and family. Other users pointed to new types of transactions they either had not been familiar with or did not know were possible with mobile money.

GG

"I started recharging my phone using Orange Money once I saw it was possible in the menu."
Pierre, Côte d'Ivoire

How is behaviour changed? (COM-B)

Psychological capabilities: As a result of making SHS payments, users gain knowledge of a mobile operator's mobile money products and services.

Automatic motivation: As SHS customers get in the routine of paying for SHS via mobile money, they can also get in the habit of purchasing mobile services from the associated mobile operator.

Reflective motivation: Exposure to new products and services can motivate SHS customers to choose new options.



Who changes their behaviour? (Customer characteristics)

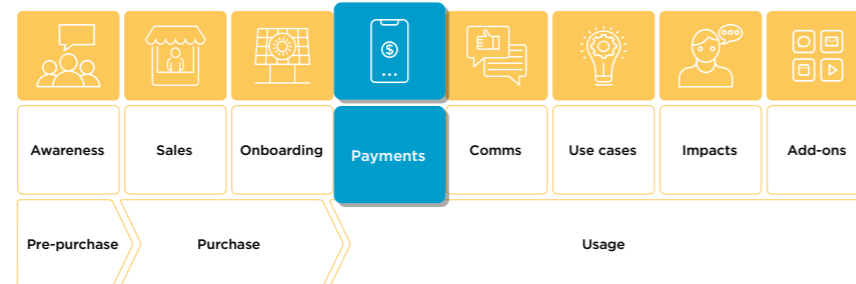
Mobile money customer journey



Those at an **earlier stage of their mobile money journey** are more likely to discover new services on mobile money.

When do we see behaviour change from SHS? (SHS journey)

Payments: Because mobile money is required for SHS payments, money is kept in wallets longer.



Non-doers

SHS customers who did not increase their mobile usage did so for five main reasons.

They were already high-volume mobile money users.

Changes in mobile behaviour are less pronounced for those who already make a high number of mobile money transactions. In these cases, much of the additional use comes simply from paying for their SHS. In Côte d'Ivoire in particular, several Orange Money users reported they already used mobile money regularly to pay bills, send/receive money and purchase airtime/data. For them, the additional SHS payments were less significant. In other cases, users who saved frequently on their mobile money accounts did not see their deposits increase like many other SHS users since the money was often already in the system and ready to be used for SHS payments.

They already had access to electricity. Those who did not increase their voice/airtime and data usage often already had the means to charge their phones at home through other SHS providers, generators or the public electricity grid. These users were therefore less likely to experience the benefits of first-time or more consistent electricity.

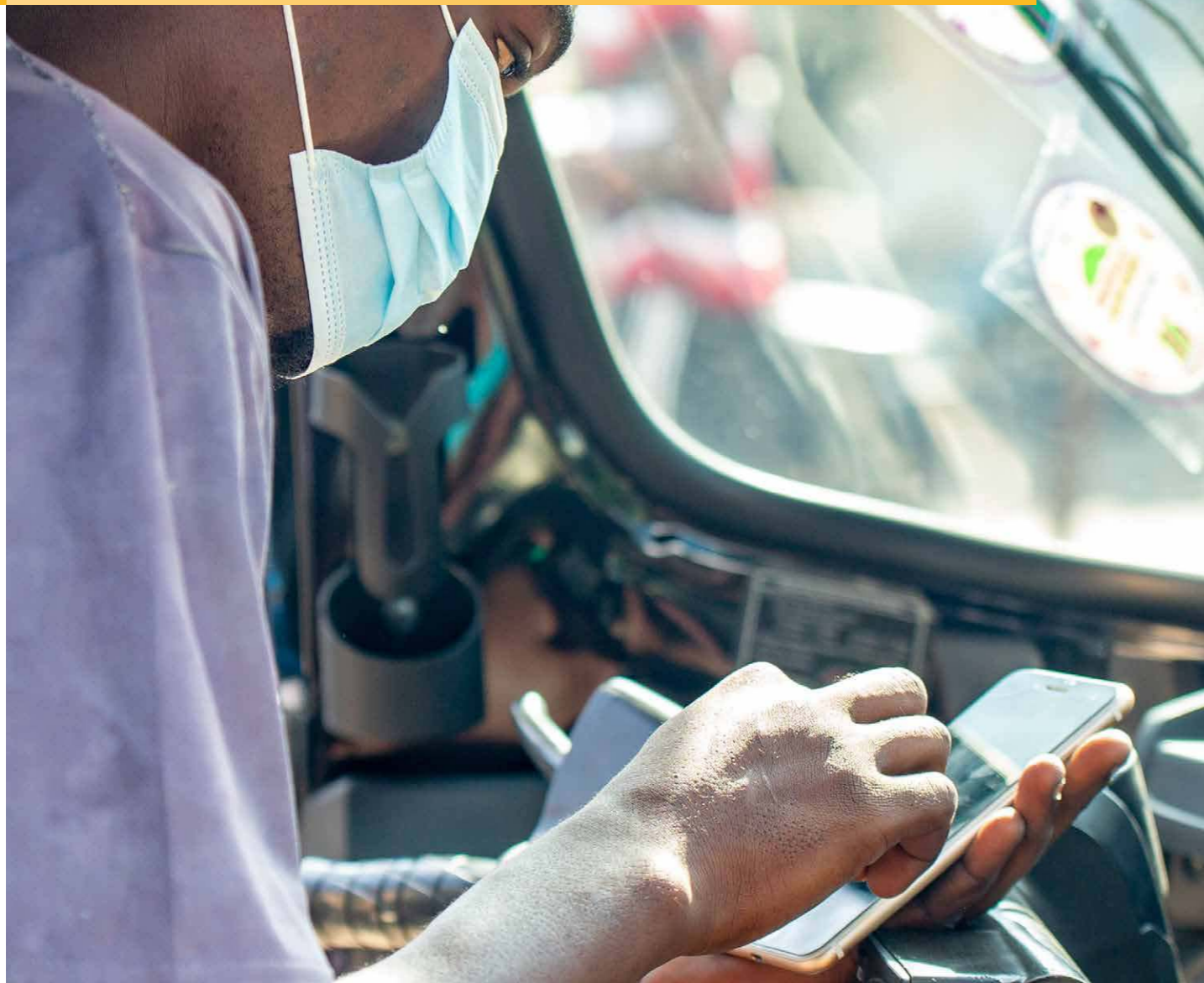
They are slower adopters of mobile money. As with any service, there are those who do not use the services as fully as others. Despite several examples of SHS helping customers understand, trust and

gain experience with mobile money, there are still customers who do not feel completely confident making payments on their own. Others are more limited by literacy, and users like Kouadio in Côte d'Ivoire often turn to others to complete transactions for them: "I go to the man who does Orange Money; I give him the money and then he pays for me."

There are network limitations. There were some examples of poor network coverage or service quality preventing customers from fully engaging with the products and services offered by a mobile operator. In these cases, customers may make sacrifices to pay for and retain the vital service they receive from their SHS. However, they are unlikely to increase voice, data or mobile money usage beyond the bare minimum. Koffi in Côte d'Ivoire noted that he travels more than 12 kilometres once a month to pay his SHS bill, but "given my situation in the village, the Orange network is not very good, so I can't make any other transactions."

They choose to pay for their SHS in bulk. Users who pay for their SHS either upfront or in large instalments tend to increase their mobile money usage less. In Côte d'Ivoire in particular, customers tend to pay monthly, which results in a smaller shift in mobile money behaviour. There are various reasons for making bulk payments, including seasonal income (farmers often receive most of their earnings at once), the desire to 'own' the system more quickly or, as one user in Benin noted, "I stopped leaving money in my mobile money account because of scammers" and decided to pay for two to three months at a time.

Summary of key findings



The 10 key factors identified in interviews as driving behaviour change were each assigned a degree of impact (Figure 12). This classification is based on both the number of people each driver appeared to affect and the degree to which mobile behaviour was changed by each factor.

The previous section showed how these factors overlap with the SHS customer journey, the COM-B framework and customer personas. The following sections synthesise the main lessons learned.

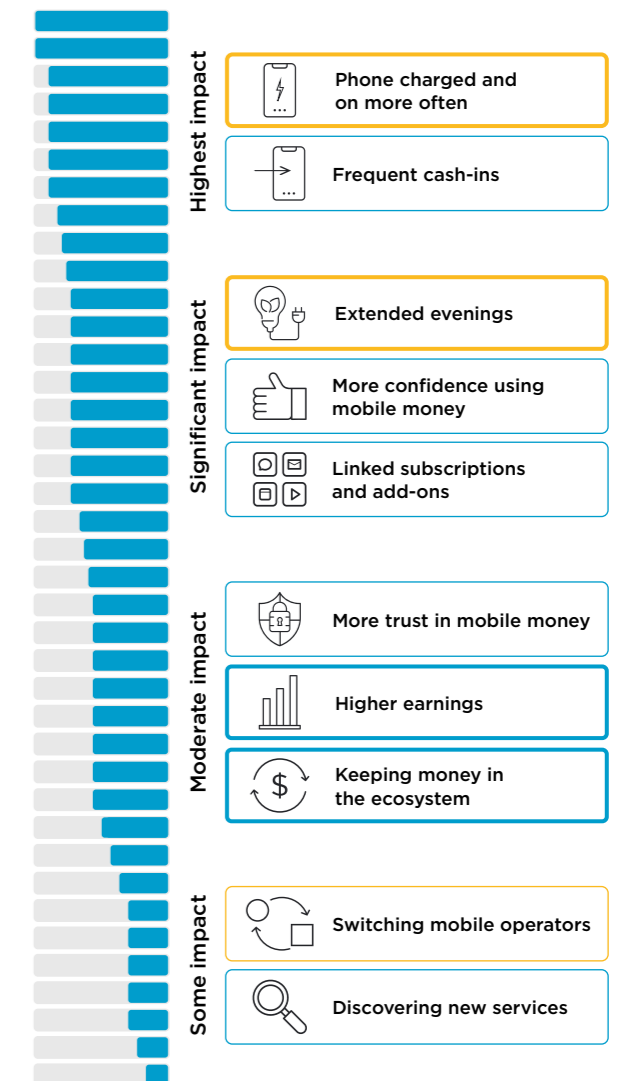
Revisiting the SHS customer journey

The SHS customer journey helped to answer when SHS drives behaviour change (see summary in Figure 13). Four key points stand out:

- **The most significant impacts on behaviour came from access to electricity.** There is a clear relationship between access to electricity and engagement with mobile services, as electricity provides the foundation for customers to adopt mobile money. Likewise, connectivity is central to the PAYG business model and is a critical enabler of access to electricity in the first place.
- **Behaviour change is primarily driven in the 'usage' phase of the customer journey.** Because mobile money is required to make SHS payments, customers are engaging with mobile money platforms regularly and many for the first time. Products offered by SHS providers (basic lighting/charging capabilities as well as more advanced add-on appliances like TVs) are also major drivers of behaviour change.
- **On-boarding and communication play a role, but a smaller one.** By introducing users to new services during SHS training and through communication strategies that include sending users payment confirmations, some users – especially those newer to mobile money – develop more confidence and trust in mobile money.
- **Differences in sales and marketing approaches do not appear to have a significant impact on the degree of behaviour change.** The research team

FIGURE 12

The magnitude of impact of factors driving behaviour change

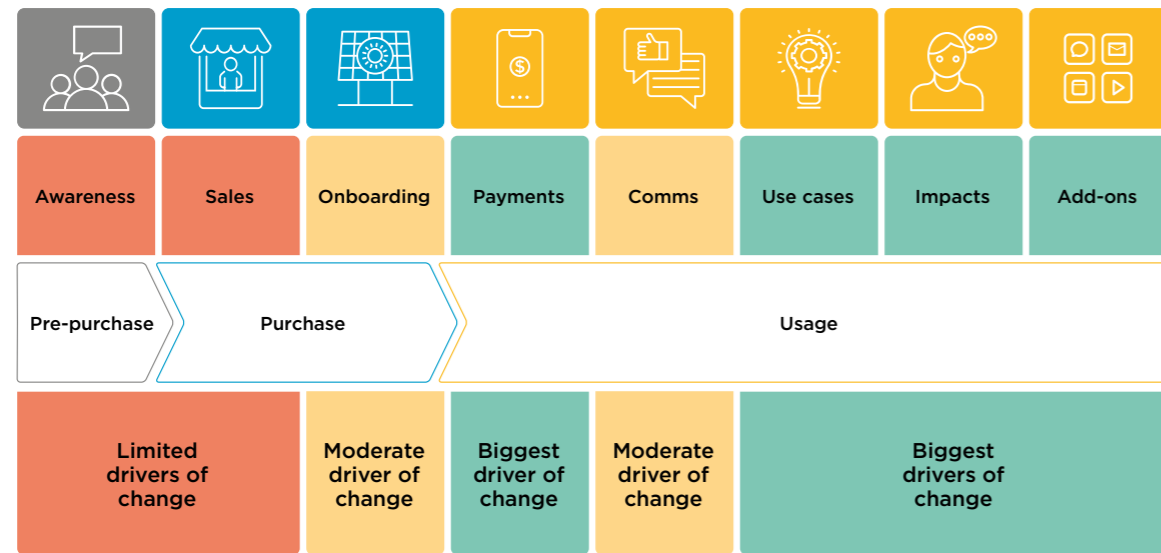


hypothesised that the channels through which users become aware of and purchase their SHS (e.g., fixed store location, door-to-door agents or call centres) may influence the degree to which users increase their mobile usage. However, interviews with users did not indicate that different engagement strategies made a significant difference to behaviour. This may be explained by the fact that most users in this study engaged with a person when they purchased their SHS. Earlier research¹⁹ by CGAP found that engagement with a person is important in encouraging mobile money adoption.

19. See: *An Innovator's Dilemma: Teaching Mobile Payments* (CGAP blog post)



FIGURE 13 Impact on mobile money transactions: Insights from Orange Côte d'Ivoire



Revisiting COM-B

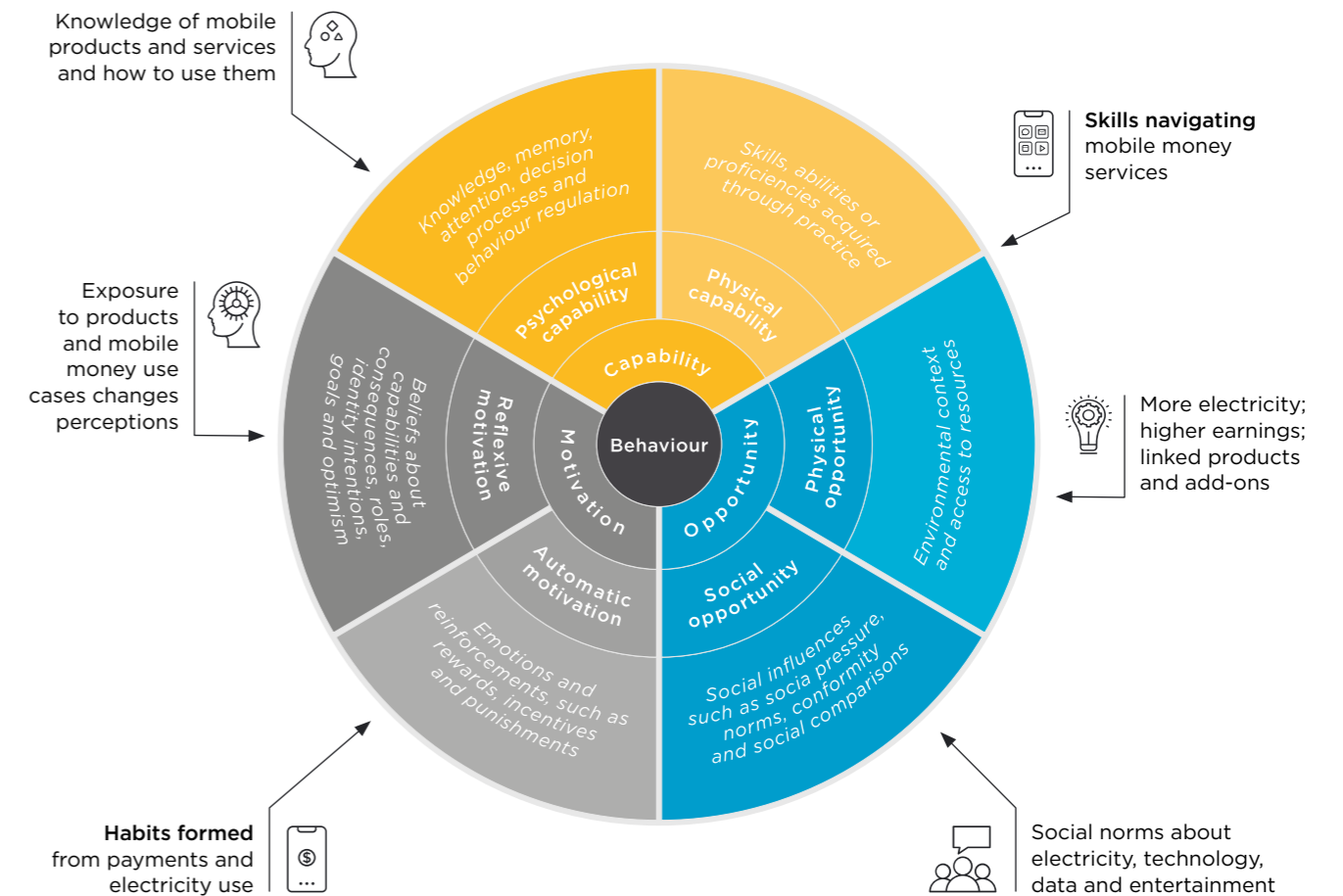
Capabilities – In terms of an SHS customer’s ability to use mobile services, greater knowledge, understanding and confidence largely came with the requirement to pay for SHS via mobile money and the on-boarding provided by SHS agents. These factors tended to have more of an impact on mobile money usage than data/voice, as SHS users in both markets were less experienced with mobile money than data/voice users before signing up for SHS.

Opportunities – SHS customers had opportunities to expand their mobile money, mobile data and mobile voice usage, primarily through direct use cases (more

electricity), secondary impacts (more earnings and savings) and linked products (satellite TV subscriptions and SHS appliances). Social norms have also shifted, creating more opportunities to use electricity, technology, data and entertainment services.

Motivations – As SHS customers make regular payments via their mobile money account, they grow to trust mobile money and perceive it as convenient. This, in turn, motivates them to use it for other transactions, and SHS customers are now consciously choosing to shift additional business to the mobile operator they use to pay for their SHS. Users are also developing new habits around SHS payments and electricity use that drive automatic shifts in behaviour.

FIGURE 14 Key impacts, COM-B



Revisiting customer personas

This section discusses how the characteristics of SHS customers shape the use of mobile services and the most significant impacts experienced by these different ‘personas’.

In general, new SHS customers who are less experienced mobile money users often increase their mobile transactions more. Those in the early stages of their mobile money customer journey stand to gain the most from a greater ability and motivation to use mobile

money since their knowledge, understanding and trust all improve. For those who have more experience with mobile money, it is more opportunities or use cases that are largely responsible for shifting them from a user who has simply tried mobile money to regular and power users.

Both these findings were evident among mobile money users in Côte d'Ivoire and Benin. Users in Côte d'Ivoire tended to be more established, already taking advantage of a wider range of mobile money transactions. Their usage was therefore less influenced by the purchase of an SHS. In Benin, users were in earlier stages of their mobile money customer journey, and gaining knowledge and trust in mobile money played a bigger role in moving them further along.



A data-ready smartphone or feature phone is a prerequisite for mobile data use, and once users have one they can reap more benefits from their SHS. Perhaps unlike mobile money, mobile data usage is less likely to change for SHS customers who are at an earlier stage of the customer journey. Once users have an internet-ready device, SHS can unlock opportunities and motivations to consume more data since their phone can be kept charged, social norms around electricity use have changed or linked products like TVs allow music and movies to be played. PAYG smartphones offered via mobile operators or SHS providers may be a major opportunity to drive behaviour change.

A user's income and ability to accumulate money have an impact on their mobile usage. Those with lower and more irregular incomes were more likely to pay for their SHS in much smaller amounts and more frequently, creating the opportunity for greater behaviour change in mobile money usage. This was reported in interviews with SHS customers in Benin. Customers with higher incomes and the ability to save over time often do not increase their mobile money transactions as much as the lower-income customers interviewed, but those with more income have the capacity to increase their data spend and adopt additional services, such as satellite TV or more appliances.

Gaining access to reliable electricity for the first time affects how much a customer's mobile usage is likely to change. SHS users who already had fairly reliable access to electricity via other solar providers were likely to have already experienced some of the positive impacts of solar products, such as more frequent phone

charging. If they switch to a new SHS provider, they are unlikely to reap those benefits again. However, those who are getting power for the first time register the most growth. This was reflected in data from Côte d'Ivoire where most SHS customers had access to other sources of power before switching to Orange Energie. Meanwhile, most MTN/Engie customers in Benin were gaining access to electricity for the first time, and more indicated that their phones were charged and consuming more data than customers in Côte d'Ivoire.

The farther a new SHS customer lives from a mobile money agent, the less likely they are to experience an increase in mobile money transactions. Interviews revealed that the more often a customer deposits cash into their mobile money account and pays for SHS, the more likely they are to increase the volume of their mobile money transactions. However, those who do not live near an agent have less ability to make frequent SHS payments. Close collaboration between SHS providers and mobile operators can help ensure that targeting – both who SHS providers seek to reach and where mobile operators seek to their build agent network – is enhanced by the other.

Comparing the markets

The two companies explored in this research have several differences, including how much their customers earn, how new they are to mobile money, how new they are to electricity, how their products are framed and how they arrive as customers to SHS providers and mobile operators.

Benin

- **SHS users were newer to mobile money.** They had developed more confidence and trust and experienced more impacts that would support future mobile money growth.
- **More likely to not have any electricity prior to purchasing an SHS.** More reliant on candles and torches.
- **Lower incomes.** SHS customers made smaller and more frequent payments.
- **Product and price framed in terms of daily use.** Together with lower incomes, this led to smaller, more frequent cash-ins and payments.
- **Engie's reputation with SHS drove people to try MTN for the first time or for more services.**

Côte d'Ivoire

- **More experienced mobile money users.** They already understood how to use mobile money, but were more likely to deposit higher earnings into other mobile money services like P2P transfers and savings.
- **More likely to have electricity.** They already had electricity via other SHS providers, public grids or generators.
- **Higher incomes.** They paid for SHS less frequently, and had more to spend on data/voice.
- **More linked services.** Since all packages come with TVs, more customers added on satellite subscriptions, which they also paid for via mobile money.
- **Orange's reputation as a mobile operator drove people to try Orange Energie for the first time.**

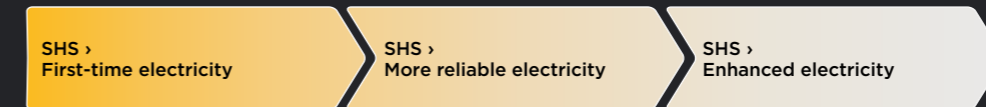
FIGURE 15

Revisiting personas

Mobile money customer journey



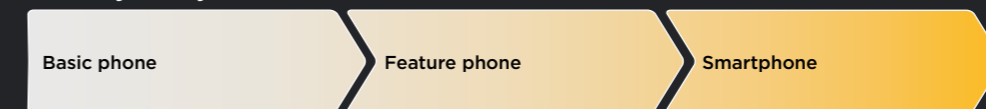
Electricity customer journey



Mobile data customer journey



Device journey



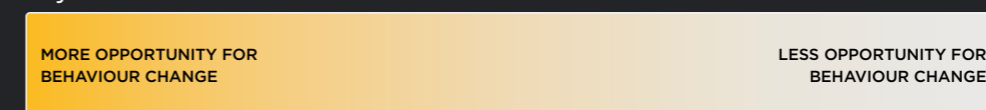
Income



Proximity to mobile money agents



Key





Takeaways for mobile operators and SHS providers



This study has confirmed deep synergies between mobile and PAYG energy services. Accessing energy for the first time via SHS changes all aspects of customer behaviour (capabilities, opportunities, and motivations) and transforms people's lives as they discover the opportunities that come with reliable energy access.

Many mobile operators and SHS providers already have established fruitful partnerships. However, in many markets, the SHS sector is still developing and has tremendous scope for the two sectors to work together. For SHS providers, mobile services and partnerships with mobile operators are key to reducing barriers to market entry and scale. Even in markets with established partnerships there are opportunities to deepen them, especially with the launch of new PAYG products and services, such as smartphones, loan offerings, productive use assets and clean cooking, as well as financial products such as school loans.

With a decade of experience working at the intersection of mobile and energy services, the GSMA Digital Utilities programme has identified some key lessons for mobile operators engaging with the PAYG solar sector:

- 1. Mobile operators are well positioned to make their technical platforms widely accessible to a range of innovative utility service providers.** However, many PAYG utility providers still face significant administrative and technical barriers to working with mobile operators and setting up seamless mobile money integration²⁰ with real-time notifications.

The GSMA has helped to bridge this gap through initiatives such as the harmonised Mobile Money API specifications²¹ and the Instant Payment Notification Hub (IPN Hub).²² These important tools help to reduce the time and cost of connecting new businesses to mobile money platforms, which is critical for mobile operators to pursue a 'payments as a platform' approach. Mobile operators that seize this opportunity are likely to reap the benefits of stronger brand recognition and greater value and customer loyalty.

- 2. Scaling PAYG solar or other PAYG products depends on specialised sales and customer support, which differs significantly from existing agent network and customer support activities.**

Unlike the sale of mobile services, the success of PAYG solar depends on targeting the 'right' customers who have the ability and willingness to repay their loan. Incautious lending brings a quick end to any asset financing business.

The specialisation of PAYG solar companies (operator- or non-operator owned) in different parts of the customer value chain (sales, distribution and asset financing) is what makes partnerships valuable for mobile operators. The nature and value of partnerships with PAYG providers differ between markets and providers, but all create the opportunity for mobile operators to reach particular customer segments with critical, 'sticky' services without adding consumer debt to the balance sheet. In the past decade, PAYG solar companies have gained experience managing credit risk for low-income customers, and this has laid the foundation to offer a wider range of products to customers with an established payment history. As highlighted in a MasterCard white paper,²³ the solar sector is driving the PAYG revolution, and PAYG models are, in turn, driving a new wave of financial inclusion.

This study has generated new evidence and insights into the experiences of customers who have adopted PAYG solar. These can be used to inform the targeting and structure of mobile operator and SHS provider partnerships, and these are discussed in the following section in turn.

Implications for targeting and customer segmentation

The impact of energy access on mobile usage differs substantially by customer profile. This study found that those who are in the early stages of their mobile money

20. For a documentation of the key challenges in seamless integration see: GSMA (2021) *Mobile Money API Industry Report: The challenges of seamless integration (part 1)* and GSMA (2021) *Mobile Money API Industry Report: The challenges of seamless integration (part 2)*

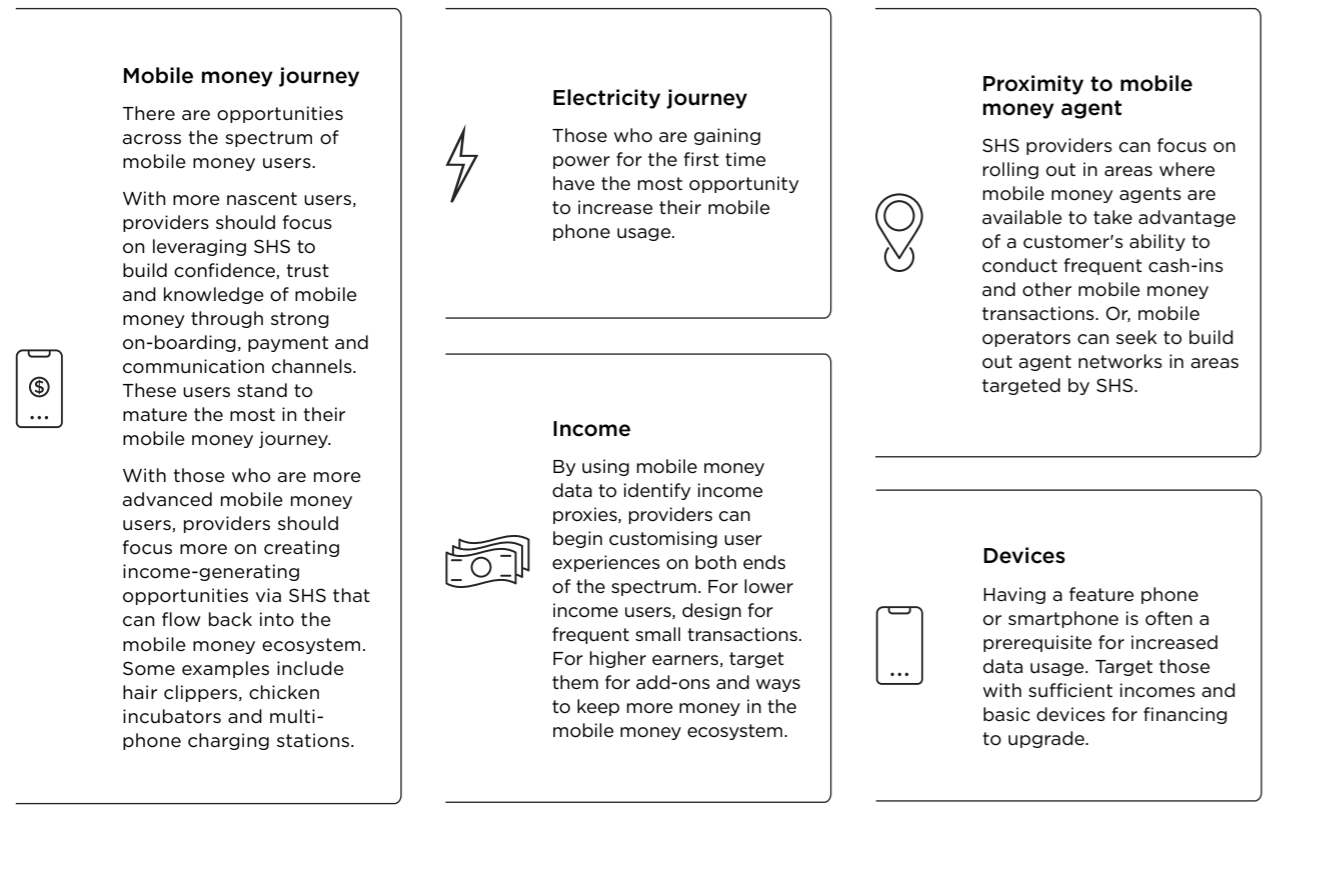
21. See: <https://www.gsma.com/mobilefordevelopment/mobile-money/mobile-money-api/>

22. GSMA (2020) *The GSMA Instant Payment Notification (IPN) Hub: Impact and insights from inception to industry transition*

23. MasterCard (2018) *Pay-As-You-Go and the Internet of Things: Driving a New Wave of Financial Inclusion in the Developing World*



FIGURE 16
Key considerations when targeting SHS customers



journey, those who are gaining access to electricity for the first time and those who are using a feature phone are most likely to see the greatest changes in behaviour. These findings underscore the fact that mobile operators are likely to reach new customers and market segments through partnerships with SHS providers. Rural populations and other populations gaining reliable electricity for the first time stand to gain the most from PAYG solar. The social return on these partnerships is high for these customers, as many are gaining access to essential services for the first time.

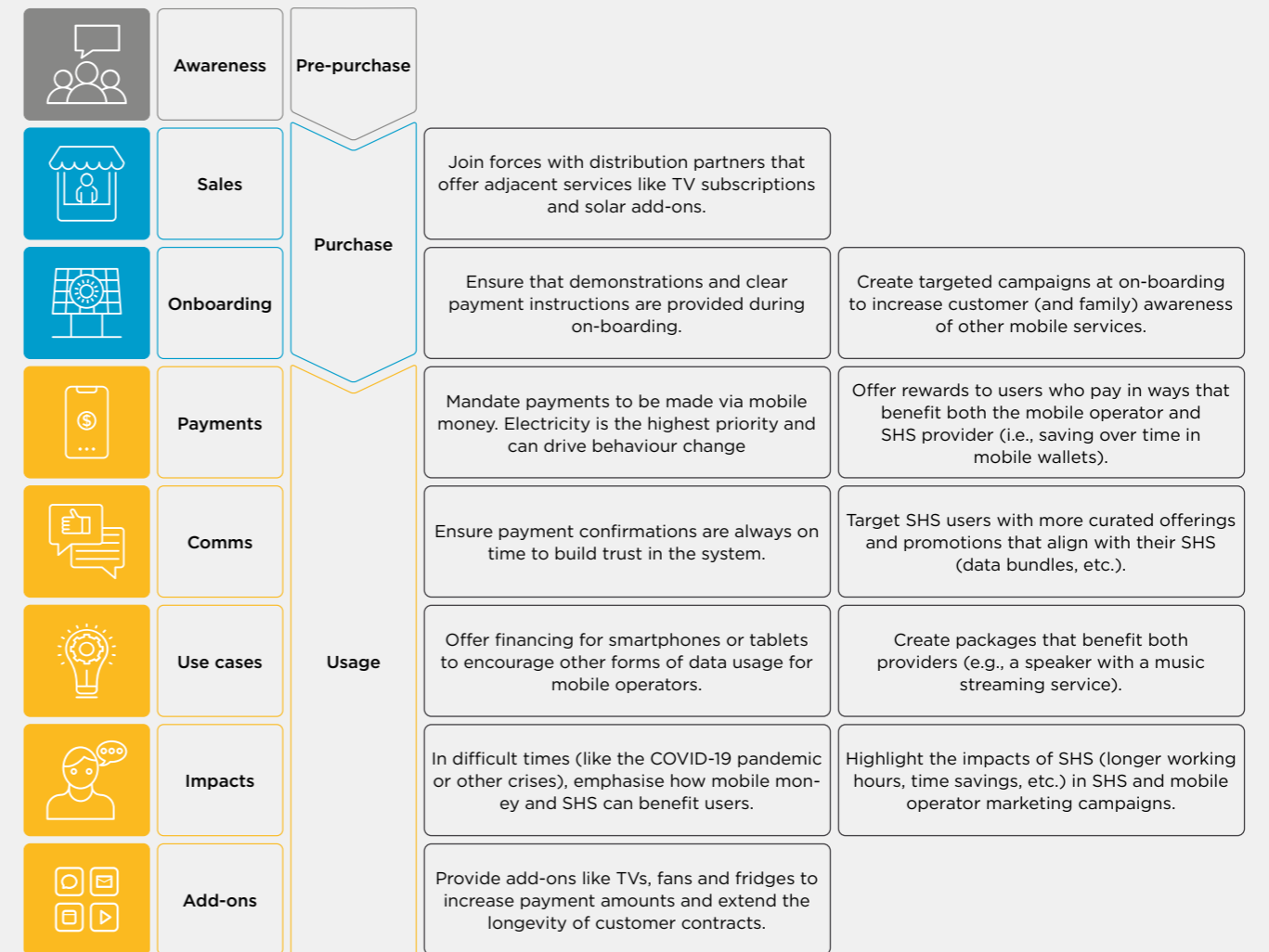
The value of these partnerships is not limited to this customer segment, however. Those with higher incomes, more experience using electricity and perhaps using a smartphone or data-enabled phone, also change their behaviour. For these customers though, a different set of factors come into play. They may shift their behaviour due to changing social norms, the discovery of new services through access to linked subscriptions and add-ons or switching to a different

mobile operator due to their SHS payments. This customer segment also has high potential for growth as adopters of additional PAYG products, such as productive use assets or smartphones.

Recommendations for PAYG service providers

This research has identified the points in the SHS customer journey where impacts are most significant. Some of the greatest impacts on behaviour are in the sales and on-boarding stages, as these are critical moments to build customer trust and capacity. It is also an important area in which to deepen mobile operator-SHS partnerships and a first step in moving from the most basic level of engagement (operators making their services available to SHS providers) to deeper engagement.

FIGURE 17
Synergies across the SHS customer journey



Use cases and add-ons are also critical areas in which to deepen partnerships. For many SHS customers, making repayments via mobile money is their first opportunity to develop a credit history. Experience with asset financing has enabled many SHS providers to diversify their product offering, which adds value to partnerships in terms of serving existing customers. Ultimately, value is generated from the benefits customers reap from accessing essential products and services for the first time and, for many people, accessing credit on a flexible and convenient basis, which was simply not an option until recently. Growth in the PAYG sector reflects this pent-up demand for access to affordable basic products and services, and the transformative value of digitally enabled, market-creating innovations that can address this demand in a commercially sustainable manner.

Looking ahead: Development outcomes and the energy-mobile nexus

The GSMA Mobile Money Prevalence Index (MMPI) combines country-level data on mobile money adoption, activity and accessibility, providing the most comprehensive, publicly available cross-country analysis of the state of mobile money. Benin and Côte d'Ivoire both rank high on the index, which provides important context for the findings of this research. It is clear that markets with less developed mobile money ecosystems



stand to gain a great deal from the continued growth of the PAYG sector/ecosystem.²⁴ Additionally, as highlighted in this report, the uptake of PAYG products by new SHS customers is a critical step towards greater financial inclusion and a thriving mobile money ecosystem.

Globally, more than 700 million people still lack access to electricity.²⁵ This huge unmet need means the addressable market for PAYG solar products is still significant, and is one reason why the growth projections for the industry remain so strong.

24. GOGLA (2020) *Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data*
 25. See: <https://trackingsdg7.esmap.org/>
 26. SE4ALL (2020) *State of the Global Mini-grids Market Report 2020*

Governments are also increasingly recognising the benefits of solar, pursuing deeper partnerships with the sector and developing supportive regulation. The findings of this study on customer behaviour change are likely not limited to household solar, but also relevant to other energy use cases. For example, digital payments and mobile are a core part of the operating models of other off-grid energy models, such as solar microgrids²⁶ and anchor-business-client models that leverage telecom towers as anchor clients, while also providing power to surrounding rural areas. The research findings on the benefits of income and access to add-on services are likely to be very relevant to these use cases.

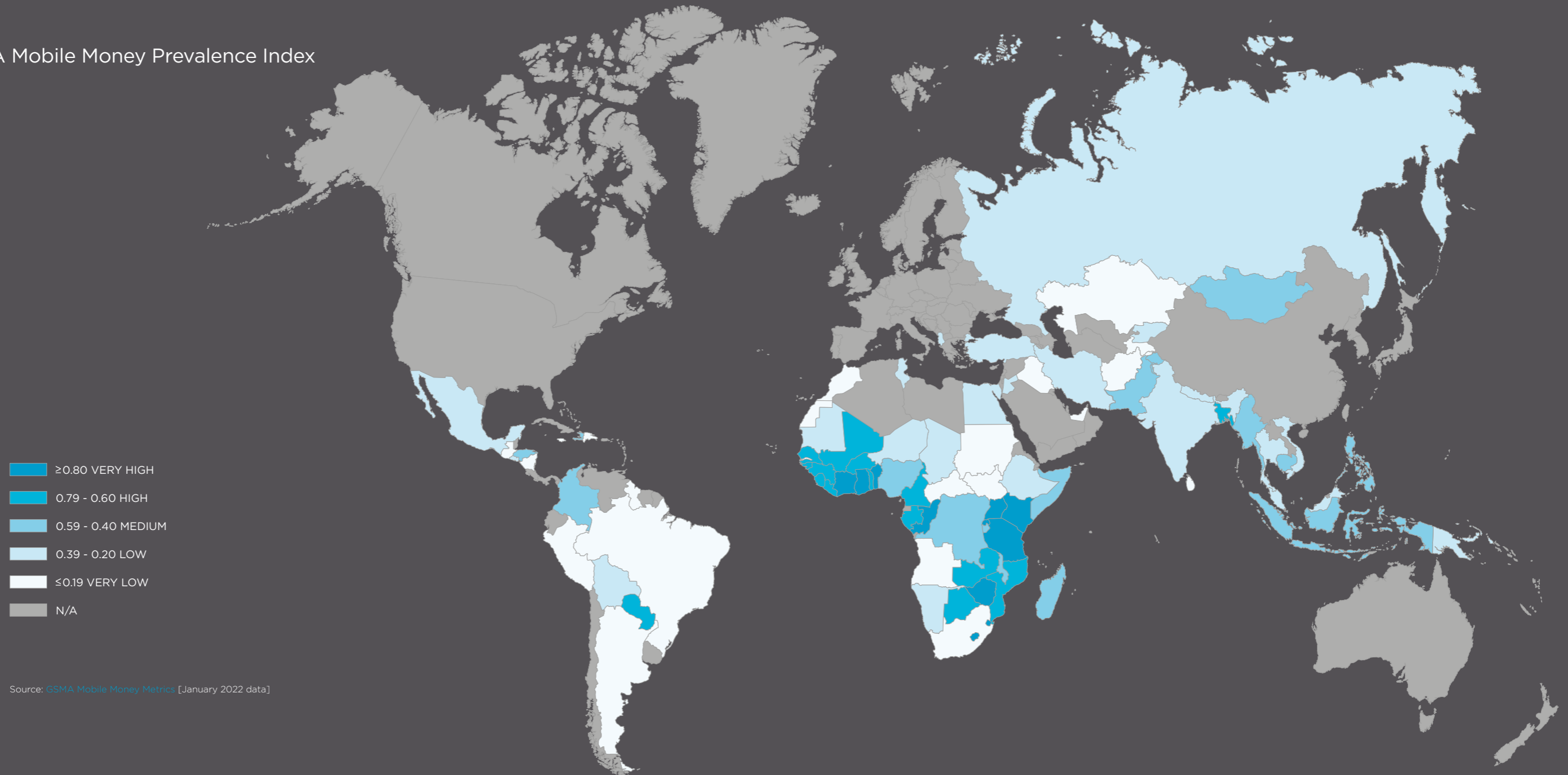
Finally, the findings of this research have implications for PAYG products beyond solar. As highlighted throughout this report, PAYG solar companies are increasingly well positioned to provide consumer credit to underserved populations thanks to the payment histories they are generating. The solar kit also remains a lockable asset that can be used as collateral, and SHS providers are becoming increasingly specialised and expanding their reach. Limited financial inclusion not only affects people's access to electricity; the rapid expansion of product and financial service offerings by PAYG solar companies also demonstrates that their operating model is best thought

27. See: *What we've learned about the role of mobile network operators in pay-as-you-go solar* (GSMA blog post)

of as a market-creating innovation, rather than simply another product or service.

The PAYG opportunity beyond solar is enormous given the extent of pent up demand for affordable pathways to access essential goods and services. PAYG provider and mobile operator partnerships are central to meeting this need as each side brings unique value.²⁷ While PAYG models have mobile services at their core, PAYG providers have the capabilities and reach that many mobile operators do not. Deepening these partnerships will ultimately reach end users with products and services they have traditionally been excluded from accessing.

FIGURE 18
 GSMA Mobile Money Prevalence Index



Source: GSMA Mobile Money Metrics [January 2022 data]



Appendix: Research methodology



Sampling and data collection

Data analytics teams from each of the participating mobile operator partners selected a cohort of SHS customers who started using an SHS six to eight months prior to data collection. Mobile usage indicators were analysed to compare the transactions these customers made in both the six months preceding and following sign-up with the SHS provider. The change in usage was then compared to a comparison group of similar mobile operator customers who had not taken up PAYG SHS.

The research team provided the mobile operators with desired profiles of respondents based on demographics and mobile usage characteristics. These were used to produce a list of customers to contact for the qualitative research. We wanted to learn from both customers who increased their mobile usage significantly more than the comparison group ('doers') within six months of joining SHS providers, and those who did not ('non-doers'). Doers included a diverse set of users who changed their mobile behaviour in one or more of the following ways:

- Increased their mobile money transactions more than the average user;
- Increased their mobile money usage significantly more than the average user;
- Increased their mobile voice/airtime consumption more than the average user;
- Increased their mobile data consumption more than the average user; and/or
- Became mobile data consumers for the first time.

Likewise, we wanted diversity in terms of gender, geography, SHS products purchased, SHS distribution channels and locations where the SHS were used (home, business or both).

Participants were recruited via SMS. Interviews were conducted via outbound calls and lasted 45 to 60 minutes on average. Calls were conducted in French and other local languages, and participants were provided with a small financial incentive for their time.

Limitations and sample bias

It should be noted that the sample of users we spoke with is not nationally representative of the two markets. Some segments were inevitably represented more or less to capture diverse perspectives. Likewise, the lessons from these two markets and SHS providers may not be indicative of all SHS providers and mobile operators globally. The drivers and barriers to behaviour change are certainly influenced to a degree by the unique features of each market.

Furthermore, as we only explored cohorts of users who had registered for SHS six to eight months ago, it is possible that recollections of certain experiences may not be completely accurate. Likewise, the insights we gleaned from the interviews only apply to behaviour change in this initial six- to eight-month period. It is possible, and even likely, that mobile usage behaviour may continue to change at later stages of the PAYG SHS customer journey as users upgrade to additional appliances or systems with greater capabilities or stop using SHS altogether. However, these changes fall outside the scope of this study.

Finally, as noted in the report, the sample of respondents was overwhelmingly male. This was because the sampling and customer identification strategy was based on the phone number that is tied to the SHS payment, and these were primarily registered in a man's name. The unequal gender representation in the sampling of respondents is a limitation of this research. Additional research on impacts by gender would be valuable.

Translating frameworks into qualitative research questions

Interviews were analysed on the basis of whether they supported or refuted a set of predefined assumptions and hypotheses. The development of these hypotheses was based on expert and practitioner interviews. These assumptions were then built out into detailed hypotheses, overlaid with the COM-B framework, as shown in Table 2. These hypotheses were used to develop the interview guides. The questions contained both open-ended enquiries to capture the stories behind customers' experiences, along with some predefined answer choices to standardise comparisons across the 120 respondents.



TABLE 2

Key assumptions

Pre-purchase	Awareness		The ways in which customers hear about SHS play a role in changing mobile usage behaviour.
	Sales		The channels through which SHS are distributed/sold play a role in changing mobile usage behaviour.
Purchase	Onboarding		The ways in which customers are on-boarded/trained on SHS play a role in changing mobile usage behaviour.
	Payments		The channels through which SHS collects payments play a role in changing mobile usage behaviour.
Usage	Comms		The ways in which SHS providers communicate with customers play a role in changing mobile usage behaviour.
	Use cases		The ways in which the customer uses SHS plays a direct role in changing mobile usage behaviour.
	Impacts		The secondary impacts of using SHS play a role in changing mobile usage behaviour.
	Add-ons		Additional products facilitated by SHS play a role in changing mobile usage behaviour.
	Targeting		The types of users targeted by SHS providers play a role in changing mobile usage behaviour.

TABLE 3

Mobile money hypotheses

Capability	Onboarding	Because they didn't use mobile money much before, they didn't understand it well. The SHS sales agent trained them how to use it.
	Payments	Because they didn't have mobile money before, the SHS sales agent helped set it up. Because they have to make payments via mobile money for SHS, they have organically explored the menus and discovered services they weren't aware of before. Because they have to make payments via mobile money for SHS, they now feel more confident using it.
Opportunity	Sales	SHS provider partnered with mobile money kiosks to sell SHS to customers who were likely to make mobile money transactions.
	Payments	They store money on their mobile wallets to pay for their SHS slowly over time, but then they use it for other expenses as well.
	Use cases	There are other services paired with their SHS that they can pay for via mobile money (e.g. satellite TV). SHS enables them to buy electronic devices and pay them off in mobile money instalments.
	Impacts	They can charge their phone more because of the SHS, so it is on more and they can use it more for mobile money.
	Add-ons	They used their SHS to start a new business (e.g. phone charging) and now receive mobile money payments for their products/services. They used their SHS to start a new business or business line for which they use mobile money to pay for supplies/merchandise. They earn more money now because their SHS helped them open a new business or business line or save on expenses, so they have more disposable income to spend on mobile money. They can send money to family using the additional money they have earned/saved thanks to their SHS.
Motivation	Payments	They get payment reminders from SHS providers, which in turn drive them to the mobile money platform more often.
	Comms	They get promotions from mobile operators because they are an SHS customer (or because they are new to the mobile money platform).
	Add-ons	SHS provider starts to promote different products (e.g. solar irrigation) that are paid for via mobile money. Because fees are low/non-existent for SHS payments via mobile money, they realise they could save on other services if they paid with mobile money. SHS users trust mobile money services more after using it to pay for their SHS. They feel it works. SHS users start to discover the convenience of mobile money.

TABLE 4

Voice and data hypotheses

Capability	Onboarding	They received training from the SHS provider on how to use services that use mobile data.
Opportunity	Payments	Once they become more familiar with mobile money by paying for their SHS, they realise they can buy data/voice easily via mobile money.
	Use cases	They use data to stream videos to their new TV that came with their SHS.
	Impacts	They can charge their phone more because of the SHS, so it is on more and they can use it more for mobile data/voice.
	Add-ons	From the additional money they earned/saved thanks to their SHS, they have more money to spend on mobile data/voice. The time they have saved due to their SHS has given them more leisure and social time to use data/voice.
Motivation	Comms	Mobile operator offers data/voice promos (either because they are SHS customers or because they are new to the mobile money platform).
	Impacts	SHS users feel empowered to be tech-savvy consumers thanks to SHS. As SHS becomes more popular, social norms become more electricity/data-focused and encourage further uptake (i.e. feeling the need to keep up with one's neighbours/village).



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