Cambodia Sanitation Marketing Scale-Up 3 (SMSU3)

SMSU3 Mid-term Assessment, July 2018 to December 2020.

Chuon Pisey / iDE / 2020 - **Working together to build a successful sanitation business**

Program Donors:

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EXECUTIVE SUMMARY

Between 2009 and end of 2020, iDE's Sanitation Marketing Scale-Up (SMSU) Program has sold and delivered 366,340 sanitary latrines, reaching approximately 1.7 million rural Cambodians. This equates to over 10% of the population in Cambodia or more than one-third (38%) of the rural population in the seven provinces where the program has operated. In the current phase of the program, SMSU3, which began in mid-2018, project-connected businesses and sales agents have sold a total of 65,159 latrines and supported an increase in sanitation coverage in project provinces from 67% to 78%. As of December 31, 2020 iDE has supported 972 villages to file Open Defecation Free (ODF) status claims, 395 villages are in development of filing, and 45 villages have been verified as ODF by the Cambodian government.

This report summarizes key findings and lessons learned from iDE's monitoring and evaluation efforts from the first half of the SMSU3 program, during the period July 2018 to December 2020. It includes analysis of sales trends and key customer behaviors like purchase, installation, and satisfaction. We then look at how SMSU is contributing to changes in sanitation coverage over time, including the lessons we are learning about pushing toward open defecation free status and ensuring access to safely managed sanitation. From there, we examine what these results mean for key program stakeholders. First, we assess the sustainability of latrine business owners (LBOs), whose ability to continue functioning in the future will contribute to market durability after SMSU. Second, we look at the GESI-related impacts of the program through analyses of intrahousehold latrine use, changes in behaviors and attitudes among program staff, and the results of a pilot for building capacity among women entrepreneurs. Finally, we provide some key findings from our early research on the impacts of climate change on improved and safely managed sanitation.

Key findings from the report include:

Sales & Deliveries

- Project-connected businesses have sold over 65,000 latrines during SMSU3, nearly 25,000 of which have been purchased at a partial discount by poor households taking advantage of the program's targeted subsidies.
- SMSU3 has also diversified the range of products available on the market to include a number of shelter options and an alternating dual pit upgrade.
- SMSU3 latrine sales account for roughly 42% of all latrines that households installed across all six program provinces since mid-2018. This indicates the significant scale that iDE's program has reached and confirms that project-connected businesses are significant drivers of improved sanitation coverage in their communities.

Purchase

- Women are key players in the decision to finance and purchase a latrine, as over 31% of SMSU3 customers say that purchase decisions were driven by the wife and 75% report that purchases were financed either by the wife or jointly.
- Convenience and security are the most commonly cited reasons for deciding to buy a latrine — 89% and 49% of households reported that these were driving factors in their decision, compared to only 39% who said that health concerns were important.

Installation

- Households generally install latrine substructures quickly after purchase: over 97% of Easy Latrines are installed within one month of purchase, and these rates do not vary based on poverty status.
- Shelter installation rates are lower — 80% of customers have installed shelters within 12-18 months of purchase — but this metric has improved in SMSU3 compared to SMSU2.

Satisfaction

- Households are mostly satisfied with their latrines, though there is some variation between provinces.
- Many customers plan to upgrade their latrines by adding a shelter, water reservoir, or shower. Few plan to add a second pit, which may present a challenge for scaling fecal sludge management solutions like the alternating dual pit upgrade.

Progress to ODF

- As mentioned above, SMSU3 is making progress in getting communities to open defecation free status. By the end of 2020, 972 villages had filed an ODF claim, while the program is working with 395 additional to develop their claim.
- Nearly a quarter of households that don't yet have a latrine have decision makers who are either permanent or temporary migrants that are often not in the home during times when SMSU sales agents might visit. The program is addressing this issue by strengthening relationships with local stakeholders that can more consistently promote improved sanitation.
- The program's customer research shows that a majority of non-latrine owning households have not purchased a latrine because they prefer sharing to owning, while financial constraints are only a major concern for 15% of households. This indicates the need for the program to more explicitly highlight the benefits of latrine ownership versus sharing in addition to the financial mechanisms it is deploying to increase affordability.

Fecal Sludge Management (FSM)

- SMSU3 is addressing gaps in rural FSM primarily through the alternating dual pit (ADP) upgrade and an associated service offering for treatment with hydrated lime. By December 2020, project-connected enterprises had delivered over 11,700 ADPs.
- Households in rural Cambodia will likely continue to perform unsafe FSM practice unless access, knowledge and familiarity for safe FSM products and services (e.g. ADP, professional pit emptying service) are improved.
- Households vocalize a strong aversion to contact with fecal waste but they also express an acceptance for using human fecal sludge (FS) as fertilizer and a preference for self-emptying.
- Today, space constraints are not a significant issue in rural Cambodia. However, over time the need for latrine capacity will continue to increase making the ADP a more sustainable and cost-effective product compared to pits in series.

LBO Sustainability

- Of the 70 active LBOs, 19% of them (n=13) are earning at least 30% of their WASH-product monthly revenue from products other than the Easy Latrine, including ADPs, shelters, and spare parts.
- 63% (n=44) of active LBOs claimed to have earned at least $1,000 in the previous 12 months from non-WASH business channels. 33% (n=23) claimed to have earned at least $10,000 in the previous 12 months from non-WASH business channels.
- 67 out of 70 active LBOs sold products via retail channels directly to customers, however only 27% of LBOs sold more than 5% of their total quantity via retail channels.
- Using the 'Quick-Look' sustainability metrics, three Active LBOs (4%) meet four out of the five criteria for sustainability, and 15 (22%) meet three out of five. The largest group of LBOs (42%) satisfy two out of the five metrics, whereas 26% meet just one metric.

Gender & Inclusion Analysis

- SMSU3 is promoting inclusive sanitation improvement in service of the mission to "Leave no one behind." Across this phase of the program, 55% of latrine customers were poor, a much higher portion

than in the population in general.

- Latrine usage rates are consistent between men and women, while the elderly and people with disabilities have the highest usage rates (around 79% of people in both groups report always using the latrine). Taken together, these findings indicate a high degree of equity in access to and use of sanitation facilities in project areas.
- SMSU's work to build the capacity of women business owners has generated some early successes. Overall, the entrepreneurs who have taken part in the SHE Investment-run training and incubation have seen increases in income and savings. Improvements in confidence and decision-making power were smaller, but stories from these entrepreneurs indicate the experience was meaningful in building skills and business acumen.

Climate Vulnerability & Resilience

- SMSU3 research indicates that rural households living in climate vulnerable flood-prone areas are more likely to face challenges with latrine functionality and more frequent occurrences of pit fillings, and that these households are more likely to express unsafe FSM intentions and behaviors.
- The research study proposes a feasible approach for iDE to estimate and target households faced with different thresholds of vulnerability to climate change in order to prioritize and market customized sanitation solutions to those who are most vulnerable.
- Targeting households that face increased risks with climate change, the All Seasons Upgrade (ASU) was designed for high-ground water and low infiltration environments and field-tested to safely divert the existing pit content into a high infiltration leach field, minimizing households' exposure to untreated FS and improving latrine functionality.

INTRODUCTION

iDE's Sanitation Marketing Scale-Up (SMSU3) program is the harmonized combination of multiple donor-funded projects: Water and Sanitation Scale-Up Program 2 (WASH-SUP2), supported by the Australian Department of Foreign Affairs and Trade (DFAT) under the Water for Women Fund, and the Cambodia Rural Sanitation Development Impact Bond (CRS-DIB) supported by the Stone Family Foundation (SFF) and the United States Agency for International Development (USAID). The United Nations International Children's Fund (UNICEF) has provided additional support in specific program operating areas. SMSU3 is the continuation of a rural sanitation and hygiene market development program that began with a pilot in 2009 and is on its third scale-up iteration. SMSU3 is active in rural communities in six Cambodian provinces: Kampong Thom, Kandal, Oddar Meanchey, Prey Veng, Siem Reap, and Svay Rieng.

This report summarizes methods and findings from iDE's monitoring and evaluation efforts throughout SMSU3, during the period July 2018 to December 2020. This report will reference progress made against the inception of SMSU3 (the endline of SMSU2) as well as progress since the beginning of the SMSU program (since February 2012). These results inform ongoing program decision-making and provide the basis for determining whether the project is progressing toward the key targets set for SMSU3 in partnership with DFAT, SFF, USAID, and UNICEF. Findings from this report will also be used to shape and influence SMSU3 targets and operations. While the SMSU program does receive some funding from DFAT for the sale of ceramic water filters through the Hydrologic social enterprise, this report will focus exclusively on our core program work and analysis in sanitation.

The report starts with a brief discussion of our methods for data collection and analysis. We organize our principal findings into a narrative that follows the course of the SMSU program by first exploring sales trends and then examining customer behaviors and perceptions around purchase, installation, and satisfaction. We tie all of this together by looking at how SMSU is contributing to changes in sanitation coverage over time, including the lessons we are learning about pushing toward open defecation free status and ensuring access to safely managed sanitation. From there, we examine what these results mean for key program stakeholders. First, we assess the sustainability of latrine business owners (LBOs), whose ability to continue functioning in the future will contribute to market durability after SMSU. Second, we look at the GESI-related impacts of the program through analyses of intrahousehold latrine use, changes in behaviors and attitudes among program staff, and the results of a pilot for building capacity among women entrepreneurs. Finally, we provide some key findings from our early research on the impacts of climate change on improved and safely managed sanitation.

METHODS

It is important to note that some data collection methods are continuous throughout program operations. Other data collection efforts, such as the latrine count, are static collection efforts. Date ranges for those data are noted in the report. Customer survey data collection ended in January 2020 as data collection resources then shifted to complete the latrine count. Latrine sales data is inclusive of all sales from July 2018 to December 2020.

OVERVIEW OF METHODS

The key indicators of success for this project are grouped around four objectives (1) Open Defecation Free status of villages in project area; (2) Safely Managed Sanitation including Fecal Sludge Management; (3) Entrepreneur and Enterprise Sustainability and (4) Gender Equity and Social Inclusion. Key indicators for those objectives include:

- Sales through project-connected enterprises
- Sales to IDPoor households[1] through project-connected enterprises

[1] The IDPoor System is an initiative administered by the Cambodian government that identifies poor households, assesses their level of poverty (IDPoor 2 is poor, IDPoor 1 is poorest), and distributes identification cards for these households.

- Changes in latrine coverage
- Intrahousehold use by household member type, including people with disabilities and women and girls
- Household adoption and use of safely managed sanitation
- Sustainability of project-connected enterprises
- Progress to Open Defecation Free (ODF) status in project areas

In order to measure these results, we have used the following methods:

- Sales data from project-connected enterprises (measures direct sales)
- Ongoing verification of latrine business sales (including a household questionnaire to identify the percentage of IDPoor customers, consistent use by household member types, and installation rate)
- A biennial latrine count to estimate changes in coverage at district level and calculate sales through other non-project-connected enterprises in project areas
- A quarterly business profile update, collecting key business data from each active latrine business
- Ongoing survey for all sales pitches that do not result in an order to help determine barriers to purchase
- ODF village-level census to identify remaining households that lack basic sanitation
- One-time data collection on households' fecal sludge management practices, behaviors and attitudes conducted in association with the University of Colorado Boulder
- A three-phased survey pilot including a survey validation with full data collection focusing on gender equality and its connections with WASH. This initiative was conducted in collaboration with the University of Technology Sydney's Institute for Sustainable Futures (UTS-ISF).

LATRINE COUNT

iDE conducted the most recent latrine count between January to July 2020 using a cluster sample method, following up on a subset of 15 villages within each district of the six SMSU provinces. Within each cluster (village) we conducted a census of households to establish the total latrine count. The last latrine count for the end of SMSU2 was completed between December 2017 and June 2018.

iDE research assistants (RAs) worked with local leadership to draw a sketch map of the village, identifying the location of all households. The RA visited each household to record the following data:

- IDPoor status (1/2/none)
- latrine type (wet/dry/none)
- installed (y/n)
- whether the latrine was subsidized (y/n)
- if no latrine, whether households shared a latrine with anyone else
- diarrhea prevalence for children

While surveys are administered at a household, the results are aggregated to the village level and our 153,163 household observations are collapsed to 750 primary sampling units for analysis. Table 1 presents the sample profile for the most recent latrine count.

TABLE 1: LATRINE COUNT SAMPLE PROFILE

PROVINCE	DISTRICTS	VILLAGES	HOUSEHOLDS
Kampong Thom	7	105	24,112
Kandal	10	150	48,132
Oddar Meanchey	4	60	12,335
Prey Veng	12	180	47,877
Siem Reap	11	165	40,689
Svay Rieng	6	90	19,102
TOTAL	50	750	192,241

RAs collected household data using paper forms, which were field checked and further validated by the M&E Manager at iDE's head office in Phnom Penh. Data entry clerks entered the data at the Phnom Penh office. The SMSU M&E Coordinator conducted field verification of latrine count data.

SALES TRACKING

iDE's team of research assistants collects sales data from each project-connected latrine business every month. Latrine businesses maintain a record book designed by iDE to track customer data (name, phone number, and village/commune/district/province) and details of the sale (units purchased, components, sales agent responsible, etc.). Research assistants record summary data on deliveries based on the record book and also take a digital photo which they send to headquarters for verification purposes.

Verification of monthly delivery records ensures that deliveries are accurately and properly recorded in the latrine business owners' (LBOs) books. Quick verification is implemented on a monthly basis and through the following process:

1. LBOs with greater than 35 reported deliveries in a month are stratified by province. The M&E Coordinator selects LBOs from each province by using probability proportional to size sampling, replacing those who were randomly selected the previous month.
2. Research assistants are assigned two LBOs for verification. Ten customers per LBO are randomly selected for follow-up.
3. RAs complete field verification reports and sync to the Salesforce database. If there are at minimum two misreported cases per LBO, the M&E team conducts follow-up checks for all deliveries of the LBO during the month.

In this report, non-project connected sales figures are calculated based on the latrine count. Estimates of sales to IDPoor households in Table 5 are calculated from customer surveys, as customer survey verification of the IDPoor status of each household is more reliable than SMSU3 sales orders.

CUSTOMER SURVEY

Follow-up surveys are given to latrine customers to learn about their poverty status, expenses for latrine, use, and satisfaction. Customer surveys also serve as a tool for verifying delivery data. Sampling procedures for the customer survey are as follows:

1. The sampling frame is restricted to customers whose latrine was delivered 12 to 18 months prior. LBOs with the highest delivery counts are selected proportional to the research assistants covering that province.
2. 20 customers are randomly selected per LBO, with additional customers selected for replacement as needed during field work.

3. RAs are provided with a list of selected customers and their contact information via the mobile app, TaroWorks. Interviews are alternated between male head of household and female head of household (or spouse).
4. Completed surveys are synced to Salesforce database. The M&E Coordinator regularly checks data to ensure results are complete and accurate.

LATRINE BUSINESS SUSTAINABILITY

Every quarter, RAs collected a set of business data from latrine businesses. These data include information on staffing, pricing, inventory, capital investments and financing. The purpose of this exercise is to build up a picture over time of the businesses providing toilets, provide a descriptive analysis of market dynamics and identify determinants of business success or failure. Data from this exercise, combined with sales data, support the business analysis in this report.

In addition to the routinely collected LBO Business profile data, we conducted a survey of LBOs to ask about their earned revenue outside of the orders that are generated through iDE, retail or institutional sales. This data collection included a relatively short survey that took about 30 minutes and included all of the active LBOs in SMSU3. This was collected in Q4 2020.

The sales order data captured in our Salesforce-based order management system can be linked to the LBO business profile data, as well as the LBO sustainability surveys because all share common LBO IDs. The LBO sustainability section of this report brings together all three sources of data for the analysis presented here.

SALES & DELIVERIES

Key Findings:

- Project-connected businesses have sold over 65,000 latrines during SMSU3, nearly 25,000 of which have been purchased at a partial discount by poor households taking advantage of the program's targeted subsidies.
- SMSU3 has also diversified the range of products available on the market to include a number of shelter options and an alternating dual pit upgrade.
- SMSU3 latrine sales account for roughly 42% of all latrines that households installed across all six program provinces since mid-2018. This indicates the significant scale that iDE's program has reached and confirms that project-connected businesses are significant drivers of improved sanitation coverage in their communities.

SMSU3 PROJECT-CONNECTED LATRINE SALES

In total since 2009, the SMSU Program has sold and delivered 366,340 sanitary latrines, reaching approximately 1.7 million rural Cambodians. This equates to over 10% of the entire Cambodian population, despite the fact that iDE only operates in six of the country's 24 provinces. In the current phase of the program, SMSU3, which began in mid-2018, project-connected latrine business owners (LBOs) and Sales Agents have sold a total of 65,159 latrines. Figure 1 presents the cumulative as well as quarterly sales numbers achieved under SMSU3.

In 2019, sales increased at a gradual, relatively linear rate. This is highly atypical. In SMSU's experience, sales performance is seasonal, with the highest sales occurring in the first and third quarters of the year. In 2019, this seasonal effect appears to have been offset by the scaling up of targeted subsidies throughout the year, which increased household purchasing significantly. Targeted subsidies were fully scaled and available in all provinces for all of 2020. With the subsidy factor constant across all provinces, we can clearly see the expected seasonal pattern again. In 2020, quarterly sales peaked in the first quarter and again in the third quarter. Notably, sales continued regularly throughout the first and second waves of the COVID-19 pandemic.

FIGURE 1: CUMULATIVE AND QUARTERLY PROJECT-CONNECTED LATRINE SALES

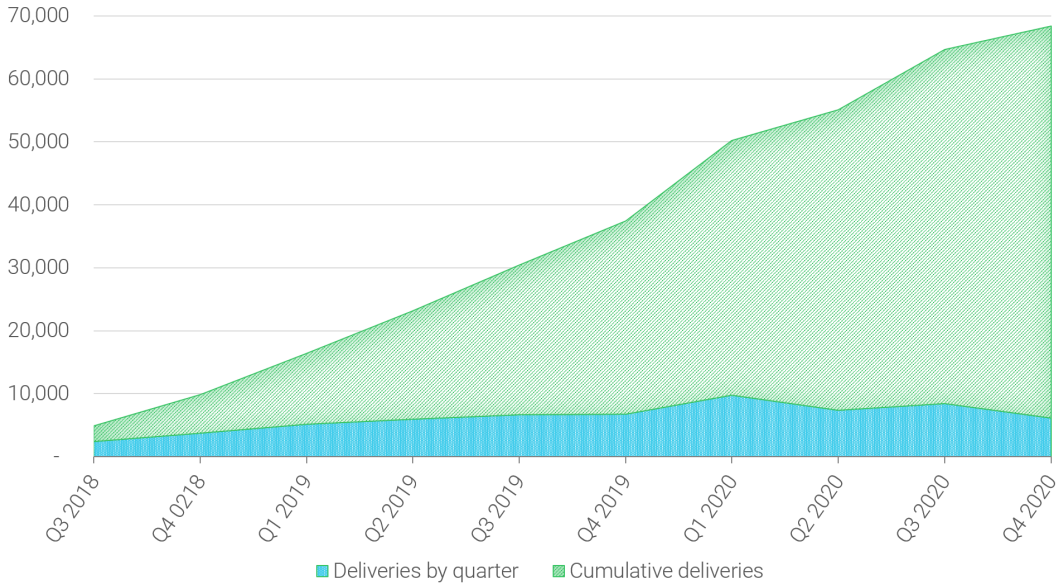


Table 2 presents the distribution of latrines sold under SMSU3 by province from the period July 2018 to November 2020. We see that Prey Veng, Kampong Thom, and Siem Reap each have a share of 20% or more of total latrine sales. In comparison, Oddar Meanchey only has 5% of all latrine sales, which is not surprising given that it has been one of the most challenging regions in which to operate.

TABLE 2: TOTAL LATRINE SALES IN SMSU3, BY PROVINCE

	Total Latrines	Percent Share
Siem Reap	16,478	26%
Kampong Thom	14,938	24%
Prey Veng	13,345	21%
Svay Rieng	8,579	14%
Kandal	6,125	10%
Oddar Meanchey	2,856	5%
ALL PROVINCES	62,321	100%

DIVERSIFYING PRODUCT OFFERINGS

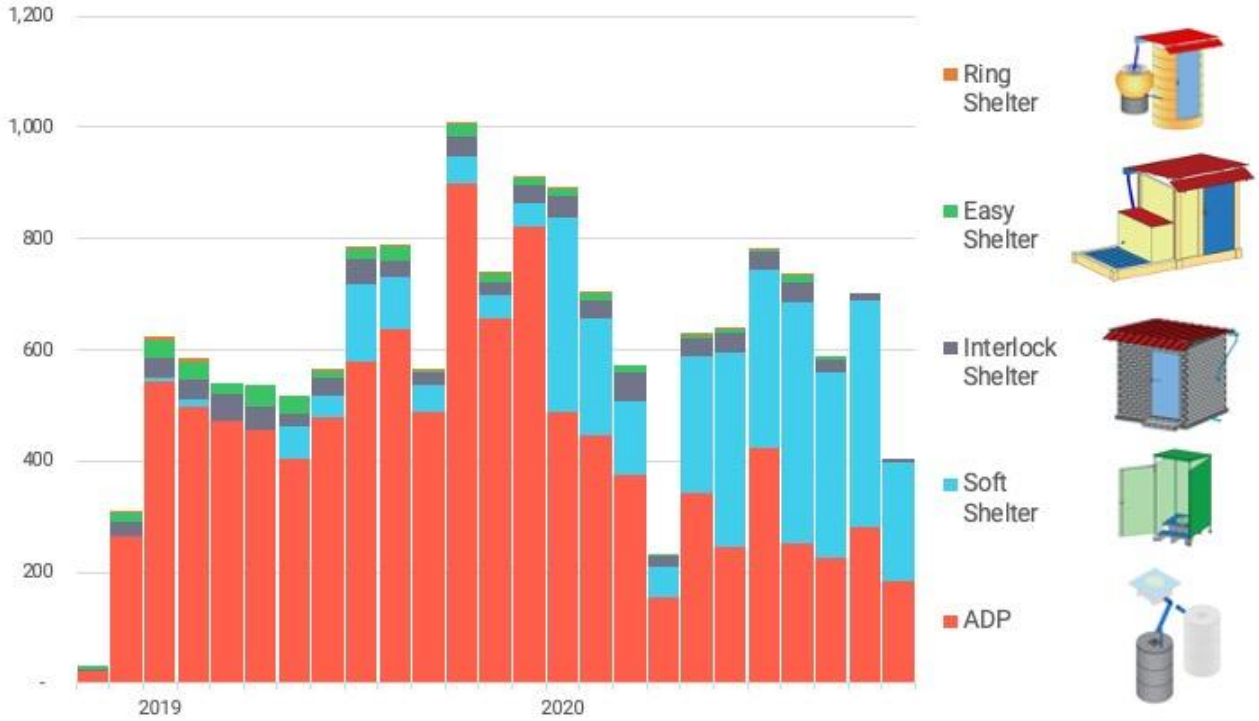
Previous phases of SMSU focused on the sale of Easy Latrines. In SMSU3, we have concentrated on scaling up the sale of sanitation products in addition to the Easy Latrine. For example, since the start of SMSU3 iDE connected enterprises have sold over 11,700 Alternating Dual Pit upgrades (ADPs), which allow households to safely manage fecal sludge through on-site settling.

TABLE 3: NUMBER OF PRODUCTS DELIVERED, TOTAL NET REVENUE & AVERAGE PRICE IN SMSU3, BY PRODUCT

	Quantity	Total Net Revenue (USD)	Average Price per unit (USD)
Easy Latrine	65,159	4,170,176	64
Alternating Dual Pit	11,730	586,500	50
Soft Shelter	4,165	145,775	35
Interlock Shelter	1,001	351,452	379
Easy Shelter	491	165,041	444
Ring Shelter	121	28,474	202

We have also pivoted to offer a greater range of latrine shelter products. Previous phases of SMSU found that households would delay their use of a newly purchased latrine until they had an aspirational shelter in place to ensure privacy. Selling low-cost shelters to ensure quicker latrine use has historically been a challenge for SMSU. However, as shown in Figure 2 below, specifically since the start of 2020 we have seen a significant increase in purchasing of Soft Shelters - the most affordable shelter option in our sanitation shelter product mix. By the end of 2020 iDE had sold over 4,165 Soft Shelters, over 3,800 of which were sold to IDPoor households with the support of a targeted subsidy. iDE has also sold 1,613 permanent latrine shelters, 165 of which have been installed with accessibility features for households with members living with a disability.

FIGURE 2: MONTHLY SALES OF NON-LATRINE SANITATION PRODUCTS IN SMSU3

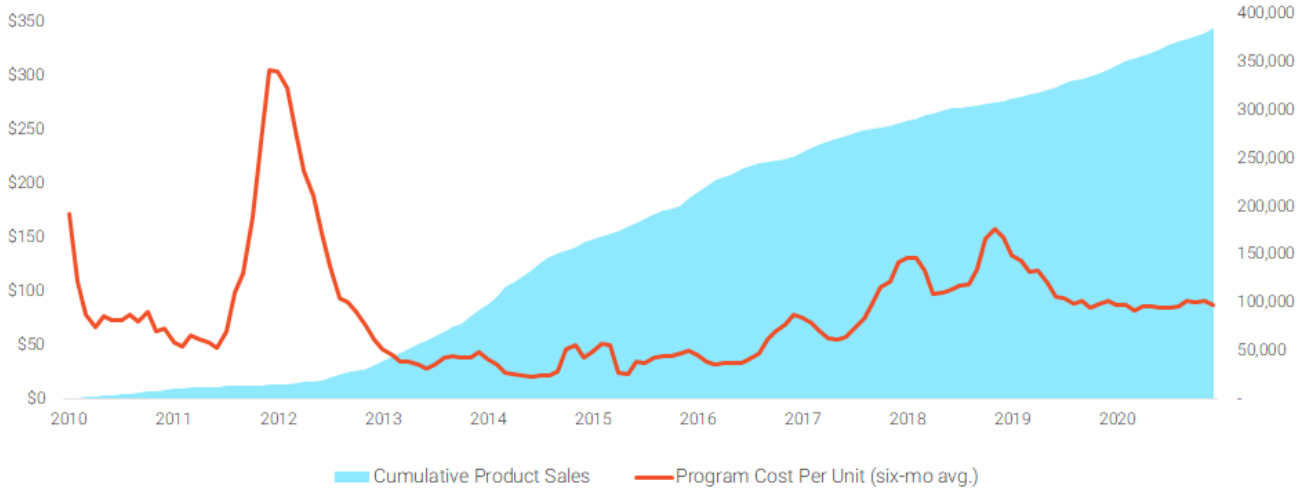


PROGRAM COST-EFFECTIVENESS

We can combine the product sales data above with program expenses to generate a cost-effectiveness measure that shows how efficiently the SMSU program is delivering impact over time. Our hypothesis, in working through markets to drive WASH impact, is that cost-effectiveness will improve over time as market forces take hold and market actors like LBOs are able to meet increasing demands in their communities.

As Figure 3 shows, this hypothesis does appear to hold true in the SMSU program. The figure compares cumulative product sales and the dollar amount the program was required to spend for each sale. The figure demonstrates that early investments in key program components like product design, IT infrastructure, and personnel drive up costs for short periods of time in 2010 and 2011-2012. Thereafter, though, rapidly rising sales and lower program expenditures lead to improved cost-effectiveness over the course of SMSU. Notably, we have seen a rise in per-unit program costs over the last four years as the market matures and remaining non-latrine owners become harder to reach and potentially poorer. Over the last two years, cost-effectiveness has stabilized around a per-unit program cost of about $87 as we have deployed new implementation features such as targeted subsidies and increased engagement with local government and other partners.

FIGURE 3: SMSU PROGRAM COST-EFFECTIVENESS OVER TIME



NON-PROJECT-CONNECTED SALES

The non-project connected sales ratio assesses the total number of latrines that have been added in our operating area and iDE-connected businesses' sales totals, then calculates the proportion of iDE-connected sales versus non-connected sales. A ratio of 1 indicates that for every latrine sold through an iDE-connected business, one additional latrine was sold in that area through non-iDE channels. Likewise, a ratio of 0 would indicate that virtually all of the latrines added in the area were delivered through iDE-connected businesses.

From Table 4 we see that the non-project-connected ratio for SMSU3 is 1.4 compared to 1.1 at the end of SMSU1. This ratio means that for every SMSU Easy Latrine sold there are approximately 1.4 latrines sold in the target area. Kandal is the province with the highest ratio of project-connected to non-project connected sales. That is, for roughly every one SMSU latrine sold in Kandal approximately 4.4 other latrines are sold. Notably, in Kampong Thom and Svay Reing, the ratios are 0.7 and 0.6, meaning that iDE project-connected sales account for the majority of new latrines in these provinces during SMSU3. It is worth noting that the non-project connected ratio does not capture the full sales story under SMSU3, where there are now a diversified set of products being sold by sales agents including shelters and ADPs (see Diversifying Product Offerings section above). As there are more latrine suppliers, SMSU affiliated LBOs are diversifying their products and offering more options to upgrade.

TABLE 4: NON-PROJECT-CONNECTED RATIO COMPARISON

	SMSU1 Ratio	SMSU2 Ratio	SMSU3 Ratio
Kampong Thom	0.2	0.0	0.7
Kandal	5.0	2.9	4.4
Oddar Meanchey	0.4	0.2	2.2
Prey Veng	1.0	1.4	1.9
Siem Reap	1.5	0.4	0.8
Svay Rieng	0.6	0.7	0.6
ALL PROVINCES	**1.1**	**0.8**	**1.4**

SALES TO IDPOOR HOUSEHOLDS

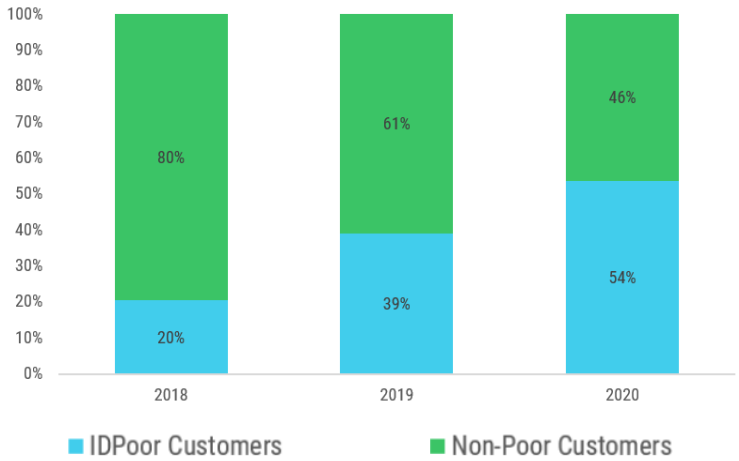
The government estimates that the IDPoor population in iDE operating areas is 16% of the total population. In SMSU3, 45% of all latrine sales have been to IDPoor customers (classified either IDPoor1 or IDPoor2). iDE is therefore significantly overserving the IDPoor market relative to its size. To an extent, "over-serving" is what we would expect as IDPoor households are less likely to have a latrine compared to non-poor households due to the association between latrine ownership and higher levels of income. However, the large increase in proportion of IDPoor sales between SMSU2 and SMSU3 is mostly attributable to iDE's distribution-at-scale of targeted subsidies to low-income households.

TABLE 5: IDPOOR SALES AS PORTION OF TOTAL SALES, BY PROVINCE

	SMSU1 End of Project	SMSU2 End of Project	SMSU3 Mid-term
ALL PROVINCES	**22%**	**20%**	**45%**

At the beginning of SMSU3, 20% of customers were IDPoor. As Figure 4 shows, year by year since 2018 the percentage of IDPoor customers has increased. In 2020 54% of the year's customers were IDPoor.

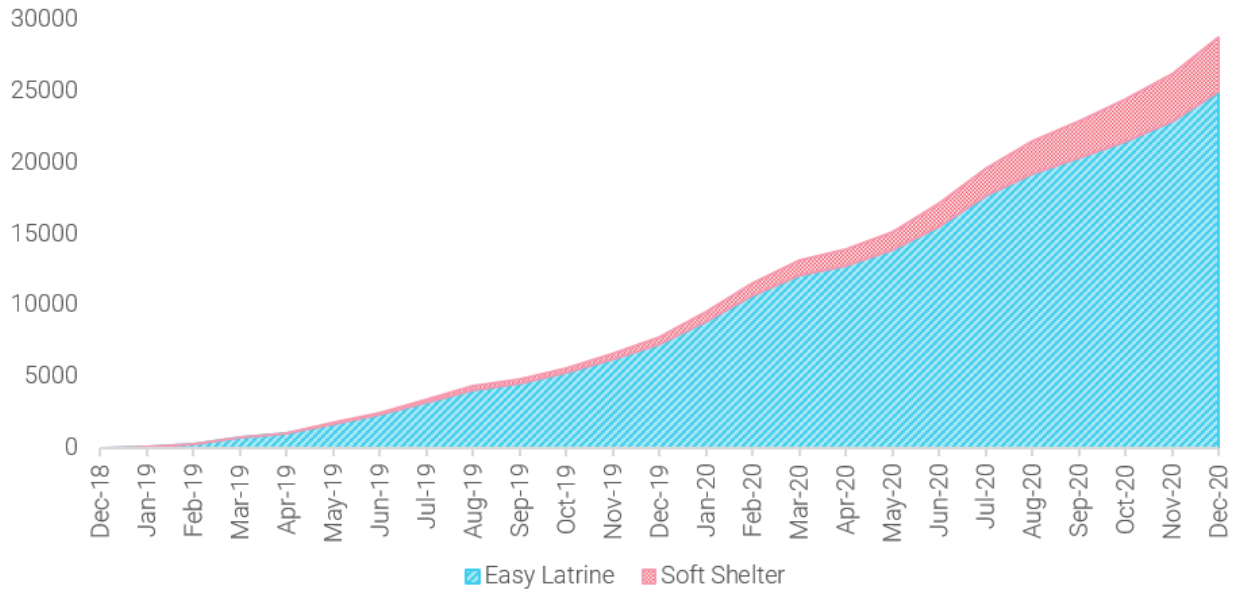
FIGURE 4: IDPOOR CUSTOMERS AS A PERCENTAGE OF ANNUAL EASY LATRINE CUSTOMERS IN SMSU3



Targeted Subsidies

The main driver of iDE's increased reach to IDPoor households has been the incorporation of targeted subsidies across the program's operating areas. Since 2019, iDE has been providing targeted subsidies exclusively to IDPoor households to reduce the price of latrines and temporary latrine shelters. The targeted subsidy model is described in detail in a tactic report[2] iDE produced in 2020. In total, iDE has facilitated the purchase of nearly 25,000 partially-subsidized latrines and 3,800 temporary "Soft Shelter" products by IDPoor families.

FIGURE 5: PRODUCT PURCHASES FACILITATED BY TARGETED SUBSIDIES



Payment Installment Plans

There are many households who are not registered as IDPoor, and are therefore ineligible for targeted subsidies, but still face significant financial challenges. One means for reducing the burden of payments for such households has been through payment installment plans. iDE has trialed and scaled a training protocol throughout its network of affiliated latrine business owners to offer simple payment installment plans with no interest paid by the customer. Over 1,047 households have now purchased latrines using this mechanism with a 99.2% full repayment rate. In addition, businesses have expressed that the skill set of dealing with households who have cash flow challenges has improved their ability to confidently work with customers for all products, helping them to operate a more viable and sustainable enterprise.

[2] Tactic Report: Reaching the poorest with sanitation through targeted subsidies. iDE Cambodia, 2020.

PURCHASE

Key Findings:

- Women are key players in the decision to finance and purchase a latrine, as over 31% of SMSU3 customers say that purchase decisions were driven by the wife and 75% report that purchases were financed either by the wife or jointly.
- Convenience and security are the most commonly cited reasons for deciding to buy a latrine — 89% and 49% of households reported that these were driving factors in their decision, compared to only 39% who said that health concerns were important.

Investigating reasons behind purchasing enables iDE to get a better understanding for household decision making dynamics and agency. This can help the program better assess if it is meeting the needs of all of the members of households who buy latrines.

Figure 6 shows who was the most outspoken in wanting to buy a latrine and who was responsible for financing the latrine. Women were more vocal in wanting to purchase a latrine. 31% of customers said it was the wife being the most outspoken compared to only 10% of husbands. However, half said it was a joint decision. This indicates a somewhat higher relative expressed preference by women than men for sanitation, reinforcing the notion that toilets fit an unmet perceived need for women more so than for men.

FIGURE 6: LATRINE PURCHASE AND FINANCING DECISIONS

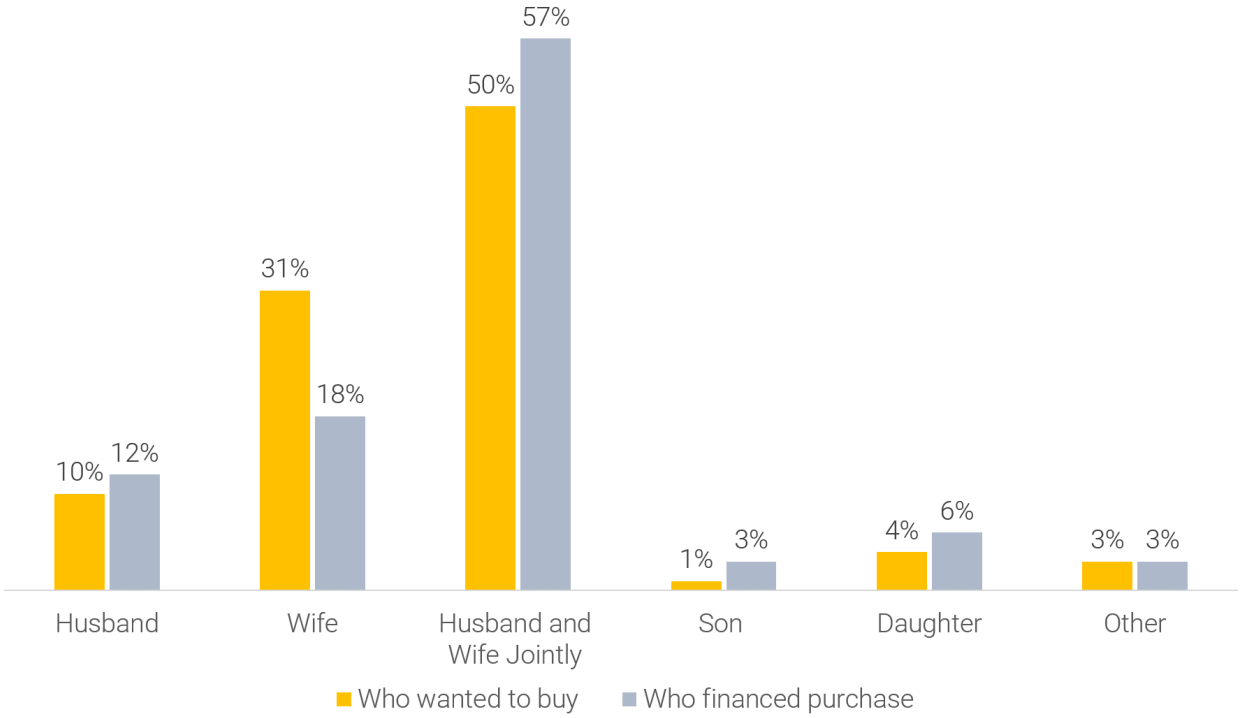


Table 6 shows the reasons a household wanted to buy the latrine. They could select more than one option so percentages total up to more than 100%. Convenience was listed by almost all customers and half cited security as a reason to purchase their latrine. Only 8% listed peer or community pressure as a reason for buying their latrine, the least selected option out of those provided. This demonstrates that "naming and shaming" techniques are not perceived as effective in motivating a household to buy. This reinforces iDE's resolve to focus on positive, aspirational messages to promote sanitation.

TABLE 6: REASONS TO PURCHASE LATRINE

Convenience	89%
Security	49%
Health reasons	34%
Social Status	21%
Privacy	17%
Peer / Community Pressure	8%

INSTALLATION

Key Findings:

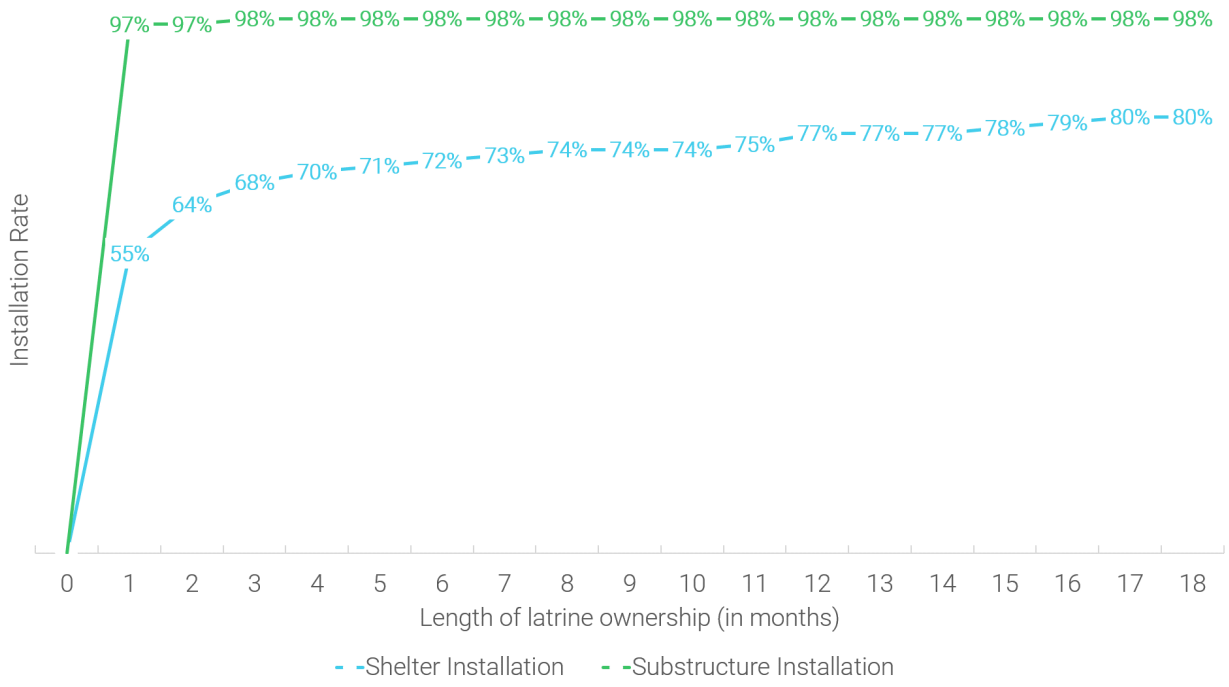
- Households generally install latrine substructures quickly after purchase: over 97% of Easy Latrines are installed within one month of purchase, and these rates do not vary based on poverty status.
- Shelter installation rates are lower — 80% of customers have installed shelters within 12-18 months of purchase — but this metric has improved in SMSU3 compared to SMSU2.

Installation is a key metric for assessing the impact of the program. Simply put, if a product is not installed, it is not being used. Similarly, if the underground latrine components are installed but a latrine shelter is not, it is highly unlikely that members of the household will use that toilet. Therefore, a delay between delivery and installation of a product equates to a delay in the impact of the project itself. As such, iDE continually strives to reduce the "installation lag" of both underground latrine components and superstructures.

Figure 7 shows the shelter installation rates and below-ground installation rates by province and for the whole of the project region.The sampling method includes customers who have had their latrine for 12- 18 months (instead of 6-12 months as was done previously) in order to capture the lag we see in shelter installation.

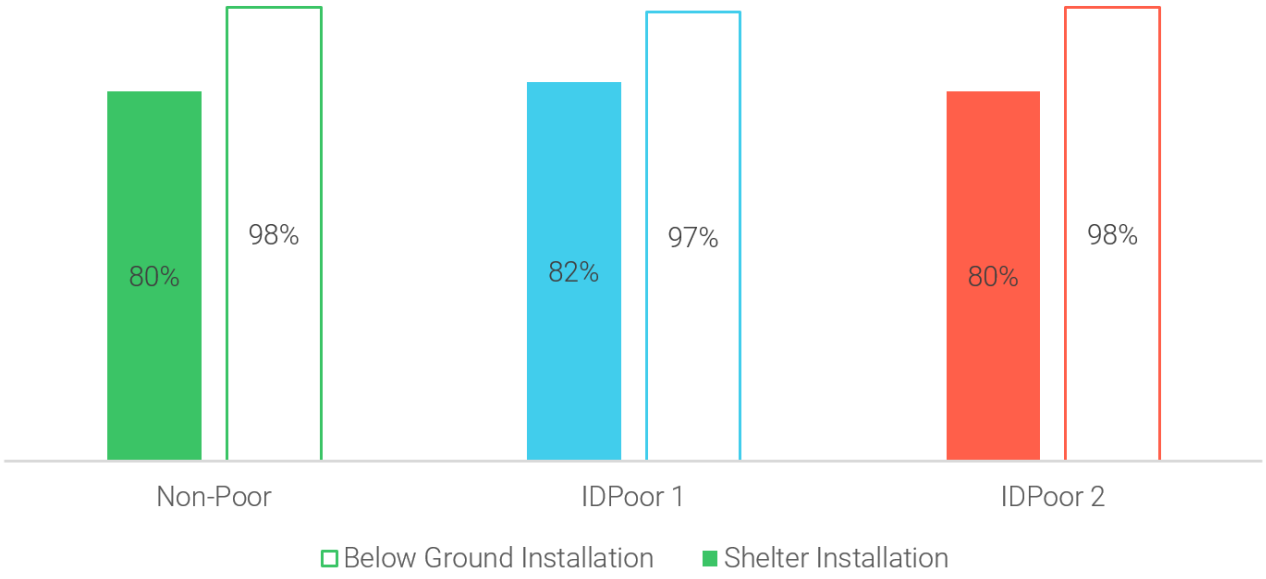
- 80% of customers have a shelter installed 12- 18 months after latrine purchase. 98% have the below-ground or substructure installed.
- Figure 7 shows the installation rates over time for both shelters and below-ground structures. This table indicates the speed at which households have their products installed after the purchase of an Easy Latrine structure. Within the first month of ownership, 97% of Easy Latrines are installed.
- Second, shelters are also being installed quicker. Compared to the end of SMSU2 only 63% of customers had a shelter installed within 6 - 12 months whereas it's 72% under SMSU3.

FIGURE 7: SMSU3 INSTALLATION RATES OVER LENGTH OF LATRINE OWNERSHIP



We also analyze below-ground installation rates by IDPoor classification to check for income marginalization and ensure there are no biases in installation for IDPoor households. We see in Figure 8 that all households have similar installation rates for both shetlers and below-ground structures, indicating no discrimination.

FIGURE 8: SMSU3 INSTALLATION RATE, BY IDPOOR



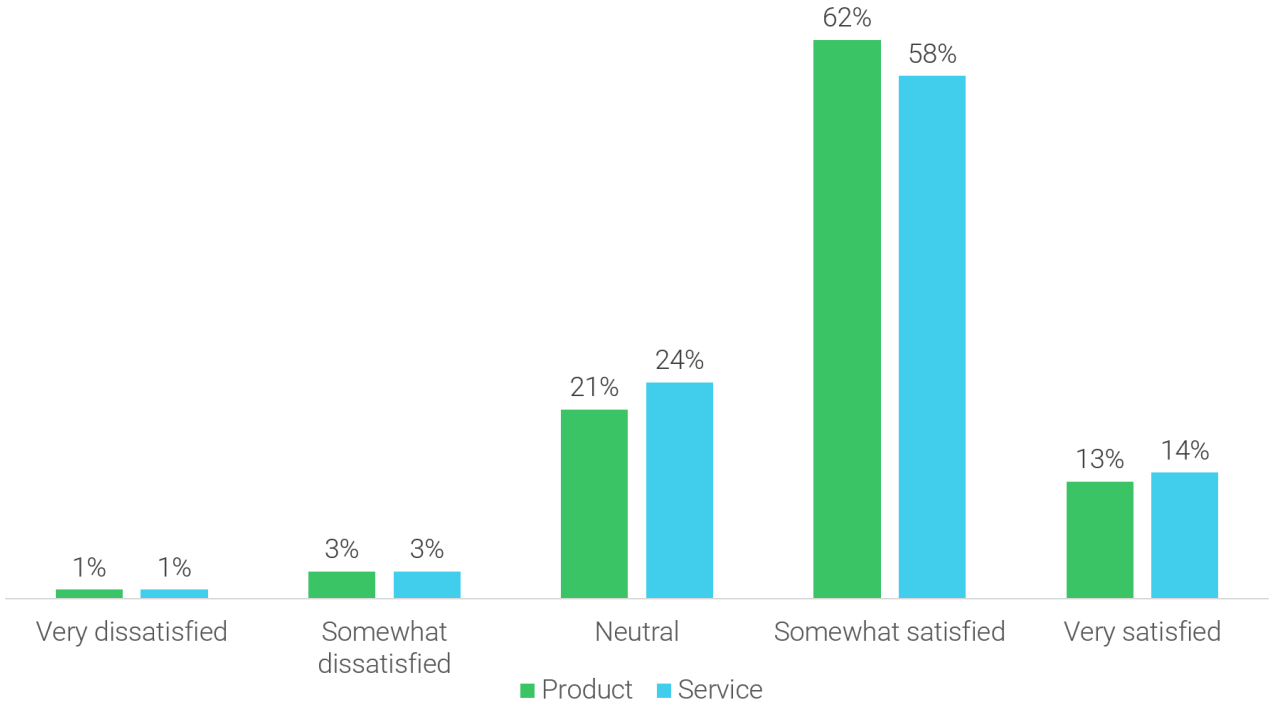
SATISFACTION

Key Findings:

- Households are mostly satisfied with their latrines, though there is some variation between provinces.
- Many customers plan to upgrade their latrines by adding a shelter, water reservoir, or shower. Few plan to add a second pit, which may present a challenge for scaling fecal sludge management solutions like the alternating dual pit upgrade.

Customers reported their satisfaction with both the latrine product and the service provided by the latrine business owner (LBO). We see in Figure 9 that customers are relatively satisfied with both their latrine product and service provision. 75% of customers are somewhat or very satisfied with their latrine product, though only 13% of those customers report being *very* satisfied.

FIGURE 9: SMSU3 SATISFACTION RATES WITH LATRINE PRODUCT AND SERVICE PROVISION



- Province variations are presented in Table 7 for overall satisfaction with the latrine product or service provision. Overall satisfaction means customers who either reported being somewhat satisfied or very satisfied.
- It is worth noting that the low satisfaction levels are not due to dissatisfaction, but rather neutral response (neither satisfied nor dissatisfied).
- There appears to be a relationship where lower satisfaction with latrine products are correlated with lower satisfaction on the service provision by the LBO.

TABLE 7: SMSU3 CUSTOMER OVERALL SATISFACTION (SOMEWHAT OR VERY SATISFIED)

	Latrine product	Service provision
Kampong Thom	71%	69%
Kandal	84%	81%
Oddar Meanchey	93%	85%
Prey Veng	72%	64%
Siem Reap	74%	71%
Svay Rieng	75%	71%

To better understand what could be leading to dissatisfaction, customers were asked about the primary issues they had with their latrines. We see in Figure 10 that the most commonly reported issues are related to latrines not properly flushing. This can be a product of poor latrine pan quality, improper installation, a full latrine pit, or environmental challenges including high ground water or flooding.

FIGURE 10: SMSU3 LATRINE CHALLENGES EXPERIENCED BY CUSTOMERS

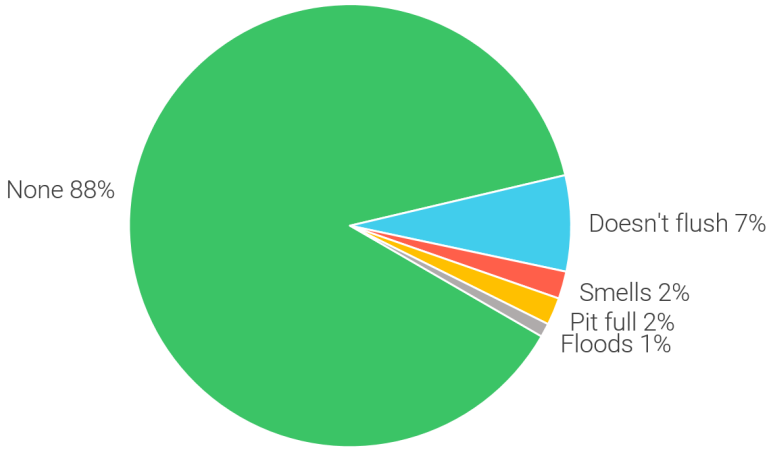


Table 8 presents the intentions of customers to upgrade or change their latrine. Over half said they would build a new or upgrade their existing shelter. Note that only 9% of respondents mentioned installing a second pit on their intentions to upgrade in the next three years indicating that FSM is not high on customers' lists.

TABLE 8: INTENTIONS FOR LATRINE UPGRADES IN NEXT 3 YEARS

Build new or upgrade shelter	55%
Build a water reservoir	36%
Build a space to shower	28%
Install a second pit	9%
Install a basin to wash hands	4%
Connect to piped water	1%

COVERAGE

Key Findings:

- Sanitation coverage rates are increasing across SMSU3 provinces.
- Coverage is increasing at a faster pace for poor households than for non-poor households, indicating that SMSU3 — and the sector more broadly — are making progress to ensure that sanitation gains are equitable.
- Latrine sharing is increasing in most places, representing a "halfway" stage between open defecation and latrine ownership

SMSU MILESTONES AND SURVEY FINDINGS

Since 2012 iDE has conducted six comprehensive household surveys to estimate latrine coverage rates in the six program provinces. The most recent latrine count under SMSU3 was completed in August 2020. This section presents the findings from the latrine count in a number of different ways.

A note about terminology:

- Wet latrine refers to installed, improved pour-flush latrines
- Poor refers to households registered as IDPoor1 or IDPoor2 status with installed wet latrines
- Installed refers to both wet and dry latrines that are installed.

In Figure 11 we see statistically significant increases in coverage rates across all phases of the SMSU program.[3]

FIGURE 11: COVERAGE RATES COMPARISON, ACROSS ALL SMSU PROVINCES

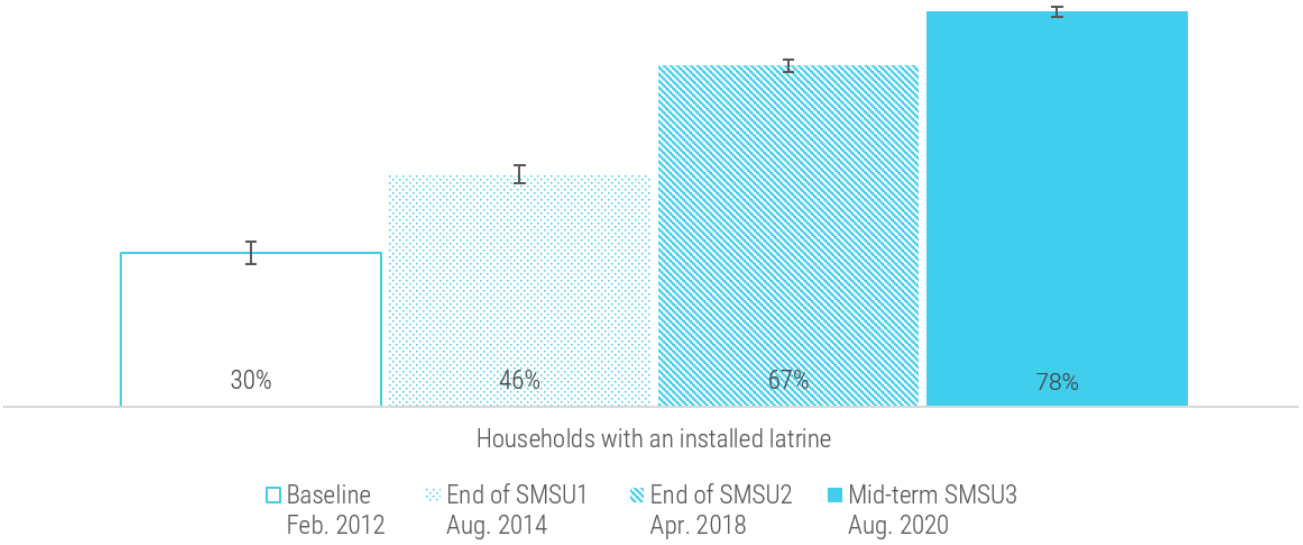
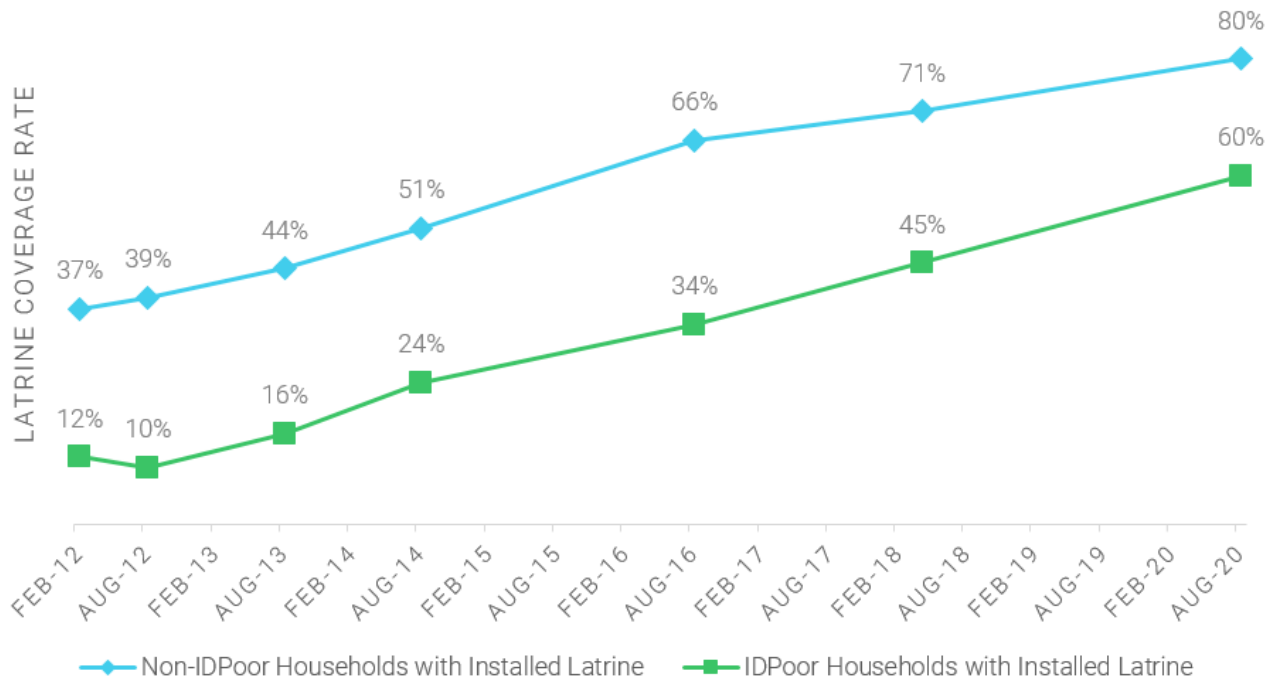


Figure 12 presents the latrine coverage rates for all rounds of data collection completed since the start of SMSU. Note that latrine count frequency changed from every year to roughly every two years since 2014. We see a positive linear growth of improved latrine coverage over this time among IDPoor and non-poor latrine owners. Notably, latrine ownership among IDPoor households has accelerated at a faster rate than for non-poor

[3] Error bars represent the 95% confidence interval for each coverage rate estimate.

households since 2016. Between 2018 and 2020, coverage among non-poor households increased by 9 percentage points whereas the rate for IDPoor households increased by 15 points. This is evidence that IDPoor households are gradually closing the gap in sanitation and the sector is making progress to ensure that the most vulnerable aren't being left behind.

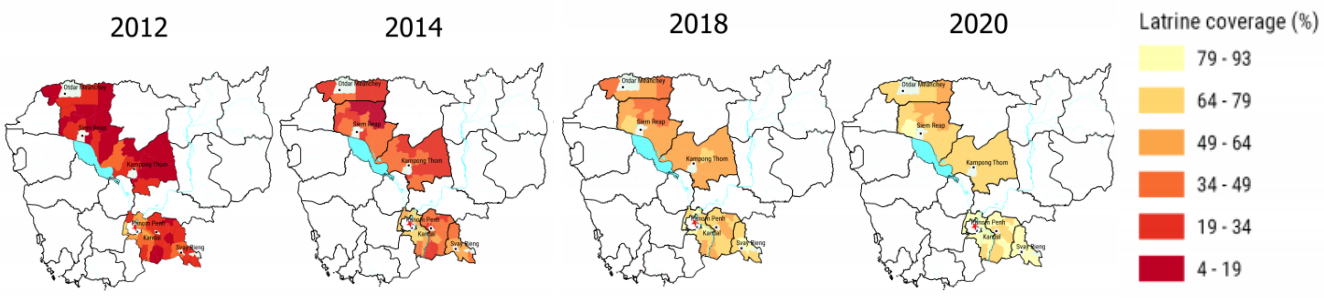
FIGURE 12: IDPOOR VS NON-POOR COVERAGE RATES OVER TIME, ACROSS ALL SMSU PROVINCES



COVERAGE BY PROVINCE

SMSU contributes to changes in sanitation coverage in the six provinces where the program operates. Coverage levels are important indicators because higher coverage is associated with positive health outcomes. Figure 13 shows a map of latrine coverage rates by province over time, demonstrating broad progress over the course of the SMSU program.

FIGURE 13: INCREASE IN PROVINCIAL SANITATION COVERAGE SINCE 2012



Figures 14 and 15 show in more detail the provincial change in latrine coverage and IDPoor latrine coverage, respectively. All provinces have shown statistically significant increases in latrine coverage rates between the start of SMSU3 and the mid-term data collection, as noted by the error bars. Oddar Meanchey province saw the greatest improvement since the start of phase three, increasing coverage by 14 percentage points. Svay Rieng

and Kandal provinces saw the lowest gains with only 7 and 8 percentage point increases, respectively. However, this is likely because they had the highest rate of coverage at the start of SMSU3 at 76%, while the rest of the project region had coverage rates below 70%. The lower gains in Kandal and Svay Reing provinces reinforce our field reporting of declining sales due to increasing market saturation. Most promising is the sizable increase in coverage rates for Oddar Meanchey, showing signs of closing the gap in coverage between provinces. While our surveys are designed to precisely measure latrine coverage rates down to commune level, they have been unable to measure the causal attribution of SMSU on coverage rates or health impacts. We have only been able to find statistically significant improvements in key health measurements (i.e. reduction in diarrheal prevalence for children under five) in our target areas following SMSU1[4]. This was attributable to the existence of a reputable secondary data from a Demographic Health Survey which has not been conducted again since 2014. Therefore, more consistent and improved tools to measure and test against diarrhea prevalence is key to continue to evaluate health outcomes in our target areas.

FIGURE 14: WET LATRINE COVERAGE UPDATE, BY PROVINCE

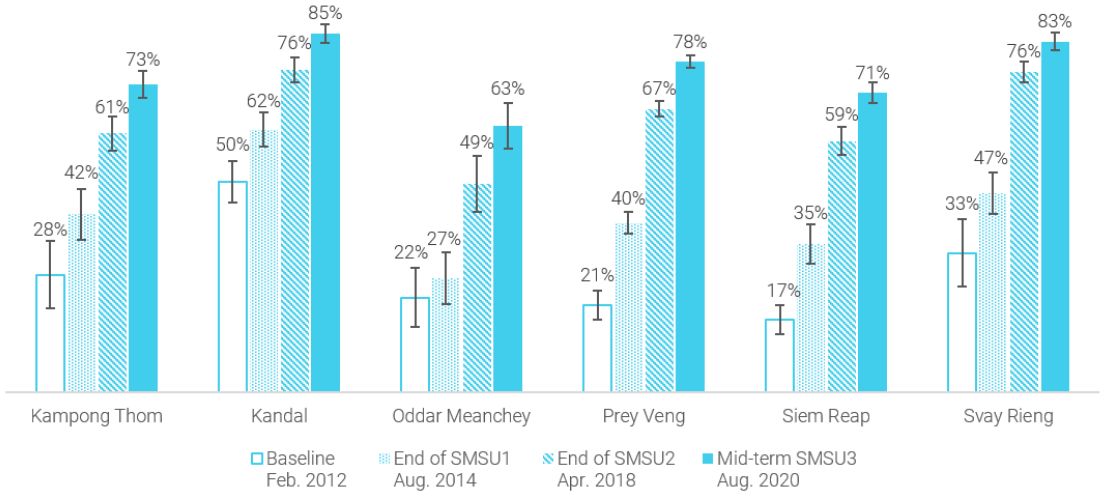
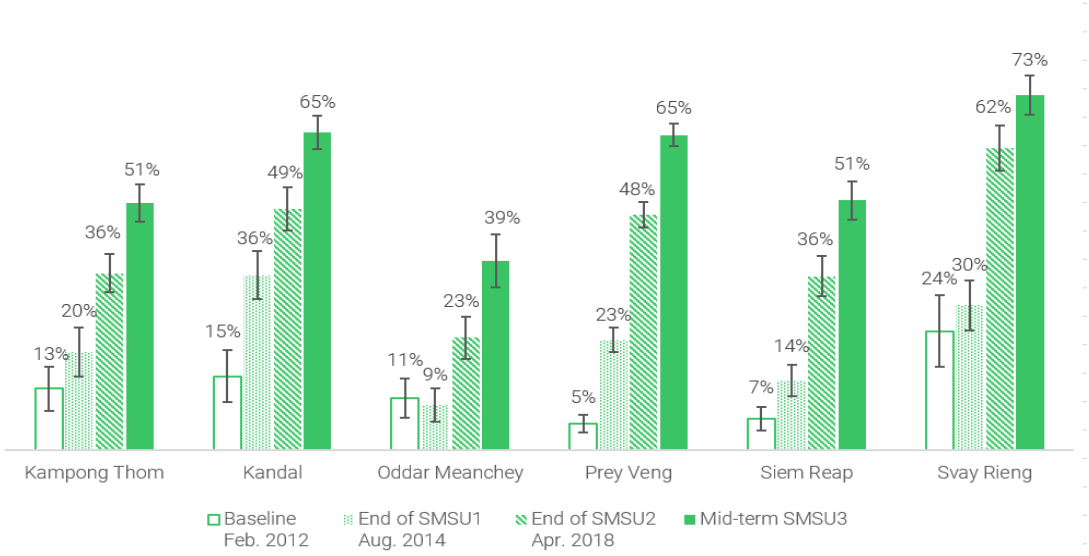


FIGURE 15: IDPOOR LATRINE COVERAGE UPDATE, BY PROVINCE



[4] Sanitation Marketing Improving Health Outcomes, Policy Brief. iDE, 2018

LATRINE SHARING

Table 9 presents the proportion of households who report sharing a latrine among non-latrine owners and within the larger population. Among households that do not own a latrine, the percent of those who report sharing a latrine with another household has increased from 8% in 2014 to 36% in 2020. The remainder report that they generally don't use a latrine and are open defecating. The increase in non-latrine owning population that is sharing a latrine with another household and the large proportion numbers (up to 56% in Kandal province) reflects an increasing tendency of rural Cambodians to share latrines.

iDE's data suggests that sharing behavior is linked with the increase in general sanitation ownership. On average sanitation coverage across iDE's operating area is 78%. Within this general area, as noted above, 36% of non-latrine owning households claim to be sharing. In areas with sanitation coverage over 85%, which is the minimum threshold to be eligible for Open Defecation Free status in Cambodia, 57% of non-latrine users report sharing a latrine. The large discrepancy in self-reported sharing between these areas indicates that in high coverage areas households are more likely than the general population to say they are sharing latrines. However, it is also plausible that due to increased social pressure to use latrines in high coverage areas, social desirability bias could be influencing a greater proportion of households to report they are sharing.

TABLE 9: PROPORTION OF HOUSEHOLDS SHARING A LATRINE COMPARISON

	% Sharing of Non-latrine owners			% Sharing of Population		
	End of SMSU1	End of SMSU2	Mid-term SMSU3	End of SMSU1	End of SMSU2	Mid-term SMSU3
Kampong Thom	8%	26%	36%	5%	10%	10%
Kandal	19%	45%	56%	7%	10%	8%
Oddar Meanchey	1%	12%	16%	1%	6%	6%
Prey Veng	6%	23%	38%	4%	8%	8%
Siem Reap	3%	9%	25%	2%	4%	8%
Svay Rieng	11%	48%	54%	6%	11%	9%
ALL PROVINCES	**8%**	**23%**	**36%**	**4%**	**8%**	**8%**

PROGRESS TO ODF

Key Findings:

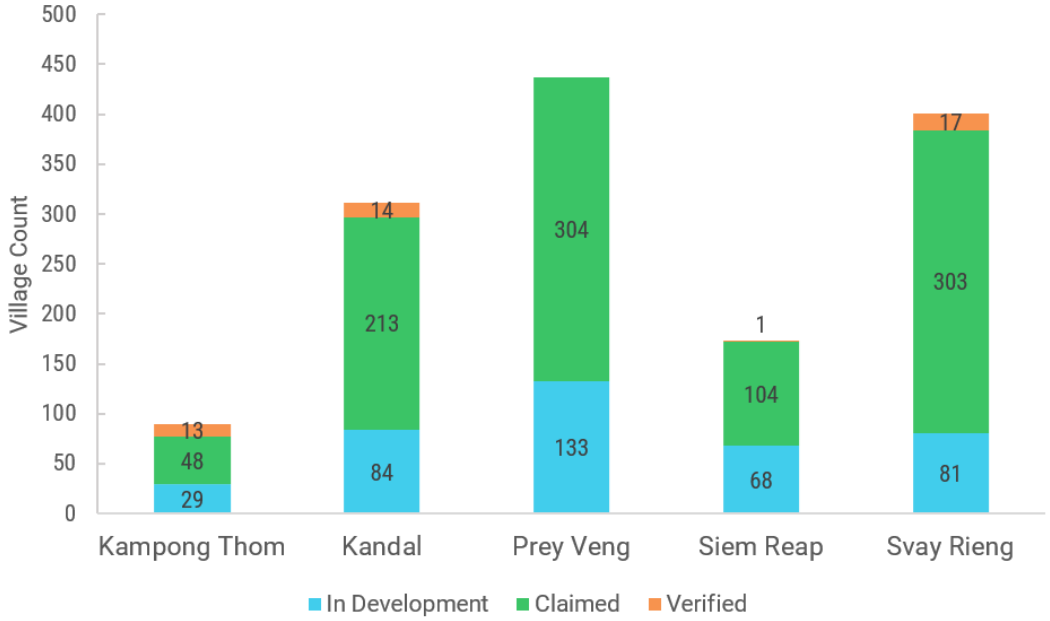
- SMSU3 is making progress in getting communities to open defecation free status. By the end of 2020, 972 villages had filed an ODF claim, while the program is working with 395 additional to develop their claim.
- Nearly a quarter of households that don't yet have a latrine have decision makers who are either permanent or temporary migrants that are often not in the home during times when SMSU sales agents might visit. The program is addressing this issue by strengthening relationships with local stakeholders that can more consistently promote improved sanitation.
- The program's customer research shows that a majority of non-latrine owning households have not purchased a latrine because they prefer sharing to owning, while financial constraints are only a major concern for 15% of households. This indicates the need for the program to more explicitly highlight the benefits of latrine ownership versus sharing in addition to the financial mechanisms it is deploying to increase affordability.

In early 2019, iDE launched the Grassroots Public-Private Partnerships (PPP) Department. The goal of the PPP team is to complement iDE Cambodia's traditional sanitation marketing activities by accelerating the achievement of Open Defecation Free (ODF) status at the village level.

By facilitating connection and collaboration between latrine business owners (LBOs), civil society (NGOs), and government, the PPP Department aims to support the further development of a sustainable sanitation ecosystem, to and beyond ODF status. The PPP team operates in communes with sanitation coverage over 85%. These high coverage areas are deemed to be the most likely to meet the various thresholds for ODF and are the ones who can use the most immediate support to reach this designation. The PPP model and activities are described in detail in a tactic report[5] iDE updated in 2021.

As of December 31, 2020, iDE has supported 972 villages to file ODF Claims, 395 villages are in development of filing, and 45 villages are ODF verified. Figure 16 shows the ODF status and claims filed for villages by province.

FIGURE 16: VILLAGES' ODF STATUS, BY PROVINCE



SMSU also conducts a non-latrine owner census in areas where latrine ownership is greater than 85%. This census provides us with crucial data for targeting sales and subsidy efforts. Key findings from this census include:

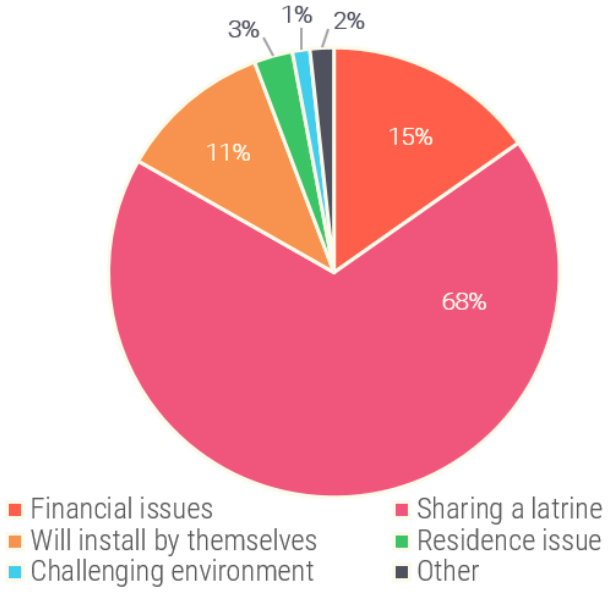
- 17% of households in the sample are registered as IDPoor. Similarly, 17% of non-latrine owners in the survey sample are registered as IDPoor, indicating the population of non-latrine owners is not disproportionately made up of IDPoor households.
- 91% of non-latrine owners in the sample report sharing a latrine. The remaining households report they generally don't use a latrine and are open defecating. Data from another source, iDE's Latrine Count Survey, indicates that of all non-latrine owners surveyed in high sanitation coverage areas (over 85% coverage at the district level), 57% of households claim to be sharing. The discrepancy in self-reported sharing between these two data sources could be the result of different data collection methodologies, data verification process, and sampling timeframes. It is also possible some of this can be explained by social desirability bias, which may be more present at the time and place in which the PPP team is working, as these communities are deliberately and publicly engaged to reach ODF. Also plausible is the explanation that in areas publicly committed to reaching ODF, latrine sharing is in fact higher as a

[5] Tactic Report: Reaching Open Defecation Free Status with grassroots partnerships. iDE Cambodia, 2021.

result of social pressure and higher general awareness of sanitation.

- Of the households who reported sharing in the Non-Latrine User Census, 7.1% claimed to be either sharing with a non-family member or using one more than 50m away. Sector research has shown individuals sharing latrines with non-family members or who report sharing latrines more than 50 meters away are unlikely to be actually sharing the latrine and are probably open defecating.[6] Therefore iDE's findings indicate the self-reported latrine sharing totals may be inflated by approximately 7%. This underscores the importance of asking qualifying questions on latrine sharing while conducting ODF verifications.
- Of those who report sharing a latrine, 15% are IDPoor and 85% are non-poor. Among the 9% of the households reporting open defecation, 22% are IDPoor and 78% are non-poor. This indicates poor households are slightly more likely to prefer open defecation over sharing a latrine.
- 22% of non-latrine owner households have decision makers who are migrant workers who are usually away from the village, whereas 78% have decision makers that all live and work in the same village. Of those who migrate, 67% are short-term migrants (away for less than one year) and 33% are long-term migrants (away for more than one year). As it is unlikely iDE staff or other external sanitation promoters will be in the village at the precise moment this decision-maker is home, this finding highlights the need for permanent, local representatives actively promoting sanitation.
- It is often assumed that laggard, non-latrine owners' primary barrier to owning a latrine is lack of financial resources. However, we found 68% of non-latrine users claim the main reason they have not invested in a toilet is their preference for sharing a toilet, while 15% of non-latrine owners claim financial issues. 11% claim they will install a latrine themselves and 3% say they do not own their residence. To note, among IDPoor households, 55% stated a preference for sharing and 29% stated financial reasons compared to non-Poor households, of whom 71% stated a preference for sharing and 13% stated financial reasons as their main objection. This indicates financial interventions such as subsidies or micro-financing are not and cannot be universal solutions to reach ODF status.

FIGURE 17: NON-LATRINE OWNERS' STATED REASONS FOR NOT OWNING A LATRINE



[6] Understanding Shared Latrine Use and Dynamics in Rural Cambodia. Causal Design. 2019.

FECAL SLUDGE MANAGEMENT (FSM)

Key Findings:

- SMSU3 is addressing gaps in rural FSM primarily through the alternating dual pit (ADP) upgrade and an associated service offering for treatment with hydrated lime. By December 2020, project-connected enterprises had delivered over 11,700 ADPs.
- Households in rural Cambodia will likely continue to perform unsafe FSM practice unless access, knowledge and familiarity for safe FSM products and services (e.g. ADP, professional pit emptying service) are improved.
- Households vocalize a strong aversion to contact with fecal waste but they also express an acceptance for using human FS as fertilizer and a preference for self-emptying.
- Today, space constraints are not a significant issue in rural Cambodia. However, over time the need for latrine capacity will continue to increase making the ADP a more sustainable and cost-effective product compared to pits in series.

ADDRESSING FSM WITH ADP

For an average household in Cambodia, a single pit latrine will take between two and five years to fill. If the pit is emptied, in virtually all cases, the waste is handled and disposed of unsafely. To address this issue, in 2017 iDE began piloting sales of its ADP product. In 2018, after revising the product and installation process based on pilot learnings, iDE began to scale the ADP product within its five main operating provinces. As of December 2020, 50 latrine business owners (LBOs) have delivered over 11,700 ADPs enabling rural households to safely manage their fecal sludge (FS).

The ADP is based on a traditional alternating twin-pit design with two additional components: a pit gauge product and a lime treatment service. The pit gauge functions like a visual alarm clock, signaling to households when their pit level is approaching its capacity. By drawing the household's attention to its latrine pit contents in a conspicuous way, iDE's intention is for the Pit Gauge to nudge the household to start considering FSM options before it's an emergency. The lime treatment service consists of treating the old pit by mixing in hydrated lime and is performed by iDE's LBOs during ADP installation. Research iDE and others conducted in 2015 indicated that hydrated lime can significantly reduce pathogens and improve the agricultural benefit of human waste when mixed into sludge. With an ADP, customers can theoretically alternate pits back and forth and safely empty stabilized waste sustainably well into the future.

Globally, there is little evidence of effective implementation and household use of alternating dual/twin pit sanitation technologies. Questions remain around the contextual appropriateness of the technology and the likelihood that pathogens within sludge in an unused pit will safely decompose within the WHO-advised two years[7]. There is also uncertainty around if and how households actually alternate pits back and forth when they fill. Within the next two years, iDE aims to answer these sector questions by quantifying the effectiveness of the ADP product to make waste safe for manual emptying and potential value extraction, thereby reducing household risk of exposure to pathogens in rural Cambodia. Specifically, we plan to assess if a) iDE's ADP product can effectively reduce the presence of pathogens in pit latrines, and b) is appropriately used at the household level by alternating and emptying pits at recommended time intervals.

FSM PRACTICES IN RURAL CAMBODIA

Having achieved a marked expansion of basic sanitation coverage over the past decade, rural Cambodia is now faced with the urgent challenge of providing safe FSM services for households. The decision of what practice to use to manage household FS is eventually faced by all rural households that own and use a latrine. In

[7] Guidelines on sanitation and health. WHO, 2018.

partnership with the University of Colorado Boulder, iDE conducted research to better understand household-level FSM decision-making and practices across five rural provinces in Cambodia. The goal of this research is to inform iDE's development of safe, effective and aspirational FSM products, services, and behavior change campaigns.

Between 2015 and 2017, iDE's Customer Survey was administered to 3,751 rural Cambodian households. The survey gathered data including demographic information (e.g. poverty level, household size, etc), customer satisfaction, and households' intentions for future purchases or additions. The FSM Intentions study[8] investigated how households responded to a particular question in the Customer Survey: *"When your pit is getting full, what do you intend* to do?" in order to understand how households' context affects their intentions towards FSM. The responses to this question were categorized as either "desirable" or "undesirable" FSM intentions. Desirable FSM intentions were deemed to be those held by latrine owners who intend to manage their FS safely by either paying for professional emptying or by installing a new pit. Other intentions, including self-emptying, stopping latrine use, and being undecided, were defined as undesirable. This study provided insights on market predictability and dependency on FSM intentions.[9]

In mid-2019, another survey (FSM Survey), was designed to further assess rural households' behaviors, knowledge, intentions, and preferences towards FSM. The goal was to deepen iDE's understanding of the current and potential market context for FSM products and services, ultimately enabling iDE to improve its approach for increasing access to safely managed sanitation in rural Cambodia. It was administered to 1,472 households with latrine pits purchased from iDE that were at least two years old at the time of the survey (average pit age: 2.8 years). This sample was selected to be representative of households who are more likely to have considered or experienced some level of FSM decision-making as their pits were more likely to have filled up. The survey scored each household on six constructs: knowledge, attitudes, social norms, perceived control, intentions and practices related to FSM. These constructs were scored on a continuum between "strongly hinders" and "strongly enables" the potential for safe FSM practices. In addition, a discrete choice experiment[10] (DCE) was administered as part of the FSM Survey to 1,461 households. The goal of the DCE is to describe which attributes of FSM services are preferred by rural households and what they are willing to pay for those attributes.

We lay out the key findings from these research streams below.

Common rural FSM practices are generally unsafe

Households in rural Cambodia will likely continue to perform unsafe FSM practice unless access to desirable, affordable, and safe FSM products and services (e.g. ADP, safe pit emptying service) is improved.

- Between 2015 and 2017, four in ten rural households intended to manage their FS unsafely using practices like self-empty (emptying their own pit with lack of proper equipment, training, treatment, or safe disposal site), flooding out (releasing sludge into floodwaters by opening their pit's lid during a flood), or reverting to open defecation (household stopping latrine use).
- In 2019, approximately one-third of rural Cambodian households (31%) preferred FSM practices that endanger public and environmental health, and many households (44%) were ambivalent about using safe FSM practices.
- Pits were pierced (installing a hole or overflow pipe into the top of the pit) in 8% of all surveyed households. Pit piercing was more common in certain provinces than others (e.g., 16% in Svay Rieng province).
- The last time their pit filled, households (n=162 of 1,472) reported emptying their pit (37%), reverting to open defecation (18%), flooding out (13%), using a neighbor's or relative's latrine (11%), installing a second pit in series (9%), and/or building a new latrine (3%).

[8] Intentions Toward Fecal Sludge Management in Rural Developing Communities. Harper et al., Jun 2018

[9] Understanding Intentions for Safe Fecal Sludge Management in Rural Cambodia. iDE Cambodia, Sep 2020.

[10] Household Preferences for Rural Fecal Sludge Management Services in Cambodia: A Discrete Choice Experiment. Harper et al., Feb 2021.

- Of households that emptied their pit or flooded out the last time it filled (n=78 of 1472), 35% disposed sludge into a field without treatment (30% intended their sludge to be used as fertilizer, 5% only as waste), 24% disposed into a water body (18% into a river or stream, 6% into a pond or lake), and only 1% disposed into a wastewater treatment plant.

Rural households have a low understanding of safe FSM

There is an overall need to increase knowledge about FSM at scale to drive safer household decision-making. Improving knowledge and familiarity with ADPs, safe emptying practices, and any other FSM intervention in rural Cambodia could improve acceptance of safe FSM practices.

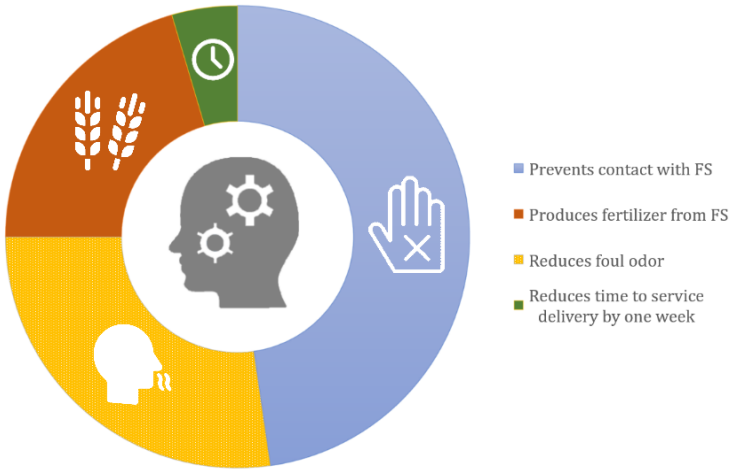
- While nearly all surveyed households (91%) understand pathogens are present in FS, 11% and 14% of households believe liquid FS from inside a pit and untreated FS disposed into a body of water are safe, respectively.
- Only 9% of households understand what emptying practices could be used to safely manage FS.
- Few households understand how an ADP works (1%) and, relatedly, how long FS must remain untouched before it can be emptied safely (25%).
- Of households that knew what an ADP is (13%), the most and least commonly understood components and design intents of ADPs were doubling the latrine's capacity to store FS (46%) and providing safer emptying than single-pit latrines (6%), respectively.

Households vocalize a strong aversion to contact with fecal waste

Substances that cause disease or bad smells are referred to as "merok" in the native Khmer language and are thought of as something to be strongly avoided. Households' strong preference to prevent contact with FS (Figure 18) validates iDE sales presentations' use of the word merok specifically in addition to points about smell and agricultural use. Households' strong preference of aversion to merok defies much of the preference heterogeneity we see for other characteristics and allows us to optimize sales messaging as well as the types of products being offered.

- The DCE study found rural households prefer preventing contact with FS most among the tested FSM-service attributes, followed by reducing foul odor and producing fertilizer from FS.
- Respondents expressed the preference of preventing contact with FS nearly twice that of reducing foul odor and more than twice that of producing fertilizer from FS.

FIGURE 18: HOUSEHOLD PREFERENCES FOR RURAL FSM-SERVICE ATTRIBUTES IN CAMBODIA



Preferences for FSM are impacted by poverty level

Sanitation products need to be aspirational and affordable to both poor and non-poor households in order to reach and ensure safe FSM for all.

- IDPoor households intended to self-empty more often (23% vs. 20%) and intended to install a new pit less often (21% vs. 25%) than non-IDPoor households.
- Although the mean willingness to pay estimates for IDPoor and non-IDPoor households are not statistically different, IDPoor households do not prefer reduced time to FSM service delivery (i.e. number of days between service request and service delivery), while non-IDPoor households were willing to pay 24k Riel (US$6) to reduce the time to service by one week.
- IDPoor households did not prefer to flood out or use a neighbor's latrine, while non-IDPoor households did prefer these non-service FSM options.

Households express an acceptance for using human FS as fertilizer and a preference for self-emptying

Households' acceptance for using human FS as fertilizer and additives to the pit validates a point made in iDE's sales presentation for the ADP product that informs households they can use waste for agricultural purposes so long as it has been stored in an unused dry pit for at least two years and has undergone lime treatment. In addition, the preference for self-emptying validates the need for ADP-like technologies which offer on-site treatment of FS and an opportunity for safe self-emptying.

- 20% of households believe disposing of untreated FS onto a field is safe.
- The DCE study found there is a significant preference in rural households for producing fertilizer from FS. (Figure 18)
- Most households (87%) preferred self-emptying because they did not have to rely on anyone outside of their household (e.g., a service provider) to manage their FS.
- Households tend to use either buckets and shovels to empty their pits (40%; manual emptying) or submersible pumps (35%; mechanical emptying).
- Of households that emptied their pit the last time it filled (n=60 of 1472), 83% had a household member perform the task (i.e. self-empty), and only 16% hired a service.
- Of households that emptied their pit or flooded out the last time it filled (n=78 of 1472), additives were added to 31% of pits and included kerosene (4%), gasoline (3%), fragrant products (e.g., shampoo; 3%), and rice husks (3%).

There is a lack of access to trained rural FSM services

The lack of access to professional or trained safe emptying services prevents households from practicing safe FSM practices even when desirable. Improved access to these affordable and timely on-site or off-site FSM services in rural Cambodia is required to reduce the environmental and public health impact of the sanitation system in place.

- 82% of households reported that they had no access to trained FSM service providers in their communities. Even if households desired safe FSM practices, many households reported difficulty in actually applying those practices.
- Of all surveyed households, only 10 (0.7%) reported hiring a service provider to empty their pit the last time it filled. Most households believed that the service provided was safe.
- While half of households paid nothing to empty their pits (47%), those that did pay something paid a median of 8000 Riel (~$2 USD), but some paid between 40,000 and 200,000 Riel (~$10 to 40 USD) depending on the type of equipment and/or service they rented/hired.

Households generally are able to install an additional latrine pit

To install a latrine pit upgrade, a household needs to have adequate space available and easy access to the existing latrine pit. Our findings indicate space constraints are not a significant issue for the majority of households and pit upgrade products offer a potential solution. However, over time, the need for latrine capacity will continue to increase, making the ADP product (i.e. continuously alternate between 2 pits) a more

sustainable and cost-effective product compared to pits in series.

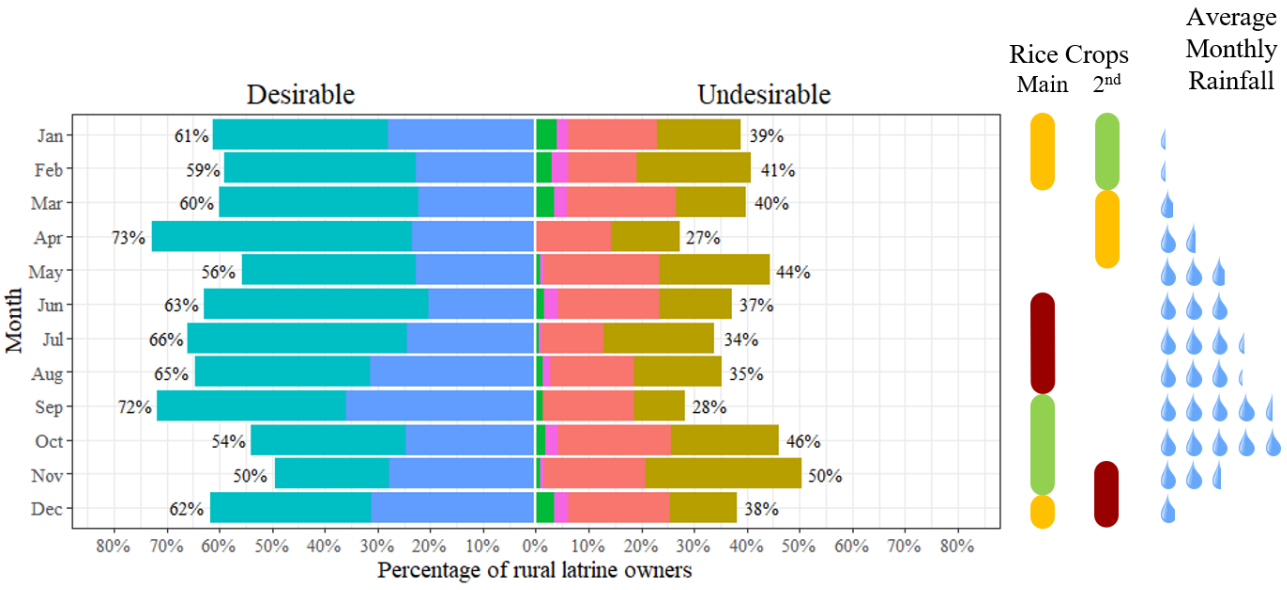
- 91% of households reported having enough space (4m^2) around their existing pit to install a second pit (e.g., ADP, pit in series). 25% of those households had enough space to accommodate only one more latrine.
- Only 8% of pits were difficult to access (e.g., located under a latrine shelter, down a narrow alley), making installation of a new pit and/or emptying relatively easy for most pits.
- 84% of households had enough space and were not difficult to access.

Timing is key for sanitation sales and financing

Sanitation markets are recommended to increase sales and behavior change efforts in the harvest season when farmers are more financially and food secure and to promote alternative payment and other cost-offsetting methods more strongly in months outside of harvest season to stabilize demand. Also, FSM markets are recommended to plan sales before and following the rainy season to prevent households from practicing unsafe FSM.

- As shown in Figure 19, desirable FSM intentions peaked in April (73%) and September (72%), and dipped in November (50%), suggesting that financial security during the rice harvest season (months preceding and including April) increases demand for sanitation and desire for safe FSM.
- Intending to self-empty (undesirable FSM intention) varied between 14% and 22% throughout most of the year but peaked in November (30%).
- Of households that emptied their pit or flooded out the last time it filled (n=78 of 1472), half emptied or flooded out in July, August or September (54%; max of 27% in August); others emptied randomly throughout the rest of the year.

FIGURE 19: PERCENTAGES OF RURAL CAMBODIAN HOUSEHOLDS REPORTING FSM INTENTIONS AGGREGATED BY MONTH AND DESIRABILITY BETWEEN OCTOBER 2016 AND SEPTEMBER 2017 WITH THE CAMBODIAN RICE CROP CALENDAR AND AVERAGE MONTHLY RAINFALL (N = 2524)



Customer satisfaction with WASH products and services can increase latrine use and safe FSM intentions

Sanitation markets should consider developing and promoting sanitation upgrade products to continue to keep customers satisfied and prioritizing their latrines. Also, the sector should continue aiming to eradicate open defecation as prior latrine ownership is a positive driver for desirable FSM intentions.

- Latrine owners who were satisfied with their product or supplier reported desirable FSM intentions more often (60% vs. 46%) and tended to favor installing a new pit (26% vs. 20%).
- Similarly, latrine owners that recommended installing a latrine or referred their latrine's installer to a friend reported desirable FSM intentions more often (19% and 21%, respectively) than non-recommenders.
- Households that owned a toilet before their current iDE toilet product (as opposed to open defecating) reported positive FSM intentions more often (67% vs. 57%).
- Most respondents report being satisfied with their latrine (86%) and use it regularly (97%). Nearly all (98%) reported a strong desire to continue using their latrines. A majority also intend to improve their latrine within the next three years (54%).

The need for FSM will only increase in rural Cambodia

As latrine pits fill, the WASH sector must continue to apply evidence to implementation to improve rural FSM safety. This will be critical to ensure the sustainability of public health gains from Cambodia's expansion of basic sanitation coverage. We must also continue to deepen our understanding of behavior, socio-economic vulnerability, and climate change impacts on rural sanitation.

- Of all surveyed households (whose latrines are on average 2.8 years old), only 11% (n=162 of 1,472) have ever had a pit fill.
- Among the households that had a pit fill, half (54%) had only experienced a full pit once but 20% had experienced a full pit more than three times.
- Of households that reported experiencing pit dysfunctionality (i.e. latrine stopped flushing or overflowed) during the last rainy season (2018), 64% have had their pits fill up at least once since installation and 18% had pierced their pits.

LBO SUSTAINABILITY & BUSINESS ANALYSIS

Key Findings:

- Of the 70 active LBOs, 19% of them (n=13) are earning at least 30% of their WASH-product monthly revenue from products other than the Easy Latrine, including alternating dual pits (ADPs), shelters, and spare parts.
- 63% (n=44) of active LBOs claimed to have earned at least $1,000 in the previous 12 months from non-WASH business channels. 33% (n=23) claimed to have earned at least $10,000 in the previous 12 months from non-WASH business channels.
- 67 out of 70 active LBOs sold products via retail channels directly to customers, however only 27% of LBOs sold more than 5% of their total quantity via retail channels.
- Using the 'Quick-Look' sustainability metrics, three Active LBOs (4%) meet four out of the five criteria for sustainability, and 15 (22%) meet three out of five. The largest group of LBOs (42%) satisfy two out of the five metrics, whereas 26% meet just one metric.

iDE has been building a network of high-performing sanitation enterprises for over ten years. As we continue to look to the future, a critical question we are facing is, how sustainable are the enterprises which we have worked hard to support and connect? For the purposes of this analysis we define the "sustainability" of Latrine Business Owners (LBOs), as the ability for an LBO to continue to sell and distribute WASH products without iDE support. This will be measured across three primary dimensions:

- Product diversity
- Revenue without iDE sales
- Business capacity

An LBO that is offering a range of products, including the Easy Latrine, ADP, and shelters is in a stronger position to be successful in the future than an LBO that is offering only a single product to customers - especially as Cambodia nears 80% coverage of pour flush latrines like the Easy Latrine. iDE also considers product diversity to include additional products beyond the WASH products that iDE has developed. In order to stay profitable and mitigate seasonal fluctuations in demand, many LBOs produce and sell other concrete products, compressed bricks, housing materials, etc. Additionally, an LBO that is actively selling products outside of iDE-generated sales channels is more likely to continue operating after the completion of SMSU3, compared to an LBO that is only selling products via iDE-generated orders. Lastly, business capacity and acumen is a critical trait for a business to be considered sustainable.

To better understand the sustainability of LBOs, we combine sales order data from iDE's Salesforce-based order management system with data obtained in a LBO Sustainability survey, which was conducted in Q4 2020. The order data is from the period July 1, 2018 to November 30, 2020 and represents the orders fulfilled by 109 LBOs including 70 currently active LBOs and 39 discontinued LBOs. The LBO Sustainability survey was conducted with 69 of the 70 currently active LBOs and captures information on business acumen, access to professional networks, non-sanitation product sales, and business registration knowledge. A key consideration is also the financial stability of the business and the household, as they are often one in the same.

TABLE 10: SNAPSHOT OF SMSU3 LBOS

INDICATORS	**VALUES**
Total # of LBOs at the start of SMSU3	109
Total # of LBOs by the Q4 2020 of SMSU3	70
Total # of new LBOs recruited and trained over the course of SMSU3	90
# of Active LBOs	70
# of Discontinued LBOs	39
Average monthly volume of sale of Easy Latrines	19.5 latrines sold on average every month by an LBO
Highest tier performers (Quintile 5) *Mid tier performers (Quintile 3)* *Lowest tier performers (Quintile 1)*	51 latrines sold on average every month by the top 20% LBOs 13 latrines sold on average every month by the middle 20% LBOs Less than 1 latrine (.4) sold on average every month by the bottom 20% LBOs
Average monthly volume of sale of any shelter type	1.6 shelters sold on average every month by an LBO
Highest tier performers (Quintile 5) *Mid tier performers (Quintile 3)* *Lowest tier performers (Quintile 1)*	1.8 shelters sold on average every month by the top 20% LBOs 0.8 shelters sold on average every month by the middle 20% LBOs 0 shelters sold on average every month by the bottom 20% LBOs
Average monthly revenue of LBOs	$1,671 Net monthly sales/revenue (units sold x unit sale price)
Highest tier performers (Quintile 5) *Mid tier performers (Quintile 3)* *Lowest tier performers (Quintile 1)*	$4,731 $1,014 $25

DIVERSITY OF PRODUCTS

Throughout SMSU2 and SMSU3 iDE has introduced a number of new, WASH-related products to the LBOs for production and delivery. It is critical for the sustainability and resilience of the LBO network to diversify beyond the production and delivery of the Easy Latrine as the remaining customer base is quite small. Many LBOs also sell products or offer services that are not WASH related, and these are also helpful in ensuring a sustainable and resilient enterprise. First, we will look at the diversity of WASH products, how the production and delivery of them has grown over time and approximately how many LBOs are diversified across WASH products.

TABLE 11: NUMBER OF LBOS PROVIDING ADDITIONAL SANITATION PRODUCTS IN SMSU3

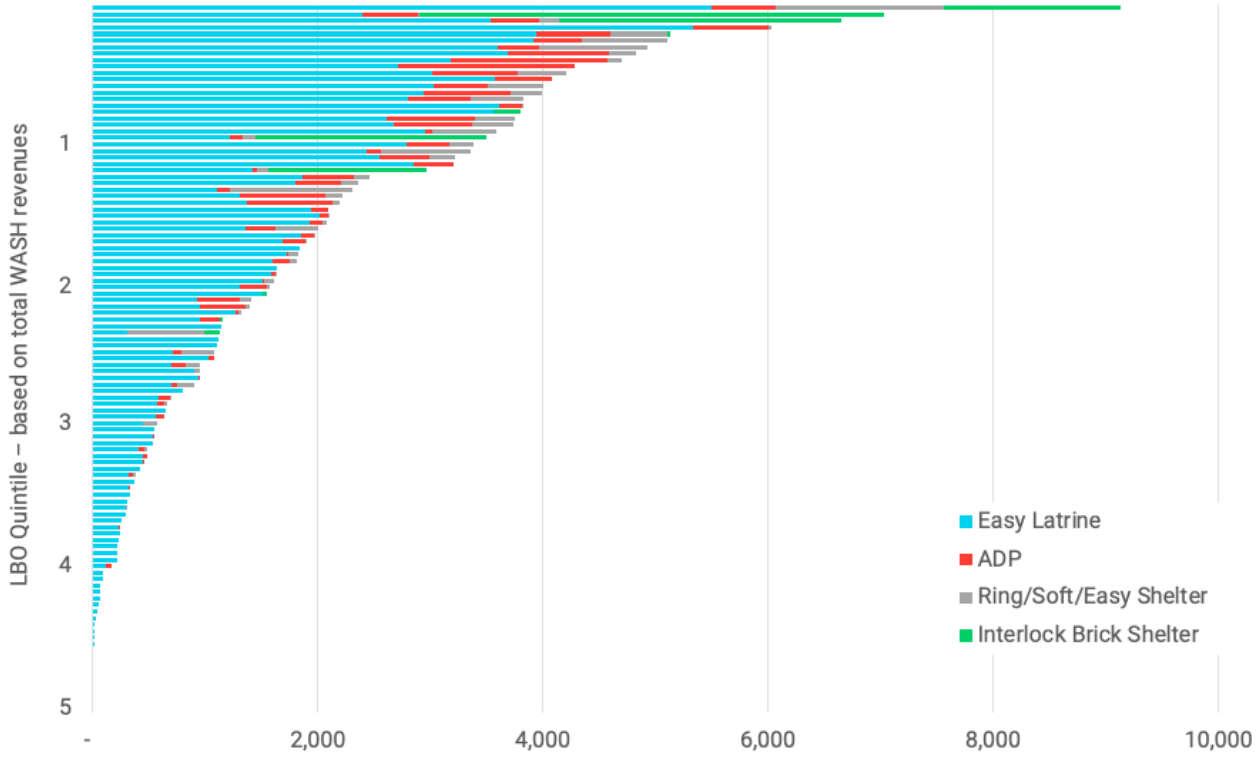
Product Category	2018	2019	2020
ADP	12	43	50
Any Shelter Type	20	28	47
Interlocking Bricks	4	4	8

The Easy Latrine remains the most common product sold, and the one which LBOs are required to sell by being part of the program. However, we have seen significant growth in the number of LBOs offering additional products since the start of SMSU3. At the beginning of SMSU3, no LBOs were selling ADPs and 20 were producing and installing shelters. By the end of the year, 12 LBOs had begun selling ADPs. At the end of 2020, 50 LBOs were selling ADPs, with more than 11,000 deliveries, and 47 LBOs were producing a shelter product.

Interlocking bricks are separated, in Table 11 above and the charts below, because they have proven to be a product with an especially high profit and product diversification potential. Interlocking bricks were originally introduced into the program in 2017 through a pilot with one LBO in Siem Reap. iDE produced the machinery and leased it to a high-performing business in order to produce customizable, disability-accommodating latrine shelter called Interlock Shelters. The bricks themselves have proven to be highly versatile and we have seen significant demand from customers to use them for homebuilding and other construction purposes. Some LBOs are also selling the bricks to other businesses, establishing the first business-to-business transactional relationships in SMSU's history. By the end of 2018, three additional businesses had invested in their own brick production machinery, which can cost up to 10,000 USD. In 2019, iDE organized a learning trip for LBOs from outside of the Siem Reap province to come visit the successful interlocking brick operations there. Since then, four other LBOs in two additional provinces have invested in machinery, begun producing bricks, and selling disability-accommodating Interlock Shelters.

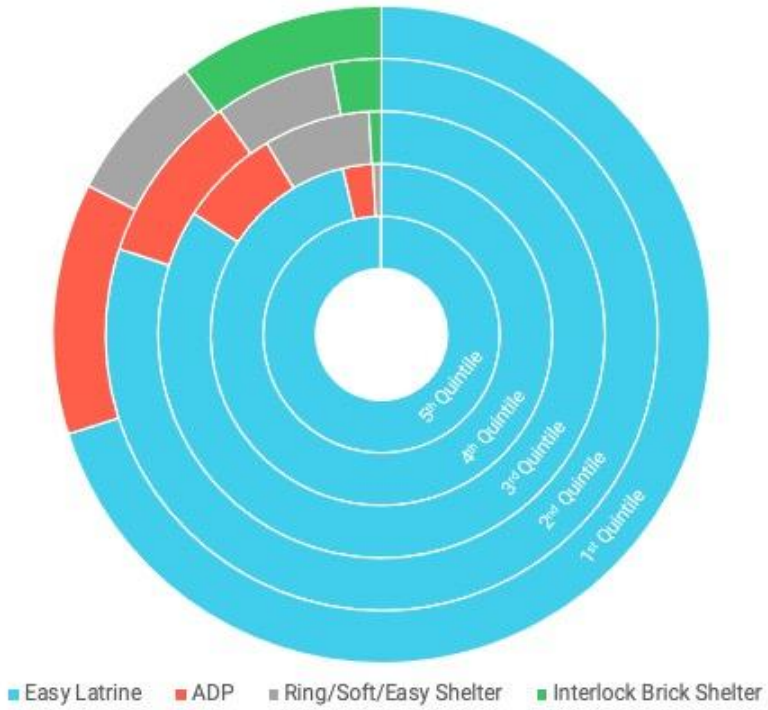
There is a fairly even distribution of ADP revenues and shelter sales across the top performing LBOs, with a few LBOs beginning to see significant growth in the shelter side of their businesses. Furthermore, the distribution of total earnings is largely skewed to the top quintile of LBOs, but LBOs across the top three quintiles are earning revenues from ADP and shelter sales when looking at the full range of LBOs in Figure 20.

FIGURE 20: MONTHLY REVENUE FOR ALL LBOS IN SMSU3, BY LBO & PRODUCT TYPE



There is a strong positive relationship between total revenue and the LBO's diversification of product offerings. In previous phases of SMSU this was not so much the case, because an LBO could rely on a single product, the Easy Latrine. LBOs offering ADPs, Soft Shelters, Ring Shelters, Easy Shelters or Interlock Shelters are more profitable overall as the remaining market for Easy Latrines is limited with currently 80% coverage of latrines in program areas (see section on Latrine Coverage). Easy Latrines make up 65% of total monthly revenue for the highest performing LBOs, compared to 83% of monthly revenue for 3rd quintile LBOs. 100% of monthly revenue is earned from Easy Latrines for the lowest performing LBOs. Of the 70 active LBOs, 19% of them (n=13) are earning at least 30% of their WASH-product monthly revenue from sources other than the Easy Latrine. This is an important indicator to track as we continue to target the last segments of the market in the second half of SMSU3.

FIGURE 21: PERCENTAGE OF MONTHLY REVENUE IN SMSU3, BY LBO QUINTILE AND PRODUCT TYPE



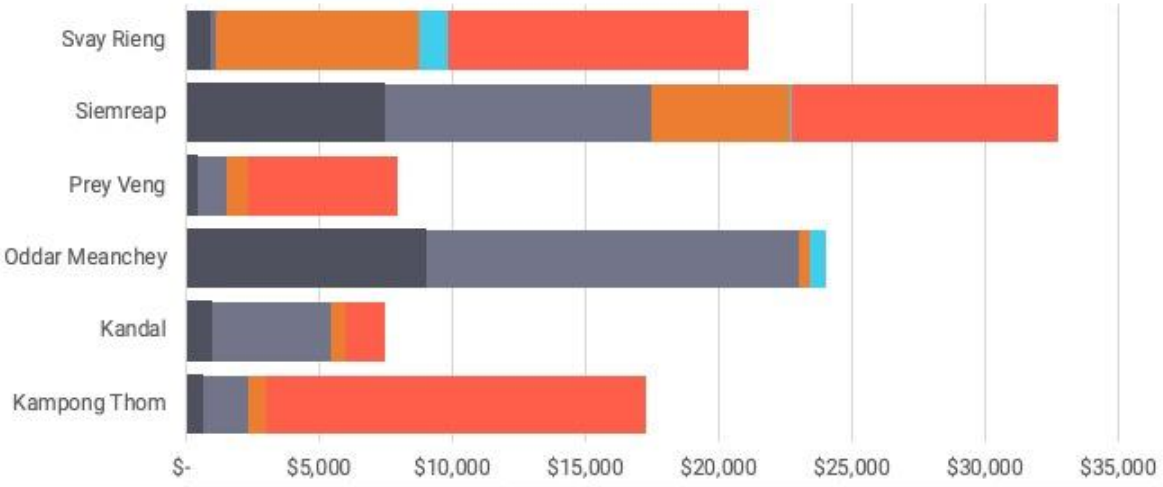
Many LBOs have additional revenue streams outside of the WASH products introduced via SMSU. While sales of non-WASH products or services are not tracked in the Salesforce-based order management system, we did ask LBOs about these revenue streams in the LBO sustainability survey. A large number of active LBOs earn revenue from non-WASH products. 44 out of 69 active LBOs claimed to have earned at least $1,000 in the previous 12 months from non-WASH business channels, and 23 out of 69 claimed to have earned at least $10,000 in the previous 12 months. In Figure 22 below we see the largest non-WASH channel for active LBOs was having a hardware store where they can sell tools, followed closely by the sale of concrete rings and stilts, both of which are closely related to the production of latrine products. There does appear to be some regional variation in non-WASH business channels with Siem Reap having both the highest average earning per LBO from non-WASH channels, and the most widely distributed across channel types. A number of additional business services were asked about in the LBO sustainability survey, including the maintenance and repair of WASH facilities, reconnecting old latrine products, household renovations, and offering vehicles for hire, but very few Active LBOs offered these services.

TABLE 12: WASH VS. NON-WASH MONTHLY REVENUE OF ACTIVE LBOS IN SMSU3

	Monthly Revenue from non-WASH Channels (self-reported)	Monthly Revenue from WASH product sales (Salesforce)	% of total monthly revenue from non-WASH channels
Median	488	1,074	16%

The self reported earnings data from non-WASH sales is not as reliable as the WASH-product order data that we are able to pull from salesforce out of the order management system. We have summarized median WASH product revenues and revenue from non-WASH sources in Table 12 above. Overall we see about 16% of total monthly revenue comes from non-WASH channels when using the median, which is a more reliable measure in this case than the mean - due to some outliers in the self-reported data that we can not verify.

FIGURE 22: ANNUAL REVENUE FROM NON-WASH BUSINESS CHANNELS IN SMSU3, BY PROVINCE & PRODUCT



	Kampong Thom	Kandal	Oddar Meanchey	Prey Veng	Siemreap	Svay Rieng
Concrete Stilts	$604	$994	$9,000	$459	$7,447	$886
Concrete Rings	$1,723	$4,468	$13,988	$1,037	$9,991	$210
Bricks	$641	$522	$400	$846	$5,206	$7,679
Spirit Houses	$-	$-	$600	$-	$81	$1,064
Hardware store/shop tools	$14,307	$1,466	$-	$5,600	$10,000	$11,250

Overall, LBOs are becoming increasingly more diversified in terms of WASH product offerings. However less than a quarter of active LBOs are earning meaningful revenue from products other than the Easy Latrine. In terms of non-WASH sales, a healthy number of LBOs are earning significant revenue from non-WASH business channels, but there are some regional differences to be aware of as we continue to research LBO resilience and sustainability moving forward. In the following section we will examine the role of iDE in generating sales/revenue for LBOs.

In order to better understand the LBOs' perceptions of their businesses and check against the verifiable revenues they are generating via WASH product sales, we ask them about their financial stability. Each LBO was asked about how long they have enough money on hand to operate. We find LBOs are relatively evenly split between having enough for one week, one month, three months, six months and longer than six months, as shown in Table 13.

TABLE 13: iDE-GENERATED VS. INSTITUTIONAL SALES FOR ACTIVE LBOS IN SMSU3, BY PROVINCE

We have enough money for..	% of LBOs	Average monthly WASH-product revenue	% of monthly revenue from non-WASH business channels
A week	25%	$ 1,613	31%
1 month	25%	$ 2,096	25%
3 months	12%	$ 2,258	35%
6 months	4%	$ 3,513	46%
> 6 months	25%	$ 3,141	27%

REVENUE WITHOUT iDE SALES

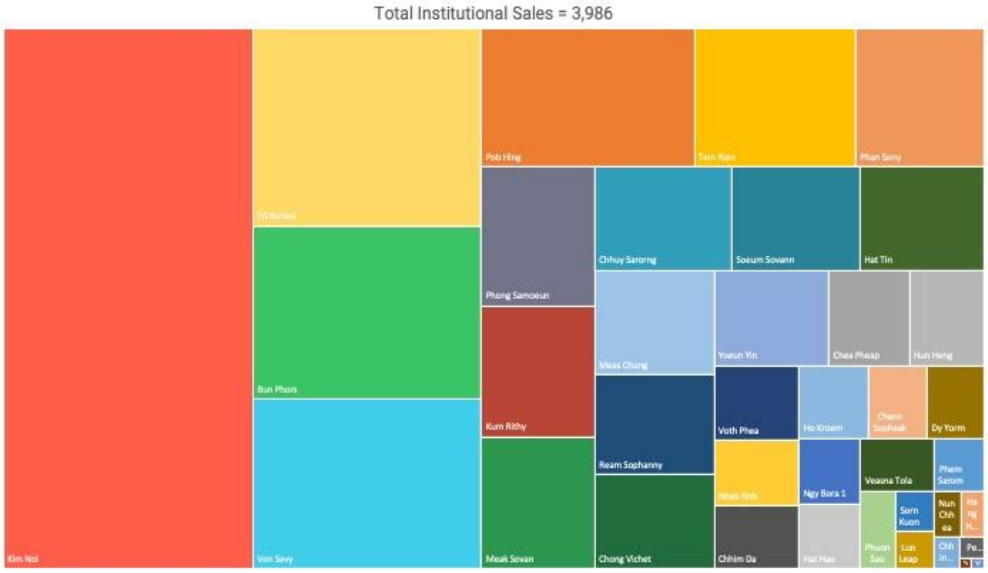
iDE categorizes sales made to the government or another NGO, without the support of an iDE sales agent, as an institutional sale. The proportion of institutional sales compared with iDE-generated sales is still quite low with a ratio of about 16.5 iDE generated sales per institutional sale. Since the start of SMSU3, 3,986 institutional sales have been delivered compared to over 60,000 iDE-facilitated sales. The number of institutional sales has remained relatively consistent over the current program period with about 120 sales per month, as well as the number of LBOs selling to institutional buyers - between 16-20 LBOs.

TABLE 14: iDE-GENERATED VS. INSTITUTIONAL SALES FOR ACTIVE LBOS IN SMSU3, BY PROVINCE

Province	Total # of iDE Generated Orders by Active LBOs	Total # Institutional Orders by Active LBOs	Average # iDE Generated Orders per Active LBO	Average # of Institutional Orders per Active LBO
Kampong Thom	13,870	317	1,261	29
Kandal	4,418	44	442	4
Oddar Meanchey	2,495	8	499	2
Prey Veng	14,775	1,283	985	86
Siem Reap	15,421	1,830	734	87
Svay Rieng	5,778	90	825	13

There is no indication institutional sales are growing over time as a proportion of total sales. We do, however, see a few LBOs with a large number of institutional sales, which are typically tied to lucrative government subsidy programs or grant-funded initiatives outside of SMSU3. Figure 23 shows the distribution of LBOs contributing to the total number of institutional sales. Four LBOs contribute half of the total number of institutional orders and one LBO is responsible for a fourth of total institutional sales delivered over SMSU3.

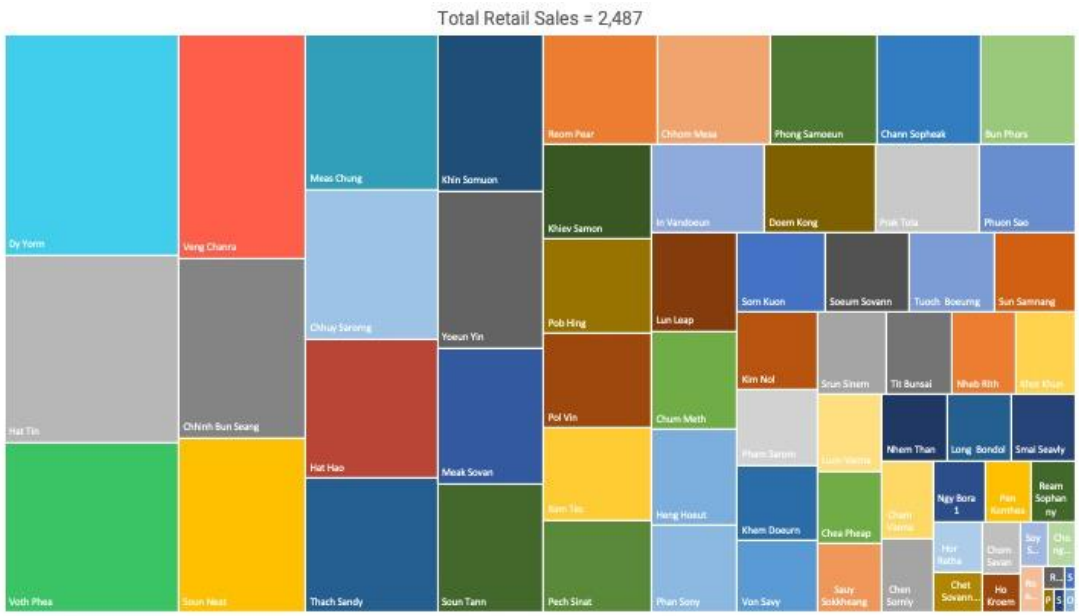
FIGURE 23: DISTRIBUTION OF TOTAL INSTITUTIONAL SALES IN SMSU3, BY LBO



According to self-reported data, 6-7% of WASH product sales revenue comes from non-iDE generated sales and 15 LBOs (out of 69) earn more than 20% of their WASH product revenue from non-iDE generated sales. In terms of geographic coverage, most LBOs (51 out of 70) are operating solely within iDE's target areas, with 15 LBOs operating in one additional province outside of iDE's intervention areas.

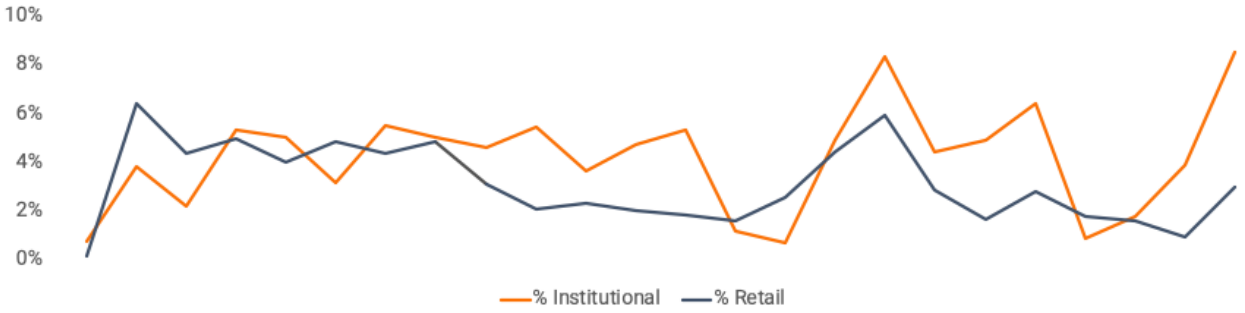
In addition to institutional sales, there was significant growth in the number of retail sales directly to households by LBOs over the course of SMSU3. Over the course of SMSU3, 67 out of 70 active LBOs sold products via retail channels. 27% of LBOs sold more than 5% of their total quantity via retail channels. Compared to institutional sales, total retail sales sold over SMSU3 is much more evenly distributed across the Active LBOs as shown in Figure 24.

FIGURE 24: DISTRIBUTION OF TOTAL RETAIL SALES IN SMSU3, BY LBO



This has not changed much over time staying between 1-5% of total product sales during any given month since the beginning of SMSU3 - see Figure 25 below. Interestingly, we do see that retail and institutional sales tend to move in the same direction at roughly the same time. The reasons for this are not fully understood at this point and require additional analysis.

FIGURE 25: PERCENT OF TOTAL PRODUCT SALES DURING SMSU3, VIA RETAIL AND INSTITUTIONAL CHANNELS



In addition to examining the sales generated by LBOs to date, we asked LBOs a number of questions related to their ability to run the business without iDE's ongoing support. 13% of LBOs (n=9) believe they would be able to sell WASH products at the same rate as they are now, and 83% (n=57) believe they could still sell WASH products, but the volume would be much lower. While many LBOs believe their sales will decrease after SMSU3 ends, the majority (84%) do have a plan for when SMSU3 is over, with only three LBOs claiming they have not thought at all about this transition. As expected, the LBOs with a clear plan, or a rough plan, are more confident they will continue selling WASH products after SMSU3 ends.

In summary, the majority of sales are still generated by iDE-connected sales agents, and only a select few have delivered a significant number of non-iDE generated orders via institutional sales. A large proportion of LBOs are

selling via retail, albeit at relatively low volumes. Generally, a small portion of WASH-related business revenue comes from non-iDE channels and LBOs are largely only operating within the sales territories under the SMSU3 program. The majority of LBOs are confident they can and will continue selling WASH-related products after the program ends, but very few believe they will maintain the same level of WASH-product revenues without SMSU3 support and iDE-generated orders.

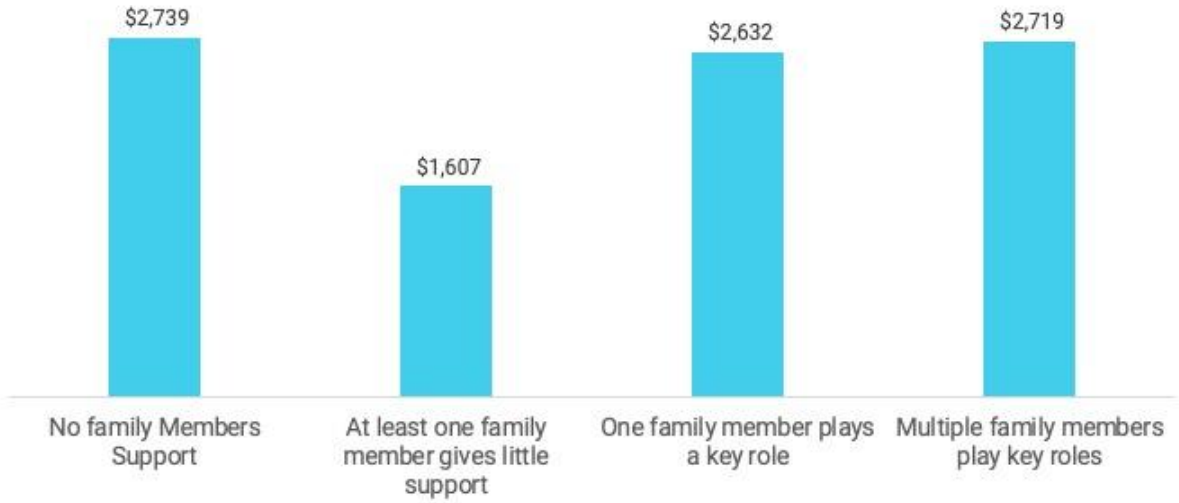
BUSINESS CAPACITY

In order to better understand LBO sustainability, iDE has investigated several dimensions of business capacity. The first is business formalization via registration because business registration is often required for the business to access financial services. Of the 70 active LBOs, only 10% registered with either the General Department of Tax, Ministry of Commerce or Ministry of Industry, Science, Technology and Innovation. 62 out of 69 LBOs do not have any form of registration. Over 40% of LBOs are interested and intend on registering their business. However there is a significant barrier in that 78% of LBOs have low or no understanding of the process for registration.

The second area of business capacity that iDE investigated is access to support systems for the business, including formal business networks or family support systems. We find all but one LBO are part of a business network including other LBOs, material suppliers, other similar local business owners, NGOs other than iDE or local authorities. 74% of LBOs estimate this network to be between 5-10 people. Because of the high number of LBOs claiming to be part of these business networks, we do not see much regional variation in this dimension. As iDE convenes groups of LBOs in each province regularly, this finding is not surprising but re-affirms that LBOs consider these groups to be support structures.

All but two LBOs involve other family members in some capacity. When examining the importance of family support, we find the lowest earning LBOs are likely to fall into the group that has at least one family member providing a little support in operating the business. In comparison, LBOs with at least one other family member playing a key role and LBOs with no family involvement earn considerably more from WASH product sales. This difference is statistically significant at 10%. This may indicate that a degree of formalization and dedicated commitment among LBO staff/members plays a significant role in LBO success.

FIGURE 26: AVERAGE MONTHLY REVENUES FROM WASH PRODUCTS IN SMSU3, BY FAMILY INVOLVEMENT



The third primary area of business capacity relates to business record keeping and profit estimation. Surprisingly, when asked whether the LBO tracks their revenue and profits for all sales, including non-iDE products, only 50% said yes. Those that do not track their revenue or profits regularly have a self-reported total business revenue estimate nearly 3X the annual business revenue estimate of the LBOs who do record their revenues and profits. When looking at iDE-generated sales (where we have verifiable order records and revenues) we do not see a significant difference in earnings between the two groups. Understanding revenues

and costs, and tracking these figures for different business channels is critical for ongoing business sustainability and growth. Not surprisingly, those who regularly track revenues and costs are more likely to claim to have businesses that make enough money 9-12 months of year, compared to those who do not track revenues and costs claiming they are only making enough 6 months of the year. This result should be handled carefully, however, because there were no differences in total revenue from WASH products.

SUMMARY

Bringing the three dimensions of LBO resilience and sustainability together to describe SMSU3's active LBO network, we have developed a set of metrics to quickly ascertain which LBOs are on track to being resilient. A description of the 'Quick Look' metrics for each indicator and the percentage of LBOs meeting each criteria are in the table below:

TABLE 15: QUICK-LOOK LBO SUSTAINABILITY METRICS: THRESHOLDS AND % OF LBOS

Sustainability Dimension	Quick-Look Metric	% of Active LBOs
Product diversity	D1: More than 20% of iDE-generated WASH product revenue is from products other than the Easy Latrine.	42%
	D2: Self-reported annual revenues from non-WASH business channels exceed 25% of total revenue from iDE generated WASH sales, non iDE generated WASH sales and revenue from other sources.	15%
Revenue without iDE sales	R1: At least 5% of total product sales (Easy Latrines and ADP) are generated via non-iDE sales channels, including institutional sales or retail sales.	49%
Business Capacity	BC1: The LBO business is formally registered with a relevant ministry	10%
	BC2: The LBO engages members of family in at least one key role	76%

Using the five 'Quick-Look' sustainability indicators above, we can categorize LBOs and quickly see how sustainable or resilient they are across the three dimensions - see example scorecard of LBOs from Kampong Thom in Figure 27.

FIGURE 27: EXAMPLE QUICK-LOOK SCORECARD: KAMPONG THOM

LBOProvince	LBOID	D1	D2	R1	BC1	BC2
Kampong Thom	1313	40%	7%	4%	1	1
	1508	28%	14%	15%	0	1
	1606	27%	2%	4%	0	1
	1533	24%	6%	11%	0	1
	1169	23%	13%	8%	0	1
	1023	17%	46%	1%	0	1
	1735	17%	14%	1%	0	1
	1055	12%	4%	3%	0	1
	1137	12%	4%	5%	0	0
	1159	11%	18%	3%	0	1
	1733	0%	2%	2%	0	0

Using this set of quick-look metrics, we have identified three Active LBOs (4%) in the network that meet four out of the five criteria for sustainability, and there are 15 (22%) who meet three out of five. The largest group of LBOs (42%) satisfy two out of the five metrics, whereas 26% of LBOs meet just one metric. There are no Active

LBOs that satisfy all five, largely because there were so few which have formally registered their businesses.

Moving forward, iDE will continue to pay close attention to fundamental aspects of LBO sustainability and resilience. The events of 2020 have reinforced our view on the critical need for this area of focus. With continued product innovation, additional mentoring and coaching, as well as new linkages being created between LBOs and local governments, we aim to improve these core metrics over the remainder of SMSU3.

GENDER & INCLUSION ANALYSIS

Key Findings:

- SMSU3 is promoting inclusive sanitation improvement in service of the mission to "Leave no one behind." Across this phase of the program, 55% of latrine customers were poor, a much higher portion than in the population in general.
- Latrine usage rates are consistent between men and women, while the elderly and people with disabilities have the highest usage rates (around 79% of people in both groups report always using the latrine). Taken together, these findings indicate a high degree of equity in access to and use of sanitation facilities in project areas.
- SMSU's work to build the capacity of women business owners has generated some early successes. Overall, the entrepreneurs who have taken part in the SHE Investment-run training and incubation have seen increases in income and savings. Improvements in confidence and decision-making power were smaller, but stories from these entrepreneurs indicate the experience was meaningful in building skills and business acumen.

SMSU3 is looking at gender equality and social inclusion within its program in a variety of ways.

First, we look at latrine sales to better understand our customer profile and to determine if any societal groups are marginalized or overlooked in our sales. This primarily means looking at the proportion of sales to IDPoor households, the breakdown of customers' gender, and the proportion of customers who have a household member with a disability.

Second, we look at the intra-household use behaviors within a household after it has purchased and installed its latrine. Questions we ask include: Do all members within the household use the latrine the same, i.e. are boys more likely to use the latrine than girls? What about men versus women? And are the elderly and disabled able to use the latrine? We complete this analysis using a method called the Safe San Index[11]. Within this analysis we also look to see if there is any relationship between the gender of the sales agent and use behaviors, answering the question: Are households that purchase from a female sales agent more likely to use the latrine?

Third, we test and scale effective models for advancing do no harm principles and supporting women entrepreneurs. In this area, we have focused on deploying a deposit restitution policy that aims to mitigate the risk of domestic violence. We are also supporting female entrepreneurs and LBOs through capacity building and training programs like our partnership with SHE Investments.

Fourth, we are mainstreaming gender principles in our programming through regular training and follow-up with our staff. We follow these training with qualitative research to better understand organizational levels of empowerment and gender norms.

Finally, through our work as an implementation partner on the Type 2 Research Grant with the Institute for

[11] The Safe San Index was published in 2014 after piloting in India and is used to quantify the hygienic safety of a household's defecation and human feces disposal practices using 15 self-reported items and two subscales. For the purposes of our study, we adapted the Latrine Use Frequency subscale, using the same weighting methods as described in the paper linked above, and standardized the results from 0 (household members never use the latrine to defecate) to 100 (all household members always use the latrine to defecate).

Sustainable Futures (ISF), we have begun to explore the broader impacts of our WASH work on non-WASH outcomes such as internal, relational and community changes in gender dynamics for our customers and change agents.

CUSTOMER PROFILE

Our SMSU3 customer survey has sampled 1,097 households (representing 5,279 individuals) since inception and up to the mid-term report. Our findings include:

- 50.2% of our clients (members of the household) are women and girls and 49.8% are men and boys.
- 1.2% of our households have one member with a permanent disability (0.49% women with disabilities and 0.74% men with disabilities).
- 85% of households had a woman involved in the decision to purchase a latrine, and 82% of households had a woman involved in the financing of the latrine.
- 45% of all latrine customers in SMSU3 are IDPoor (55% in 2020).

INTRA-HOUSEHOLD LATRINE USE

To study intra-household latrine use, we adapted a tool from the Safe San Index (SSI) called the Latrine Use Frequency subscale. The SSI is a useful tool as it aggregates and standardizes latrine use responses to an easy-to-understand 0 - 100 scale, where zero is that household members never use the latrine and 100 is that all household members always use the latrine to defecate. Numbers lower than 100 indicate that household members may only sometimes or usually use the latrine, or that latrine use is inconsistent between household member types - such as men may use it more frequently than women.

Table 16 shows the average SSI score for SMSU3 and the average by province. We see that overall the scores are quite high, with an average score of 87.8. Most province level variances are within the margin of error of each other, though Svay Rieng score of 83.5 is statistically lower than the higher-scoring provinces such as Kampong Thom and Kandal.

TABLE 16: SSI SCORES, BY PROVINCE (0-100 RANGE WHERE 100 IS ALL MEMBERS USE THE LATRINE ALWAYS)

Kampong Thom	90.2
Kandal	90.2
Oddar Meanchey	85.2
Prey Veng	87.3
Siem Reap	88.2
Svay Rieng	83.5
ALL PROVINCES	**87.8**

The SSI is a helpful tool as it not only provided an overall score measuring intra-household latrine use, but also gave us the opportunity to look at each group of household members and their defecation practices. Table 17 shows the different household member groups as defined by the SSI and the percentage of household members that reported to always use the latrine from that member group. In the right-most column, we see a pattern of latrine use that appears to be higher based on age or ranking within a household. For example, elders and married individuals have higher rates of always using the latrine compared to unmarried individuals and children. We don't see any significant differences in latrine use for different genders in the household. Note that the rate for infants is quite low as the categorization is around proper disposal of feces in the latrine.

We continue to check if there are any relationships between sanitation use and gender of the sales agent as we have found other sanitation marketing programs that there were. We found no differences at the aggregate household level. The first two columns in Table 17 dig into individual group usage by showing the rates of always using the latrine when disaggregating by whether the household purchased from a male or female sales agent. When disaggregating at this level the sample size becomes quite small making it hard to observe any

statistically significant differences. Still, when comparing latrine use rates from households that bought from a male sales agent and a female sales agent we see that most member groups report higher use when sold a latrine by a female sales agent. This is particularly true for women and young girl household members. It would be worth repeating this analysis with more data to see if any statistically significant differences can be observed. In any case, these results contrast with a similar analysis that iDE ran in our sanitation marketing program in Nepal. There, we found that household usage rates differed significantly based on sales agent gender. This may reflect cultural differences affecting customers' gendered perceptions of sales agent credibility. We also ran a separate analysis (not shown here) looking at household usage rates based on how involved women were in the decision to purchase a latrine. We did not find any significant differences in this analysis, either.

TABLE 17: PERCENT OF HOUSEHOLD MEMBERS ALWAYS USING THE LATRINE (BY MEMBER GROUP)

	HH that bought from Male Sales Agent	HH that bought from Female Sales Agent	All Households
Elders	78%	81%	79%
Married Women	74%	78%	76%
Married Men	72%	75%	74%
Unmarried Women	65%	69%	67%
Unmarried Men	67%	67%	67%
Girls	57%	67%	62%
Boys	54%	60%	57%
People with disabilities	79%	79%	79%
Infants	3%	9%	6%

DO NO HARM: GENDER-BASED VIOLENCE AND DEPOSIT RESTITUTION

Gender-based violence (GBV) and violence against women remains a challenge for Cambodia: 21% of women and girls between the ages of 15 and 64 will experience some type of physical or sexual intimate partner violence during their lifetimes (Ministry of Women's Affairs Cambodia 2015). In addition, Cambodia has a higher level of community acceptance of GBV than countries like Nepal in which the Water for Women Fund is also working (DHS 2014).Therefore, it is anticipated that iDE Cambodia's programming would witness examples of violence happening within target communities.

To explore this theme in more detail within the program, we asked all field staff members in a qualitative study about their experiences as staff members. When asked about what type of change they would like to see in their communities regarding gender equality, 9% of respondents (n=180) mentioned a reduction in gender-based violence. Additionally, when asked about changes they have experienced because of their participation in the program, 9 respondents (in 203 stories of change) mentioned that they hope that this change would continue into reductions in GBV for themselves or their communities.

We also investigated evidence that some households experience increased domestic violence after a woman solely takes the decision to purchase a latrine without her husband's consent. During in-depth interviews, several staff members confirmed that they had encountered this type of challenge. However, they stressed that this type of violence is primarily verbal resulting in arguments and reduction in access to household assets and resources. Interviewees mentioned that the gender equality training that iDE Cambodia conducted with all staff members has led to increased confidence to engage with communities and support women to make these decisions safely. The order cancellation period and engagement with local authorities has led to increased purchasing support from husbands who are migrant workers. These strategies are layered on top of an undercurrent of rapid societal change leading to higher levels of gender equality that was mentioned by almost all interviewed staff members. iDE is working to amplify this positive societal change and to mitigate possible backlash from changes in household decision making.

In Q3 2019, the Program finalized a component of its "Do No Harm" policy: deposit restitution. When

households purchase any product from an iDE sales agent, they have always been obligated to pay a deposit of $5 to secure their order and deter order cancellations. In the past, when households cancelled their orders, they forfeited their deposits. As noted above, iDE suspects that the forfeiture of this deposit could lead to family disputes, which could disproportionately impact the mental and physical health of female members of the family and put an undue burden on poor households' financial situations. As such, SMSU has rolled out a policy for returning deposits in the instance of order cancellation. Poor households now receive their deposit back in full if they cancel for any reason. Non-poor households can cancel their order for any reason within 72 hours. We believe this is a critical use of program resources as we strive to improve the program's pro-poor and "do no harm" aspects. To date, 1,877 households have received their deposit after cancelling orders, 1,680 of which are IDPoor households.

FEMALE ENTREPRENEUR SUPPORT WITH SHE INVESTMENTS

Beginning January 2019, the iDE Cambodia WASH program supported eight female microentrepreneurs and four iDE field staff through a six-month training and peer mentoring program, facilitated by SHE Investments. The entrepreneurs are latrine business owners working with iDE to sell and deliver latrines in Siem Reap province. All eight entrepreneurs participated in follow-up interviews or surveys with SHE as part of this evaluation, with none of the women business owners leaving the program prior to its completion. An evaluation was conducted using interviews and surveys from program graduates, with data collected every month until program completion. Findings related to each of the pilot's objectives are reported below.

Objective 1: Increase incomes for women and families. Each entrepreneur reported that their income increased as the program progressed. It must be noted that all income data was self-reported and the assumption has been made that given figures are accurate.

- Average increase in monthly revenue for program participants was 100% - with the lowest increase at 4.7% and the highest increase at 241%.
- Increased revenue in total between all businesses was $5,872 per month, or USD $70,471 annually.
- The number of family members that women are directly supporting financially — around 32 members total — remained the same throughout the six-month program.
- The women entrepreneurs created six new jobs through employment in their businesses.

Objective 2: Improve women's financial, business and problem-solving skills. At baseline, one business owner reported she was tracking finances (recording income and expenses). By the end of the program all business owners were regularly tracking finances. At the beginning of the program, one woman reported that she separated her personal and family finances from her business finances. By the end of the program, seven of the eight participants were separating business from personal and family finances. By the end of the program seven out of eight women were paying themselves a salary, six of them for the first time.

Objective 3: Improve Savings, Debt & Assets. Key outcomes for this objective included:

- Total increased savings (taking into account women whose savings decreased) was USD $6,350.
- Average increase in savings per woman was 65%.
- Total decrease in debt was USD $2,000. This represented an average decrease in debt of 1.28%.
- The proportion of women participants who owned bank accounts or assets increased from 25% at the beginning of the program to 62% by the end of the program.

Objective 4: Improve women's confidence, facilitate network building, and create female leaders in communities. In order to assess "self-confidence" and "decision-making power," iDE and SHE used a series of questions, each with a weighted scoring method, to determine whether a woman had "high" or "low" self-confidence and decision-making power in their household and business. The increase or decrease in these final scores was measured. Questions used to measure decision-making power included:

- "At home, if I want to spend money on small daily expenses (food, clothing, cleaning products) then I first need to ask permission from my husband or family".
- "At home, money is not given to me to manage, because my husband/family do not trust me to make

the best financial decisions".
- "In my business, I need to consult with my husband/family before deciding on suppliers. They also negotiate with suppliers for me. "

Each question was given a weighted score, which together totaled 100%. If the answer given was positive (i.e. "I never have to ask permission to spend money on small daily expenses") then the score was higher. Results for increase in decision-making power in the home and business were marginal:

- Average increase in reported decision-making power at home was 0.43%, a slight increase to 29.25% from the baseline of 29.13%
- Average increase in reported decision-making power in business was 1.34%, a slight increase to 18.88% from the baseline of 18.63%

Despite this quantitatively low scoring, most participants felt compelled to share what they had learned from the workshops with their families, friends, and close employees. Many expressed a newfound confidence tracking their finances and creating a business plan. A testimony from one entrepreneur identifies the link between increased skills, confidence, and decision-making within her business:

"I found that I improved the relationship with my husband because I tracked business expenses and income regularly. So I could talk to my husband about finances more confidently with evidence. It allowed us to focus more on discussions about how to improve the business rather than fighting each other about money. Moreover, I know how to do the cash flow for my business. It helps me a lot managing cash of my business and I clearly know when I should use money and when I should not."

- Hat Tin, Siem Reap Province

Female entrepreneurs brainstorm during the Siem Reap iDE-SHE Investments Business Incubator Program

Results of this pilot have motivated iDE and SHE to collaborate again to scale this business incubator program to iDE's network of small business partners in all of iDE's operating provinces. This scale-up training program began in late 2020 and will be complete in early 2021. Another analysis, refined based on the learnings of the pilot analysis, will be conducted to assess the impact of the scale-up initiative.

SMSU STAFF AND GENDER MAINSTREAMING

SMSU has twice conducted an all-staff Gender Mainstreaming training. After the second training, we partnered with UTS-ISF to conduct qualitative research on the impacts of the training for our team. We have gained two key insights from this research.

First, we found that gender training spills over into household harmony. During in-depth interviews with staff members, several mentioned changes in their household communication and reductions in arguments and verbal disagreements. One staff member mentioned that he observed changes in how his colleagues treated their wives, "and the way they speak to their wives is much better than before, more polite than before." Another described changes in his own tone: "Before I used to get angry with my wife. I would blame her a lot. But now everything has changed. Really it has. I now talk to her gently". This has led to more household harmony: "before

there were a lot of problems in the house, but now our family can talk with each other gently….and it brings more happiness to our family." Interviewees linked these changes to their participation in gender equality training and from a realization of the work which spouses were doing, specifically in the household. And in some cases, this has led to changes in access to household resources – such as money. One interviewee mentioned that "in order to change society, I first must change myself."

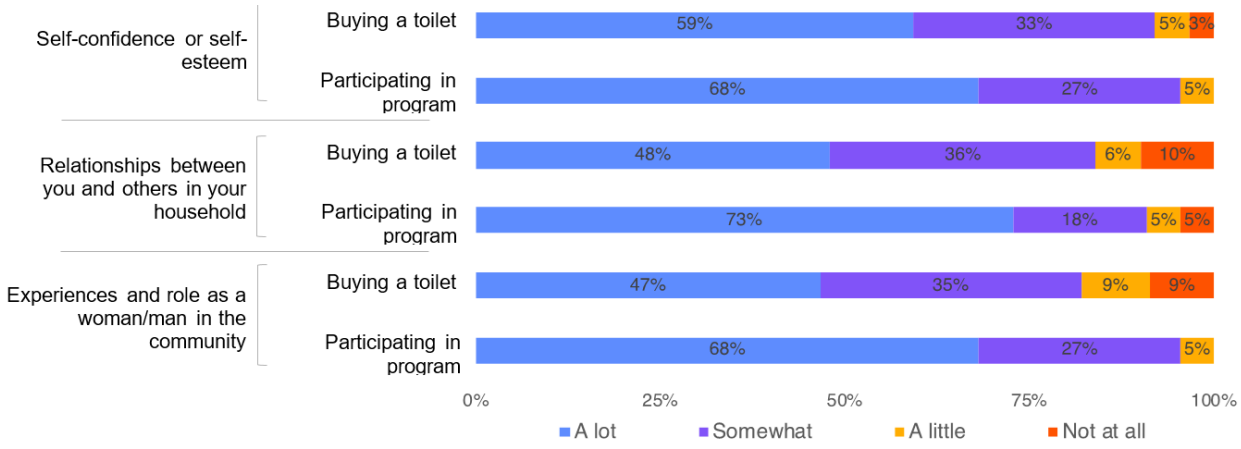
Second, we found that the training has the potential to create real change in perceptions, attitudes, and behaviors. While the concept that women and men are equal is taken for granted in many circles, for some iDE staff members, this concept has been life changing. "This has been a 10/10 change for me. I had never heard of equality before. Before, the training I had never heard that I could do big things, but now I am realizing my potential. I'm ready for leadership." Many staff members had never heard of gender equality at all or that women can do the same "stuff that men can do."

WASH-GEM AND IMPACTS BEYOND WASH

SMSU has been collaborating with ISF to develop and test the WASH-Gender Equality Measure (WASH-GEM). The WASH-GEM aims to assist practitioners and researchers in exploring gender outcomes associated with WASH programs for women and men. The WASH-GEM anticipates that WASH programs can influence WASH-related gender outcomes which in turn can lead to wider changes in gender equality. The tool has been tested and refined through a process of collaborative piloting with in-country partners in Nepal and Cambodia.

Through this collaboration, we also explored the extent to which individuals experienced changes due to accessing a new latrine within the last 12 months or participating in the SMSU program. As can be seen below, individuals who participated in the program experienced more changes related to confidence, relations and roles. On average, 70% of program participants and 51% of individuals who purchased a latrine experienced "a lot" of change. This supports the theory that involvement in a WASH program as a client or change agent can lead to internal, relational and community changes in gender dynamics. Strategies to maximize this change could be developed on the basis of reviewing areas of gender equality that are weak and considering if and how iDE's program could potentially contribute.

FIGURE 28: CHANGES EXPERIENCED DUE TO PURCHASING A LATRINE OR PARTICIPATING IN THE PROJECT



CLIMATE VULNERABILITY & RESILIENCE

Key Findings:

- SMSU3 research indicates that rural households living in climate vulnerable flood-prone areas are more likely to face challenges with latrine functionality and more frequent occurrences of pit fillings, and that these households are more likely to express unsafe fecal sludge management (FSM) intentions and behaviors.
- The research study proposes a feasible approach for iDE to estimate and target households faced with different thresholds of vulnerability to climate change in order to prioritize and market customized sanitation solutions to those who are most vulnerable.
- Targeting households that face increased risks with climate change, the All Seasons Upgrade (ASU) was designed for high-ground water and low infiltration environments and field-tested to safely divert the existing pit content into a high infiltration leach field, minimizing households' exposure to untreated fecal sludge (FS) and improving latrine functionality.

FSM & CLIMATE CHANGE

It is estimated that over 25% of Cambodia's population is affected by challenging environments that experience floods, high ground water, and other barriers to effective sanitation and fecal sludge management (FSM). Rural households living in these environments are more vulnerable to climate change and have limited capacity to resist, cope with and recover from climate hazards. For the context of rural Cambodia, we defined physical climate vulnerability as living in flood-prone areas that are faced with higher frequency and severity of climate shocks. In late 2020, using data from the FSM Survey, we explored the link between climate vulnerability, latrine functionality, and FSM intentions and practices of rural households. A better understanding of this link will allow us to target our sanitation efforts in challenging areas and increase households' WASH resilience against increasingly extreme seasonal climate change shocks.

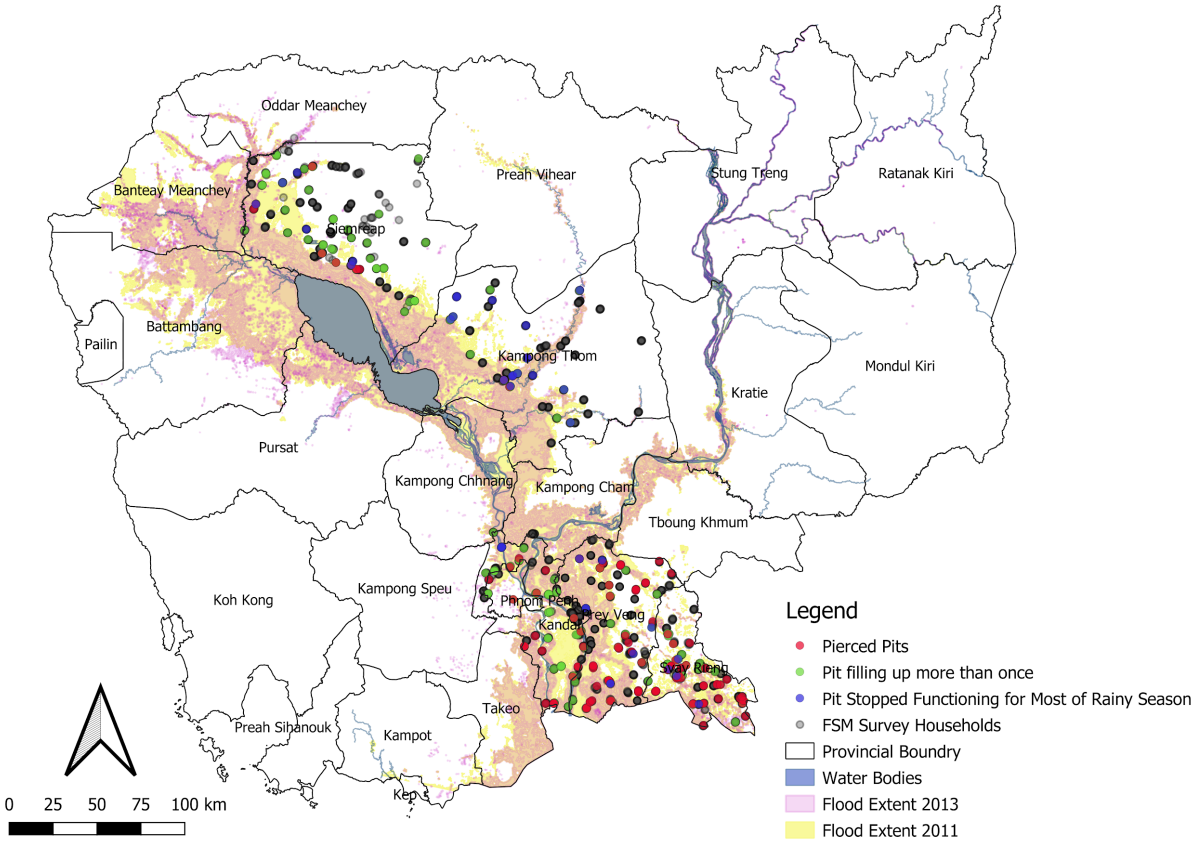
The FSM Survey data analyzed in this study included frequency of latrine overflow/malfunction during the rainy season, frequency of latrine pits filling up, and unsafe FSM practices such as releasing FS into the open environment (e.g., opening the pit lid during a flood, piercing the pit). Using GIS mapping, the FSM Survey data was compared against major and average flood events from 2011[12] and 2013[13] respectively, as well as a number of buffer regions from 0.5 km to 1 km from observed flood incidence. A spatial representation of this analysis is shown in Figure 29. Additionally, to better understand the isolated effect of being in a flood-prone area, controlling for other confounding factors, a logistic regression model was used to explain latrine functionality as a function of household size, number of pits, depth of pits, IDPoor status[14], province and whether or not the household was in a flood-prone area.

[12] Cambodia Flood Extent in 2011. https://geonode.wfp.org/layers/geonode%3Akhm_nhr_floods_unosat_2011

[13] Cambodia Flood Extent in 2013. https://data.humdata.org/dataset/cambodia-other-0-0-0

[14]The IDPoor System is an initiative administered by the Cambodian government that identifies poor households, assesses their level of poverty (IDPoor 2 is poor, IDPoor 1 is poorest), and distributes identification cards for these households.

FIGURE 29: RURAL HOUSEHOLDS FACED WITH LATRINE FUNCTIONALITY CHALLENGES AND EXHIBITING UNSAFE FSM BEHAVIORS AGAINST 2011 AND 2013 FLOOD EVENTS IN CAMBODIA



The key research findings from this study include:

- **Rural households living in climate vulnerable flood prone areas are more likely to face challenges with latrine functionality and more frequent occurrences of pit fillings.** Climate vulnerable households (as indicated by households within the 2011 flood zone) were more likely to have had a non-functional latrine during the rainy season [$r(1,472) = .07$, $p < .01$] and were more likely to have a pit fill up [$r(1,472) = .05$, $p < .05$].
- **Living in climate vulnerable flood-prone areas can exacerbate households' unsafe FSM intentions and behaviors.** We found statistically significant differences in unsafe FSM intentions between households living within 1km of the 2011 flood extent and those that do not [$t(1,472) = .03$, $p < .10$]. We also see significantly more households with pierced pits [$t(1,472) = .04$, $p < .05$]. Comparing pit piercing behaviour for households with more frequent rainy season fillings and pit functionality, both had statistically significantly higher rates of pit piercing at 1% level of significance.
- **Pit functionality is affected by household size and living in a flood-prone area.** Of all the factors considered in the logistic regression model to affect pit functionality, household size and being in a flood prone area were both positive and significant at 1% and 5%, respectively, but these results were sensitive to how we define the model[15].
- **We do not see a greater proportion of IDPoor households in flood-prone areas.** 13% of the sample population is IDPoor in both flood and non-flood prone areas with no statistically significant difference.

[15] Model used the 2011 Flood Zone with no buffer

Results indicate that climate vulnerability is related to latrine functionality and has additional effects on FSM intentions and practices. With increased flooding across iDE's operational areas due to climate change, we can expect to see increased challenges with dysfunctional latrines which will further amplify the potential for unsafe FSM behaviors and practices. To reduce households' climate vulnerability, these associated unsafe FSM behaviors can be targeted and mitigated. This study proposes a more feasible approach to target household level WASH-climate vulnerability when compared to existing costly and difficult to deploy tools (e.g. groundwater mapping, precipitation/flood models, ground-soil assessments, etc.). On a national level, by using flood incidence maps from an existing reputable source, we can identify and prioritize sanitation-challenging areas. Alternatively, in the absence of or in conjunction with a flood incidence map, increased occurrences of latrine dysfunction, pits filling up, and pierced pits can be used as proxy indicators to identify climate vulnerability at the household level. Sanitation marketing implementers can use this approach to target households in challenging environments with more resilient FSM products and services.

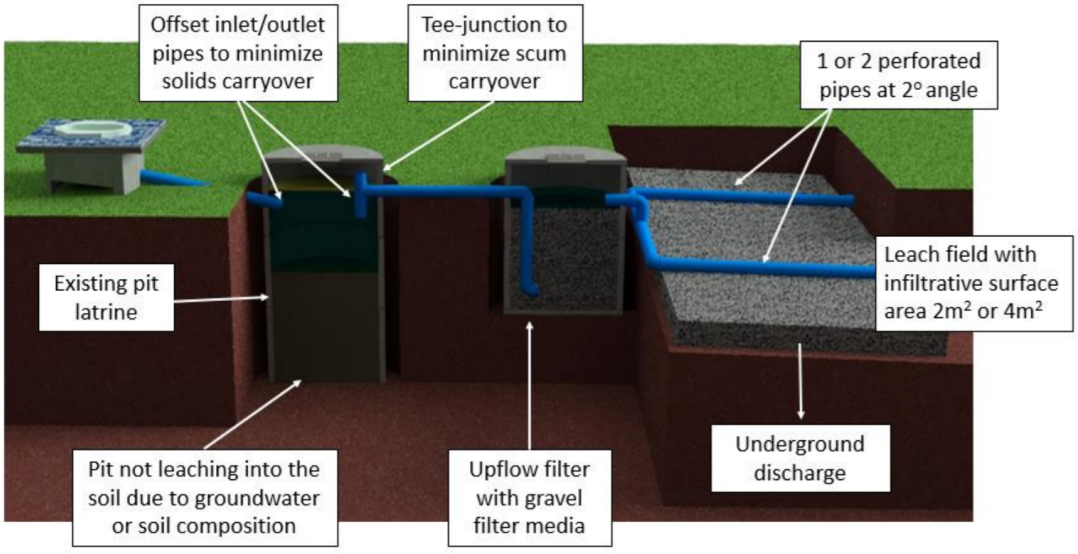
As latrine pits fill, the WASH sector must continue to apply evidence to implementation to improve rural FSM safety. This will be critical to ensure the sustainability of public health gains from Cambodia's expansion of basic sanitation coverage. Research into households' decision-making and challenges with rural sanitation systems must also continue to deepen our understanding of behavior, socio-economic vulnerability, and climate change impacts on rural sanitation.

ALL SEASONS UPGRADE (ASU) PILOT

Rural households living in challenging environments are faced with different thresholds of vulnerability to climate change and barriers to effective FSM products and services. Appropriate technologies for Sanitation in Challenging Environments (SCE) and FSM are critical to ensure that rural Cambodians can safely manage their sanitation, despite increasing climate risks. In high-ground water and low infiltration (i.e. dense and saturated soil) environments, pour-flush pit latrine owners tend to experience higher pit filling rates driving them to unsafely discharge the pit content into the open environment. Targeting these challenging environments, iDE collaborated with Engineers without Borders (EWB) Australia to develop and test an appropriate, market-viable SCE technology.

The ASU is a latrine upgrade product that attaches a gravel filter pit and leach field to an existing pit latrine as shown in Figure 30. Between 2019 and 2020, iDE and EWB Australia deployed a one-year field test pilot of the ASU systems to: (1) test the treatment effectiveness of the ASU system to meet standard levels of safe disposal into the environment and (2) understand the functionality and contextual appropriateness of the ASU product.

FIGURE 30: ASU PRODUCT DESIGN OVERVIEW



We used biochemical oxygen demand (BOD), total suspended solids (TSS), and E. coli wastewater sampling, soil quality sampling, and field observations to evaluate the effectiveness of the ASU system at reducing pathogens while qualitative user survey questions were used to understand the households' willingness to pay, customer satisfaction, and overall functionality of the ASU system. Data was collected from 14 households every two months for a one-year pilot period. Households selected for this pilot study were ones who lived in high groundwater and/or clay environments (i.e. low soil infiltration), experienced higher pit filling rates, and have practiced unsafe FSM practices such as pit piercing.

Overall, as designed, the ASU diverted the existing pit content into a high infiltration leach field, minimizing households' exposure to untreated FS and improving latrine functionality. The treatment effectiveness of ASU (i.e. meeting effluent standards) was difficult to assess due to challenges in collection and analysis of wastewater samples. Nonetheless, the data did demonstrate that the ASU system can improve effluent quality when compared to discharging raw wastewater from pit piercing or pit overflow. In addition, survey and observation data showed that the ASU product provided continuous functionality of the toilet throughout the one-year testing period despite seasonal changes, demonstrating that ASU can significantly increase the pit capacity and reduce the pit emptying frequency. Further cost reduction and pilot sales trial testing are yet to be conducted to test ASU's market-viability.

COVID-19 ADAPTATION

SMSU3 is operating nearly at a level of business-as-usual with COVID-19-related activities and precautions embedded into daily activities. Household sales presentations and meetings with government officials are all conducted with adequate social distancing and begin with a conversation about COVID-19 awareness and prevention. Since April 2020, iDE staff have been distributing COVID-19-related informational material, including leaflets, posters, and handwashing promotion signboards attached with soap in a hanging mesh bag. Since April 2020, the program has:

- Trained all of our 192 field-based staff on COVID-19 prevention, including
    - iDE policy around prevention best practices in social distancing, handwashing, mask-wearing and other measures;
    - How to recognize/avoid disseminating incorrect COVID-19 information online;
    - Training of trainers on how to communicate COVID-19 prevention information to our stakeholders at the household, government, and private sector levels.
- Conducted COVID-19 advocacy and prevention training for over 400 local government officials at the village and commune level.
- During sales presentations, distributed hand washing promotion signboards with soap to 7,938 households and UNICEF-produced information leaflets to 36,272.
- Provided COVID-19 prevention training and facilitated a UNICEF COVID-19 Knowledge, Attitudes, and Practice Survey for all 69 of the program's affiliated latrine business owners
- Prototyped and tested hygiene-improving products including low-cost handwashing devices and a bidet product.
- Continued to sell hand washing facilities integrated into latrine shelters
- Participated in national and provincial government COVID and WASH working group meetings to support the government with coordination and planning of COVID-19 prevention and advocacy activities. Regularly coordinated with and sent data to the government on iDE's COVID-19 activities and results.

Our COVID-19 advocacy efforts have reinforced our relationships with the government and built support for WASH issues in the community. Before and throughout the COVID-19 pandemic, iDE program staff have always met with village chiefs before entering a village to get their support and assistance. During the pandemic, staff began these meetings by giving local officials hand sanitizer and explaining they would be handing out COVID-19 awareness leaflets in addition to talking about sanitation and hygiene. The COVID-19 and WASH

messages aligned and we found local government officials generally appeared to be more receptive to the importance of our sanitation and hygiene work than before the pandemic. This often translated into more enthusiasm and support for our work by local officials. We had a similar experience in our engagement with commune level authorities including the Commune Committee for Women and Children, where iDE staff also regularly provide them with COVID awareness posters and advocacy raising training. The response by the government to support sanitation and hygiene work in the interest of preventing the spread of COVID-19 further reaffirms our resolve to advocate for WASH as a critical public health need in the communities where we work.