



Cambodia Sanitation Marketing Scale-Up 3 (SMSU3)

SMSU3 End of Program Assessment, July 2018 to November 2022



Program Donors:



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Acronyms

ADP	Alternating Dual Pit
ASU	All Seasons Upgrade
DIB	Development Impact Bond
CCWC	Commune Committee for Women and Children
CFU	Colony Forming Unit
CR-WASH-SUP	Climate Resilient WASH Scale-Up Extension Project
DCWC	District Committee for Women and Children
DFAT	Australian Department of Foreign Affairs and Trade
E. coli	Escherichia coli
EWB	Engineers Without Borders
FS	Fecal Sludge
FSM	Fecal Sludge Management
GEDSI	Gender Equality, Disability, and Social Inclusion
IDPoor	Identified Poor by the Cambodian Government
LBO	Latrine Business Owner
MHH	Menstrual Health and Hygiene
NGO	Non-Governmental Organization
ODF	Open Defecation Free
PPI	Poverty Probability Index
PPP	Public Private Partnerships
SCE	Sanitation Challenging Environments
SFF	Stone Family Foundation
SMS	Safely Managed Sanitation
SMSU	Sanitation Marketing Scale-Up
SSI	Safe San Index
UNICEF	United Nations International Children's Fund
USAID	United States Agency for International Development
UTS-ISF	University of Technology Sydney's Institute for Sustainable Futures
WASH	Water, Sanitation and Hygiene
WASH-GEM	WASH Gender Equality Measure
WASH-SUP2	Water and Sanitation Scale-Up Program 2
WfW	Water for Women
WHO	World Health Organization

EXECUTIVE SUMMARY

In Sanitation Marketing Scale-Up's (SMSU) third phase, SMSU3 (2018-2022), iDE focused on the challenge of leaving no one behind and reaching the last remaining market segment without latrines. iDE introduced new approaches to reach this remaining market segment by applying a grassroots approach in public-private partnerships (PPP) to support villages in reaching open defecation free (ODF) status, developing a hyper-low-cost temporary latrine shelter product, and deploying targeted subsidies to reach the lowest income households.

SMSU3 facilitated rural sanitation markets by serving those who already have latrines with products that enable more sustainable sanitation management. iDE scaled the promotion of a fecal sludge management (FSM) upgrade product and expanded the production of customizable interlocking brick latrine shelters that increase accessibility for people with disabilities. The program developed and trialed climate-resilient technologies and approaches, including a latrine upgrade for high groundwater and dense soil areas, as well as a subsidy delivery model focused on targeting climate-vulnerable households.

iDE deepened its focus on building the sustainability of sanitation supply chain actors, specifically female entrepreneurs, and deployed gender-sensitive business training throughout its network. Through training and coaching on business fundamentals, adoption of new, diverse products, and building skills to effectively offer customers payment installments plans, iDE-connected latrine business owners (LBOs) demonstrated increased sustainability and stability. These entrepreneurs have the resources, networks, and skills to continue to supply water, sanitation, and hygiene (WASH) products and services to their community after iDE's engagement ends.

In SMSU3, iDE prioritized generating knowledge and sharing learning with the Cambodian and global WASH sectors. In partnership with research firms and international universities, iDE facilitated the following: (1) two robust studies on rural FSM, (2) supported the development of the WASH-Gender Equality Measure (WASH-GEM), a novel quantitative multidimensional tool that assists practitioners in exploring gender outcomes associated with WASH programs, and (3) conducted a randomized controlled trial on the effectiveness of climate-targeted sanitation subsidies. These learnings have been integrated into nationally-endorsed, Cambodian government policy documents on national sanitation strategy including subsidies, rural FSM, and sanitation in challenging environments (SCE).

Through a systems strengthening and inclusive market-based approach, iDE increased the equitable and universal access to and use of WASH services in rural Cambodia at scale. Through door-to-door sales, SMSU3 reached 878,264 households with WASH behavior change messaging. SMSU3 sold and delivered 140,749 WASH products to rural Cambodian households and contributed to the increase in sanitation coverage in program areas from 67% to 88% of households owning improved, pour-flush latrines. iDE supported 1,867 villages to claim ODF status in collaboration with Cambodian authorities.

As a result of interventions from iDE and other partners, Cambodia has achieved the greatest progress in reducing open defecation since 2015¹ globally. Since the start of iDE's WASH program in 2009, more than 407,000 households have invested in improved sanitation through iDE-promoted entrepreneurs, representing one in five rural Cambodian households. With Sustainable Development Goal 6.2 calling not only for universal access to sanitation and hygiene services by 2030, but also introducing criteria on the level of service provided, iDE is committed to continuing to increase sanitation coverage while deepening focus on safely managed, climate-resilient solutions.

¹ WHO & UNICEF, 2021. [Progress on household drinking water, sanitation and hygiene 2000-2020: five years into the SDGs](#)

The following are key lessons learned and achievements from SMSU3 featured in this report:

Diversified product offerings and targeted subsidies help increase equitable access to sanitation services in some of the most marginalized, hard-to-reach market segments.

- Using a human-centered design approach created inclusive, market-appropriate sanitation and hygiene products including on-site FSM products, SCE products, and shelter products accommodating low income households and households that have members with a disability. LBOs sold 607 disability-friendly and accessible shelters.
- SMSU3 trained 117 LBOs and facilitated the sales and delivery of 140,749 WASH products to rural Cambodian households. This contributed to the increase in sanitation coverage in program areas from 67% in 2018 to 88% in 2022 and a total net revenue of \$9.8 million to LBOs².
- SMSU3 removed barriers to latrine access in hard-to-reach market segments by introducing payment installment plans and delivering 38,941 partial, targeted subsidies to government-identified (IDPoor) households.

Business capacity building of LBOs and diversification of products creates a sustainable, long-term and independent sanitation market that will help Cambodia reach universal access to WASH services.

- LBOs offering a diversity of products in addition to the Easy Latrine, including FSM and latrine shelters are more profitable overall, suggesting business sustainability.
- LBOs are not entirely dependent on iDE sales agents. All active LBOs have sold products via retail or institutional channels without iDE support. However, this represents a small portion of their total sales. Only 52% of LBOs sold more than 5% of their total products without iDE sales agents.
- 91% of all LBOs have a plan for adapting their business when SMSU3 is over, with only two LBOs claiming they have not thought at all about this transition. This suggests that business sustainability is possible outside of iDE's support.

A grassroots approach to PPP strengthens WASH systems, creates a sustainable sector financing model that improves access to sanitation, and improves progress towards ODF status.

- In 2019, iDE launched the Grassroots PPP Department to accelerate progress towards the Cambodian government's goal of nation-wide ODF status by 2025.
- By facilitating collaboration between LBOs, civil society, non-governmental organizations (NGOs), and government, the PPP department supported 1,867 villages to claim ODF status.
- Through systems-strengthening initiatives, iDE has built the capacity of sub-national governments to locally subsidize latrines for poor households. Since 2020, in areas where the PPP team was active, local governments have allocated nearly \$19,000 in funds towards the subsidization of latrine purchases for 428 poor households.

Alternating Dual Pit (ADP) upgrades enable rural households to safely manage their sanitation but adoption of recommended practices is still a challenge in rural areas.

- During SMSU3, LBOs sold 22,227 ADP upgrades to enable households to treat and safely dispose of fecal sludge (FS).
- When recommended protocols are followed (mixing the pit with a lime treatment and storing for two years), the ADP is only effective at reducing pathogen concentrations to safe levels in two-thirds of cases. This calls into question the effectiveness of the standard two-year storage treatment in real-world applications.

² All monetary values are in USD.

- In a sample of 46 households that emptied their ADP, none waited the recommended two years. Increasing access to reliable, safe, and affordable FSM service providers will allow households to safely empty and switch their pits, and dispose of waste, even if there are pathogens present.

Integrating Gender Equality, Disability & Social Inclusion (GEDSI) helps ensure equitable access to and use of WASH services.

- The WASH-GEM results showed that most women have access to sanitary menstruation products but experience stress in managing their menstruation. This prompted iDE to include a menstrual health and hygiene (MHH) awareness module in its gender mainstreaming approach to staff training and post-ODF training to local authorities. 128 female local authorities completed the MHH training and promoted improved menstrual hygiene management practices in their communities.
- iDE partnered with SHE Investments and trained 27 female and 38 male entrepreneurs on gender-focused and culturally tailored business practices to foster a more inclusive sanitation market.
- iDE updated its 'Do No Harm' policy to include deposit restitution. Returning deposits within 72 hours after a purchase has the potential to mitigate the risk of family disputes related to sanitation product purchases.

Promoting appropriate SCE technologies, safely managed sanitation (SMS), and climate-targeted subsidies can increase resilience to climate change.

- iDE conducted research that shows how climate vulnerability correlates with toilet dysfunction and abandonment and unsafe household FSM practices. These issues are magnified in SCE environments especially for the lowest income households in rural communities.
- To meet the needs of households living in SCE, iDE has launched the All Seasons Upgrade (ASU) – a latrine upgrade that functions in high groundwater and saturated, dense soils. In a sales trial, the ASU demonstrated potential on how latrine upgrades can be functional and resilient during periods of heavy rain.
- A randomized control trial found that climate-targeted subsidies improve the likelihood of successful sales for latrine products in climate-vulnerable households by 32% without distorting the market.

A cohesive program and flexible funding mechanisms enabled the design and implementation of a cost-effective and resilient WASH program.

- SMSU3 integrated the world's first WASH development impact bond (DIB) into its funding structure, crowding-in private finance to de-risk the public sector.
- In terms of cost-effectiveness, iDE achieved a social return on investment (SROI) of 3.3, meaning that for every dollar spent in grant funding, \$3.30 was gained by a latrine purchasing household through income savings and improved productivity.
- The ability to quickly adjust implementation tactics to adapt to conditions on the ground was key in supporting speedy responses to fluid situations during the COVID-19 pandemic. This ensured that iDE both achieved intended milestones on ODF villages and supported the government to respond to COVID-19.

INTRODUCTION

iDE's SMSU3 program is the harmonized combination of multiple donor-funded programs: 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 (WfW) Fund, and the Cambodia Rural Sanitation Development Impact Bond 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. From July 2018 until December 2022, SMSU3 was active in rural communities in six Cambodian provinces: Kampong Thom, Kandal, Oddar Meanchey, Prey Veng, Siem Reap, and Svay Rieng. As of January 2023, iDE will scale down until the end of SMSU3 in June 2023. Moving forward, iDE will continue its sanitation marketing efforts with a strong focus on low-coverage, climate-vulnerable, flood-prone environments across four provinces—Siem Reap, Kampong Chhnang, Pursat, and Kampong Thom. iDE will also continue its efforts to improve SMS access and to achieve ODF status by targeting the most vulnerable, marginalized populations who are still without a toilet.

This report summarizes methods and findings from iDE's monitoring, evaluation and learning efforts throughout SMSU3, during the period July 2018 to November 2022. 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 will also be used to shape and influence the SMSU3 program through its conclusion in June 2023. Additionally, they will inform operations for the WfW-funded Climate Resilient WASH Scale Up Program (CR-WASH-SUP)—a costed extension of SMSU3, active January 2023 through December 2024. While the SMSU program did receive some funding from DFAT for the sale of ceramic water filters through Hydrologic, a social enterprise launched by iDE, this report will focus exclusively on our core program work in sanitation.

We organize our principal findings into a narrative that follows the course of the SMSU program. We first look at changes in sanitation coverage overtime and how SMSU has contributed to that improvement through exploring sales trends and examining customer behaviors and perceptions around purchase, installation, and satisfaction. We discuss the lessons we are learning about leveraging funding for sanitation from households and the public sector, pushing toward ODF status, ensuring access to SMS, and challenges identified through research with FSM in rural Cambodia. From there, we examine what these results mean for key program stakeholders. First, we assess the sustainability of LBOs, whose ability to continue functioning in the future will contribute to market resilience after SMSU. Second, we look at the GEDSI-related impacts of the program through analyses of intrahousehold latrine use, impacts of capacity building among women entrepreneurs and local authorities, and results of the piloted implementation of the WASH-GEM. Finally, we provide key learnings from our work in climate vulnerable areas, including research on the impacts of climate change on sanitation, iDE's technical solutions for high groundwater and high soil density areas, and research on the viability of climate targeted subsidies. iDE will continue to apply these learnings in CR-WASH-SUP to address climate risks and improve the health, gender equality and well-being of Cambodian communities through inclusive, sustainable systems that increase access to WASH services. The report ends with an annex of a brief discussion of our methods for data collection and analysis.

SANITATION COVERAGE

Key Findings:

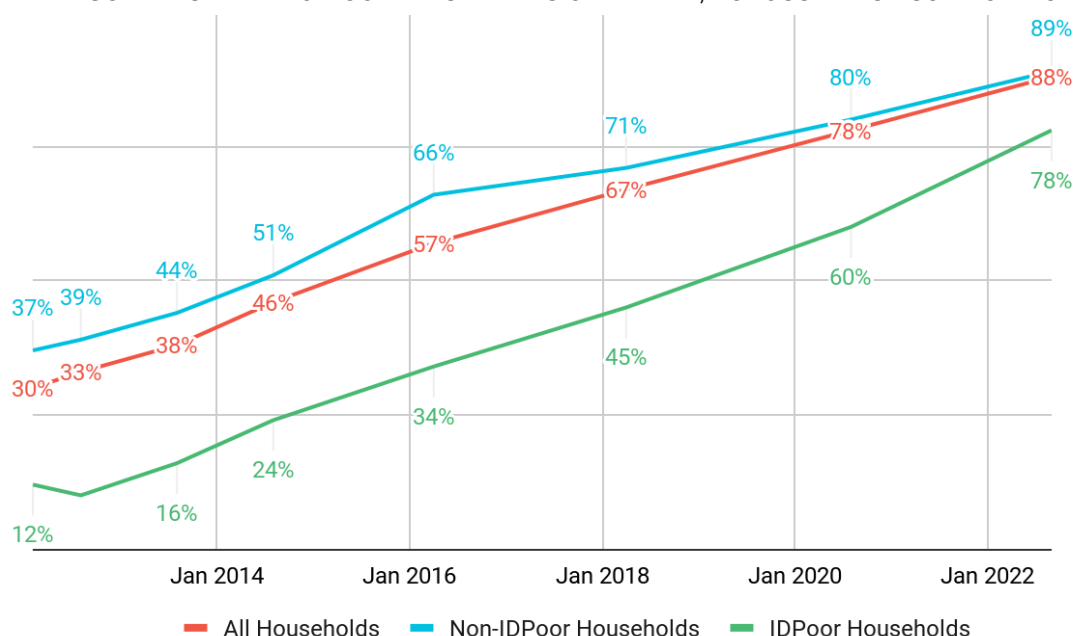
- Sanitation coverage rates have reached 88% in SMSU3 provinces, an increase of 21% since the beginning of the program (2018).
- Coverage for IDPoor households has increased at a higher rate, 33%, over the course of SMSU3, indicating that the program and the sector more broadly are making progress to ensure that sanitation gains are equitable and leaving no one behind.
- 71% of non-latrline owners report sharing a latrine, an increase from 23% at the beginning of SMSU3. As sanitation coverage increases, latrine sharing rates are more noticeable amongst the remaining non-latrline owners, representing a “halfway” stage between open defecation and latrine ownership.
- Latrine abandonment rates have remained very low (at 0.1% of the total population across the SMSU3 provinces) indicating sustainable sanitation access.

SMSU MILESTONES

Since 2012 iDE has conducted eight comprehensive household surveys to estimate latrine coverage rates in the six program provinces. The most recent latrine count was completed in November 2022. The coverage rates presented here describe installed, wet latrines (improved, pour-flush latrines). Wet latrines represent the vast majority of latrines installed across Cambodia and are largely preferred by households compared to dry latrines.

Figure 1 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 in 2014. We see a positive linear growth of improved latrine coverage over this time among both IDPoor and non-poor latrine owners. Notably, latrine ownership among IDPoor households has increased at a faster rate than for non-poor households since 2016. Between 2018 and 2022, coverage among non-poor households increased by 18% whereas coverage for IDPoor households increased by 33%. This is likely, in part, due to iDE’s use of partial, targeted subsidies for IDPoor households between 2019-2021. IDPoor households are gradually closing the gap in sanitation and the sector is making progress to ensure that the most vulnerable are not being left behind.

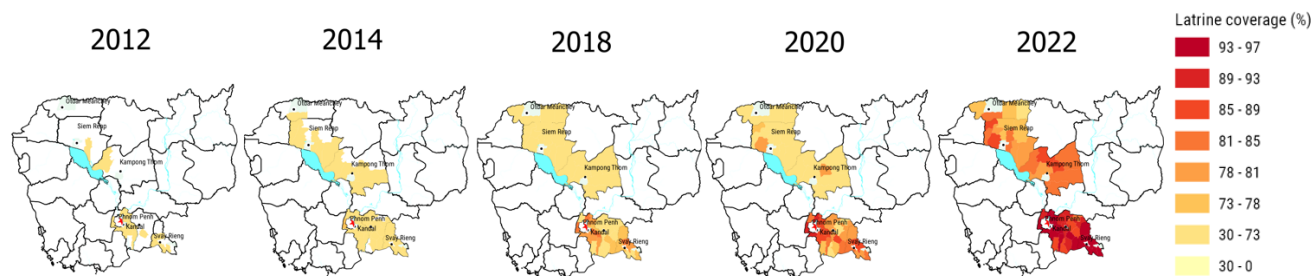
FIGURE 1: SANITATION COVERAGE RATES OVER TIME, ACROSS ALL SMSU PROVINCES



COVERAGE BY PROVINCE

SMSU has contributed 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 2 shows a map of latrine coverage rates by province over time, demonstrating broad progress over the course of the SMSU program.

FIGURE 2: INCREASE IN PROVINCIAL SANITATION COVERAGE SINCE 2012



Figures 3 and 4 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 in SMSU3, as noted by the error bars. Svay Reing now has the highest coverage (94%) of the 6 provinces, which was previously Kandal. Oddar Meanchey and Prey Veng provinces saw the greatest improvement since the mid-term SMSU3, increasing coverage by 12%. Kandal provinces saw the lowest gains with only 8% increases. However, this is likely because they had the highest rate of coverage at the midterm of SMSU3 at 85%, while the rest of the program provinces had coverage rates below 83%. Smaller gains in Kandal and Svay Reing provinces reflect 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.

FIGURE 3: LATRINE COVERAGE PROGRESS, BY PROVINCE

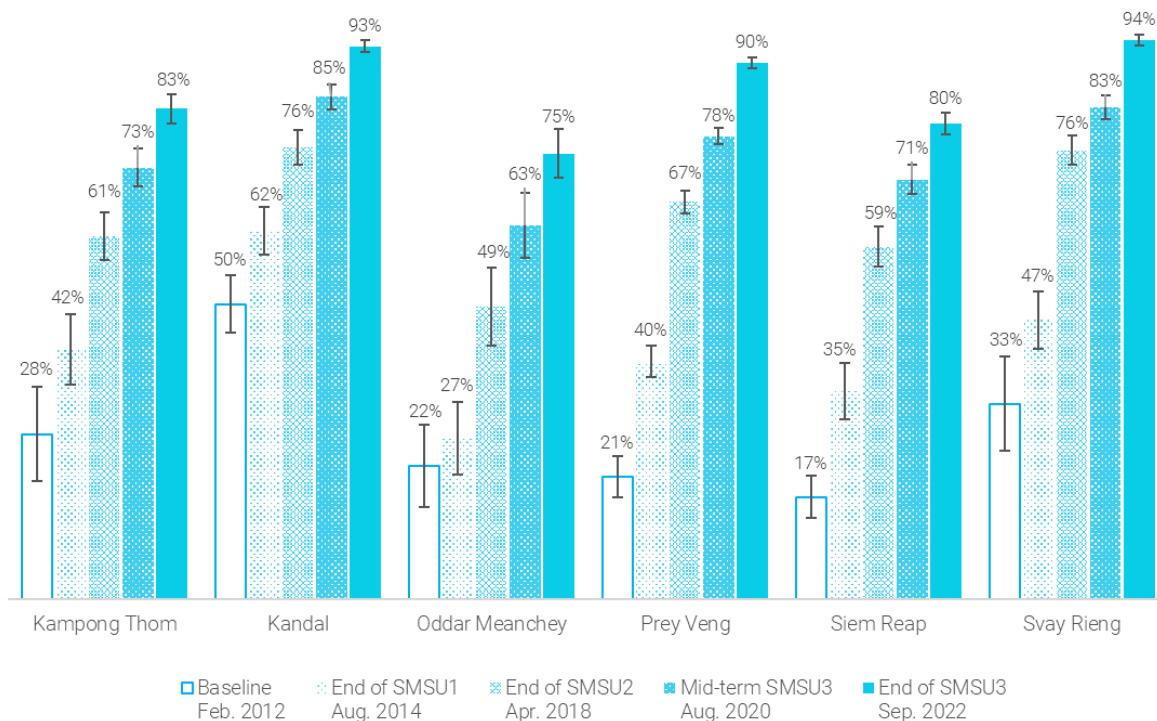
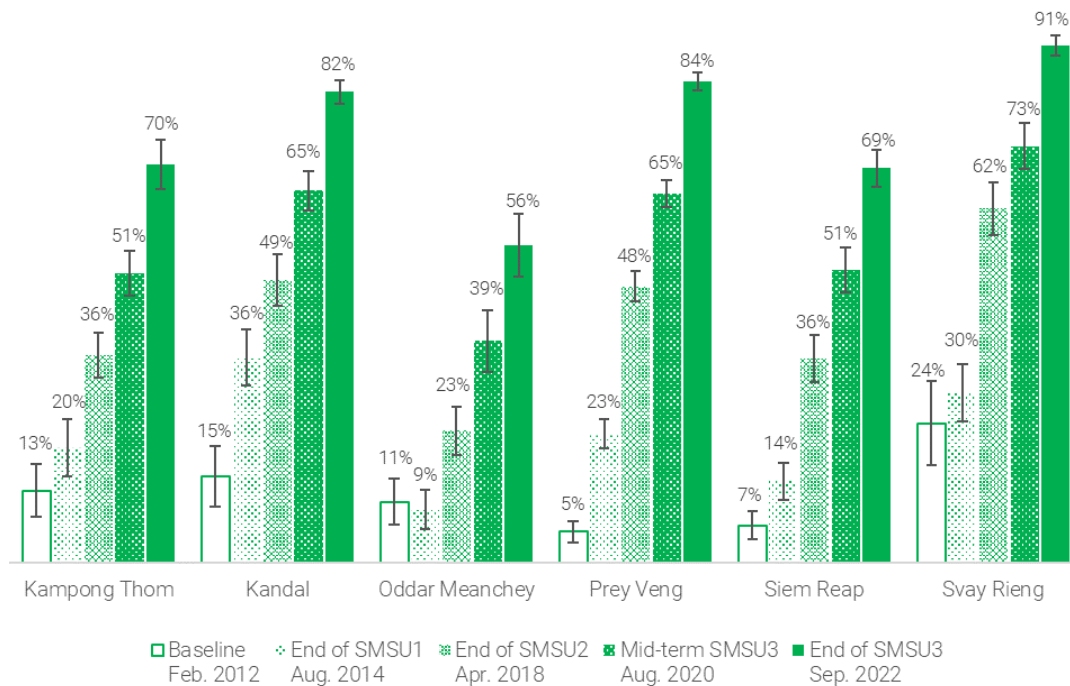


FIGURE 4: IDPOOR LATRINE COVERAGE PROGRESS, BY PROVINCE



Note: Error bars represent the 95% confidence interval for each coverage rate estimate.

HOUSEHOLDS THAT DO NOT OWN LATRINES

Table 1 presents the proportion of households who report sharing or abandoning a latrine.

Among households that do not own a latrine, the percentage of those who report sharing a latrine with another household has increased from 36% in 2020 to 71% in 2022. The increase in the non-latrine owning population that share a latrine is promising, representing a “halfway” stage between open defecation and latrine ownership and is an important step in efforts towards ODF communities. However, efforts should continue to be made to encourage these sharing households to purchase their own 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 88%. Within this general area, as noted above, 71% 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 ODF status in Cambodia, 90% of non-latrine owners report sharing a latrine. The 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.

Latrine abandonment refers to households who have not used their latrine for at least 12 months. Throughout the program, latrine abandonment rates have remained very low, and are currently at 0.1% of the total population across the SMSU provinces, indicating sustainable sanitation access. In the latrine count, households with abandoned latrines are grouped with non-latrine owners.

TABLE 1: PROPORTION OF HOUSEHOLDS SHARING OR ABANDONING A LATRINE

	% of Non-latrine owners				% of Population			
	End of SMSU1	End of SMSU2	Mid-term SMSU3	End of SMSU3	End of SMSU1	End of SMSU2	Mid-term SMSU3	End of SMSU3
Sharing	8%	23%	36%	71%	4%	8%	8%	9%
Abandonment	0.5%	0.7%	1.2%	1.0%	0.2%	0.2%	0.3%	0.1%

SALES, INSTALLATION & SATISFACTION

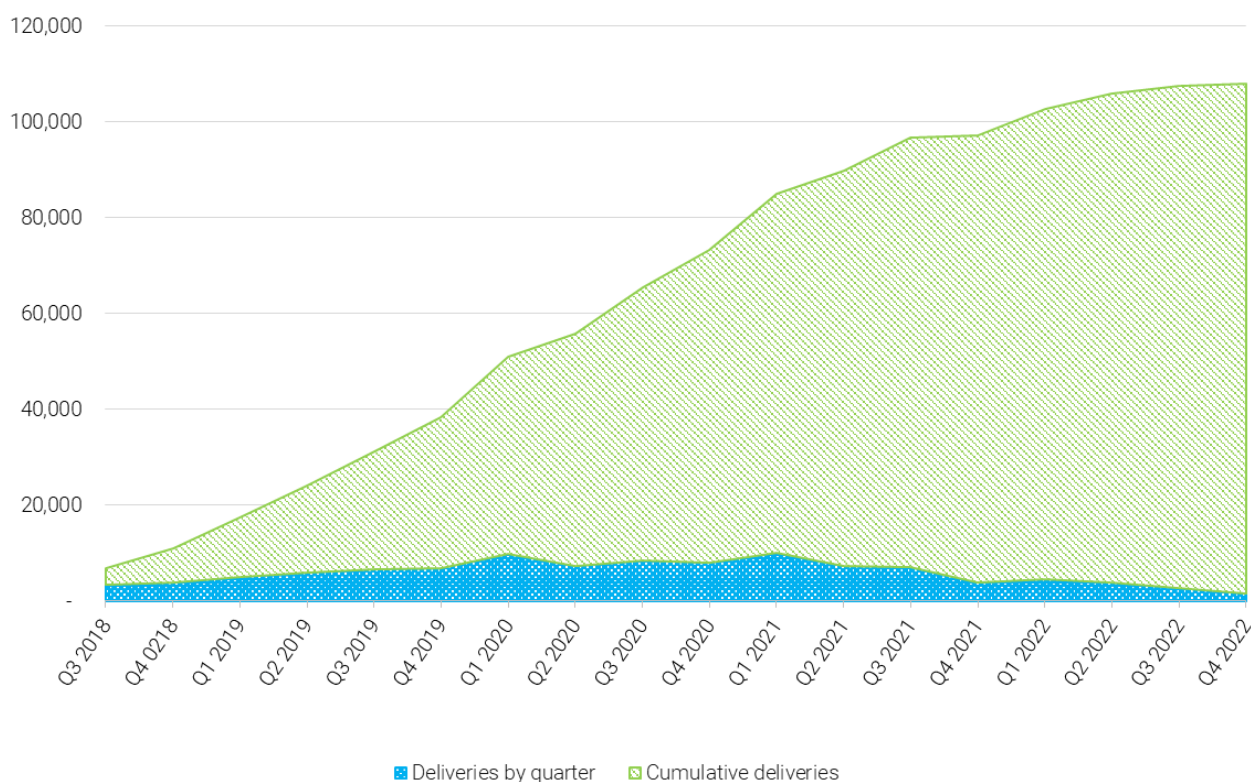
Key Findings:

- iDE conducted door-to-door sales to households during SMSU3 reaching approximately 878,264 rural households with WASH behavior change messaging and generating a total of 140,749 WASH product deliveries in rural areas.
- SMSU3 has introduced to the market seven affordable and contextualized WASH products sold at scale including a number of toilet shelter options, an on-site FSM upgrade product, and SCE technology. Through these WASH products, LBOs have achieved a total net revenue of \$9.8 million.
- In a mature market where sanitation coverage has reached over 70%, subsidies targeting the lowest income households accelerated progress towards “leaving no one behind” and ODF. LBOs sold 106,383 latrines during SMSU3, 38,941 of which have been purchased at a partial discount by poor households.

SMSU3 SALES

In total since 2009, the SMSU program has sold and delivered 407,564 sanitary latrines, reaching approximately 2 million rural Cambodians. This equates to 12.6% of the entire Cambodian population and 20.8% of the rural population³, despite the fact that the SMSU program only operates in six of the country's 24 provinces. In SMSU3 program-connected LBOs and sales agents have sold a total of 106,383 latrines. Figure 5 presents the quarterly and cumulative sales numbers achieved under SMSU3.

FIGURE 5: CUMULATIVE AND QUARTERLY PROGRAM-CONNECTED LATRINE SALES



³ Calculated assuming an average household size of 4.8 people and population from the most recent Cambodian general census (2019).

In 2019, sales increased at a gradual, relatively linear rate. This is highly atypical. In SMSU's experience, sales performance is seasonal and fluctuates with the rainy and dry seasons, 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 five 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. Sales followed the expected seasonal trends in 2021 although decreased throughout the year, in part due to the ending of the subsidy program. There was a small seasonal peak in the first quarter of 2022, although sales gradually declined as the program scaled down.

DIVERSIFYING PRODUCT OFFERINGS

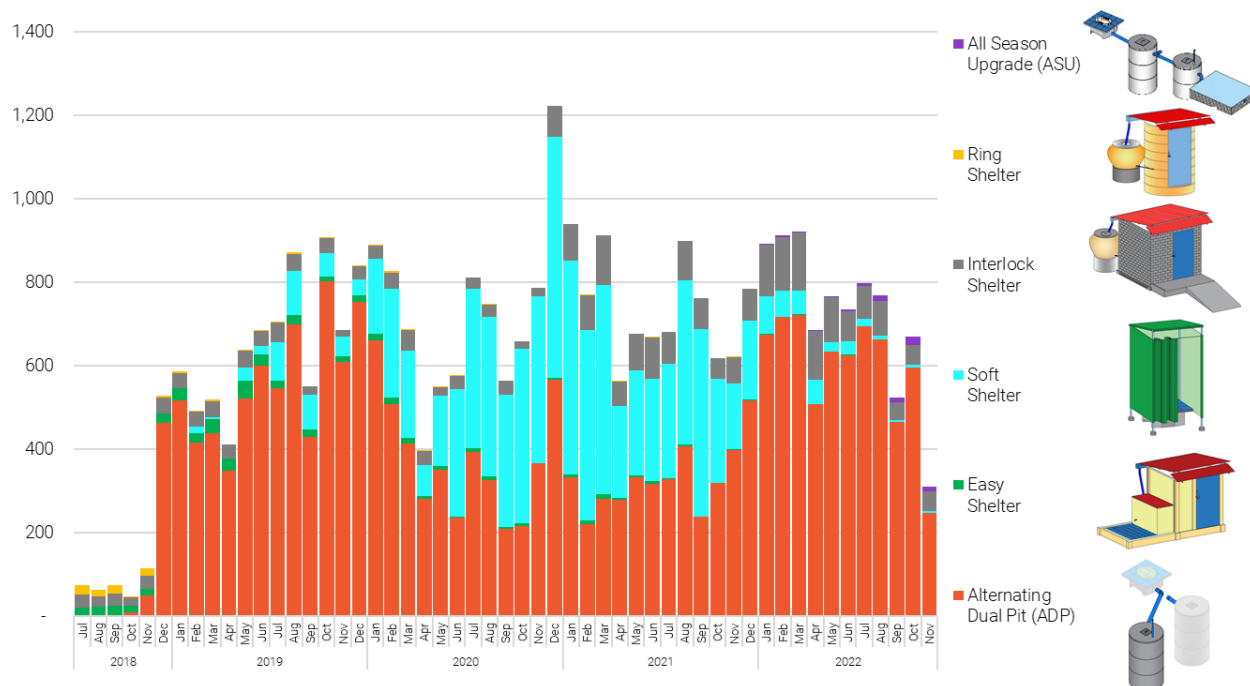
Previous phases of SMSU focused on the sale of Easy Latrines. In SMSU3, we have concentrated on scaling up the sale of sanitation products in addition to the Easy Latrine (Table 2). For example, since the start of SMSU3, iDE connected enterprises have sold over 22,227 ADP upgrades, which allow households to safely manage FS through on-site settling, and 79 ASUs, which are designed for SCE.

TABLE 2: PRODUCTS DELIVERED, LBO TOTAL NET REVENUE & AVERAGE PRICE IN SMSU3, BY PRODUCT

	Quantity	LBO Total Net Revenue	Average Price per Unit
Easy Latrine	106,383	\$7,065,188	\$66
ADP	22,227	\$1,135,399	\$51
Soft Shelter	8,418	\$116,273	\$38
Interlock Shelter	2,956	\$1,199,325	\$379
Easy Shelter	560	\$256,996	\$459
Ring Shelter	126	\$24,639	\$196
All Season Upgrade	79	\$6,590	\$83
Total	140,749	\$9,804,410	–

We have also pivoted to offer a greater range of latrine shelters. 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 6 below, between 2020-2021, we saw a significant increase in purchasing of Soft Shelters, the most affordable shelter option in our sanitation shelter product mix, due to targeted subsidies. Soft shelter sales significantly decrease in 2022, reflecting the end of the targeted subsidy program. By the end of November 2022 iDE had sold 8,418 Soft Shelters, over 7,390 of which were sold to IDPoor households with the support of a targeted subsidy. iDE has also sold 3,642 permanent latrine shelters, 607 of which have been installed with accessibility features for households with members living with a disability. According to our customer survey, 1.3% of our households have one member with a permanent disability (0.57% women with disabilities and 0.75% men with disabilities).

FIGURE 6: MONTHLY SALES OF NON-LATRINE SANITATION PRODUCTS IN SMSU3

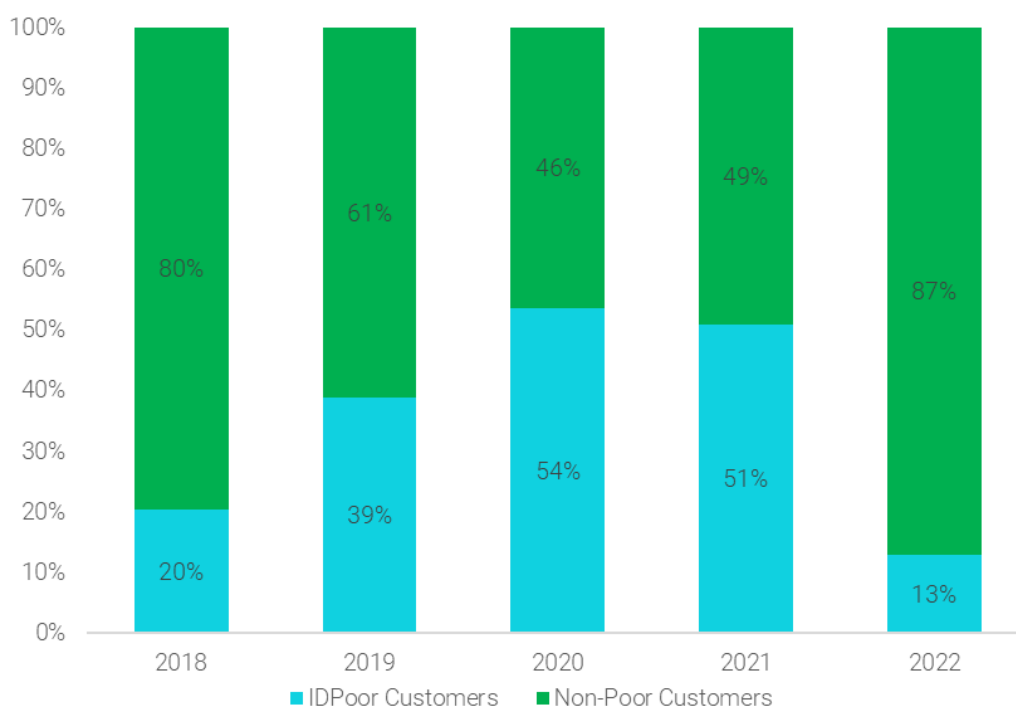


SALES TO POOR HOUSEHOLDS

The Cambodian government estimates that the IDPoor population in iDE operating areas is 13% of the total population. In SMSU3, iDE sold 45,228 Easy Latrines to IDPoor customers (classified either IDPoor1 or IDPoor2) which equates to 43% of all latrine sales. iDE has therefore successfully reached a significant proportion of the IDPoor market. The reach of IDPoor households in SMSU1 (22%) and SMSU2 (20%) proves that a sanitation market is able to reach a significant proportion of the lowest income households without financial mechanisms such as targeted subsidies. However, the large increase in proportion of IDPoor sales in SMSU3 is mostly attributable to iDE's distribution-at-scale of targeted subsidies to IDPoor households.

At the beginning of SMSU3, 20% of customers were IDPoor. As Figure 7 shows, the percentage of IDPoor customers started to increase once targeted subsidies were introduced at the beginning of 2019. It peaked in 2020 at 54% when the targeted subsidies were eligible at scale to all IDPoor households across five rural provinces. After the targeted subsidies program ended in 2021, only 13% of sales were to IDPoor customers. 38,941 households were reached using targeted subsidies contributing to the accelerated increase of sanitation coverage across iDE's program areas to 88% in 2022 (see [Sanitation Coverage](#) section). Only 13% of sales reached IDPoor in 2022 as the market became more saturated for Easy Latrines and especially for IDPoor households since subsidies targeted that population.

FIGURE 7: IDPOOR CUSTOMERS AS A PERCENTAGE OF ANNUAL EASY LATRINE CUSTOMERS IN SMSU3



Note: Targeted subsidies began in Jan 2019, was scaled up to five provinces by 2020, and ended in Sep 2021

TARGETED SUBSIDIES

Following the Cambodian national guiding principles on hardware subsidies for rural household sanitation⁴ which iDE supported in drafting, to avoid market distortion, sanitation subsidies should only be introduced once the commune basic sanitation coverage has reached at least 60%. By first ensuring that there is both demand and supply available, the subsidies can then be used more effectively to increase IDPoor household motivation and financial ability to purchase a latrine. Between 2019 and 2021, iDE scaled its target subsidy mechanism to five provinces as they each reached 70% sanitation coverage at the provincial level. Also, to continue building ownership and sustainability of sanitation products, households receiving iDE's targeted subsidies had to invest at least 60% of the product cost themselves. Figure 8 shows cumulative purchases facilitated by 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. Between 2019 and 2021, iDE provided targeted subsidies exclusively to IDPoor households to reduce the price of latrines and temporary latrine shelters⁵. In total, iDE has facilitated the purchase of 38,941 partially-subsidized latrines and 7,387 temporary "Soft Shelter" products by IDPoor families.

Early 2021, Svay Rieng reached a sanitation coverage of ~85%. To further accelerate Svay Rieng's goal to become the first ever ODF province in Cambodia and reach the remaining laggards and poorest households, for three months (Jan-Mar 2021) iDE doubled its discount subsidy rate. This decreased the amount which IDPoor households needed to invest in Easy Latrines to 20% of the product cost. During this time, 1,259 households purchased toilets at this double subsidy rate. In April 2022, the government celebrated Svay Rieng as the first ever

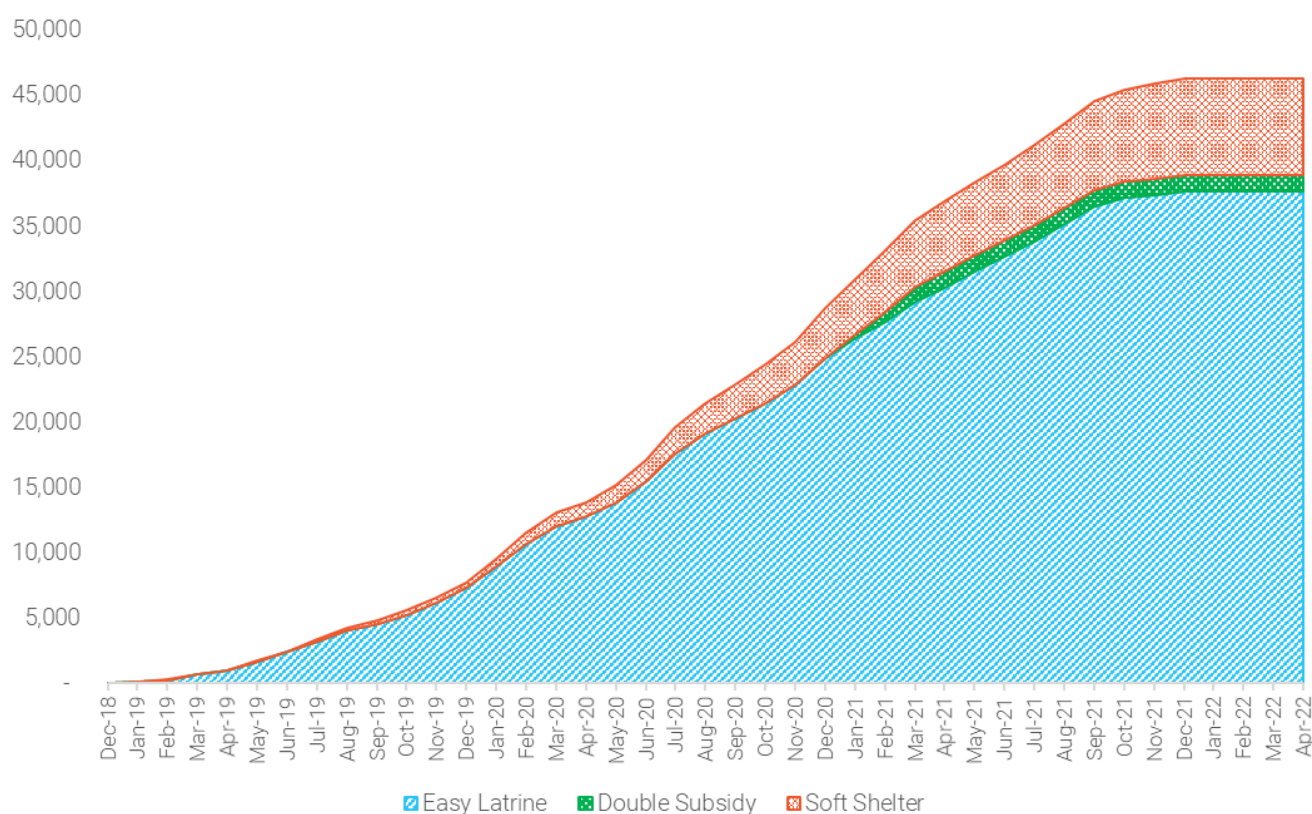
⁴ [Cambodian National Guiding Principles on Hardware Subsidies for Rural Household Sanitation](#)

⁵ iDE, 2020. [Tactic Report: Reaching the poorest with sanitation through targeted subsidies](#)

province in Cambodia to declare ODF status. During the event, iDE's PPP activities and targeted subsidy intervention were officially recognised as key tools to accelerate Svay Rieng towards ODF ahead of other rural areas in Cambodia.

When introduced at the right time to avoid market distortion, targeted subsidies have been a successful financial mechanism to accelerate market reach of low income households and progress towards “leaving no one behind”. In addition to implementation timing, another key limitation to the targeted subsidy intervention in Cambodia is that it is based on the government's IDPoor poverty assessment system which may not reach the most vulnerable populations including landless, migrants, ethnic minority who are also more likely to reside in challenging environments such as flood-prone areas. iDE conducted research to develop a new targeted subsidy assessment that would account for climate vulnerability in addition to poverty (please see the [Climate Targeted Subsidies](#) section below).

FIGURE 8: PRODUCT PURCHASES FACILITATED BY TARGETED SUBSIDIES



PAYMENT INSTALLMENT PLAN

There are many households who are not registered as IDPoor, and are therefore ineligible for targeted subsidies, but still face significant financial barriers to purchasing latrines. One means for reducing the burden of payments for such households has been through payment installment plans. iDE has trained LBOs to offer simple payment installment plans with no interest paid by the customer. 2,771 households have now purchased latrines using this mechanism with a 98.7% 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.

MOTIVATION FOR PURCHASE

Investigating reasons behind purchasing enables iDE to better understand household decision making dynamics and agency, which helps the program assess if it is meeting the needs of all of the members of households who buy sanitation products. Figure 9 shows who was the most outspoken in wanting to buy a product and who was responsible for financing.

Women were more vocal in wanting to purchase latrines and ADPs. Nearly 40% of customers said it was the wife being the most outspoken compared to only 11% of husbands; although, 45-47% said it was a joint decision. Overall, a majority of households had a woman involved in the decision to purchase a sanitation product (87% for latrines, 86% for ADPs) and a majority had a woman involved in the financing (82% for latrines, 86% for ADPs). 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 9: LATRINE AND ADP PURCHASE AND FINANCING DECISIONS

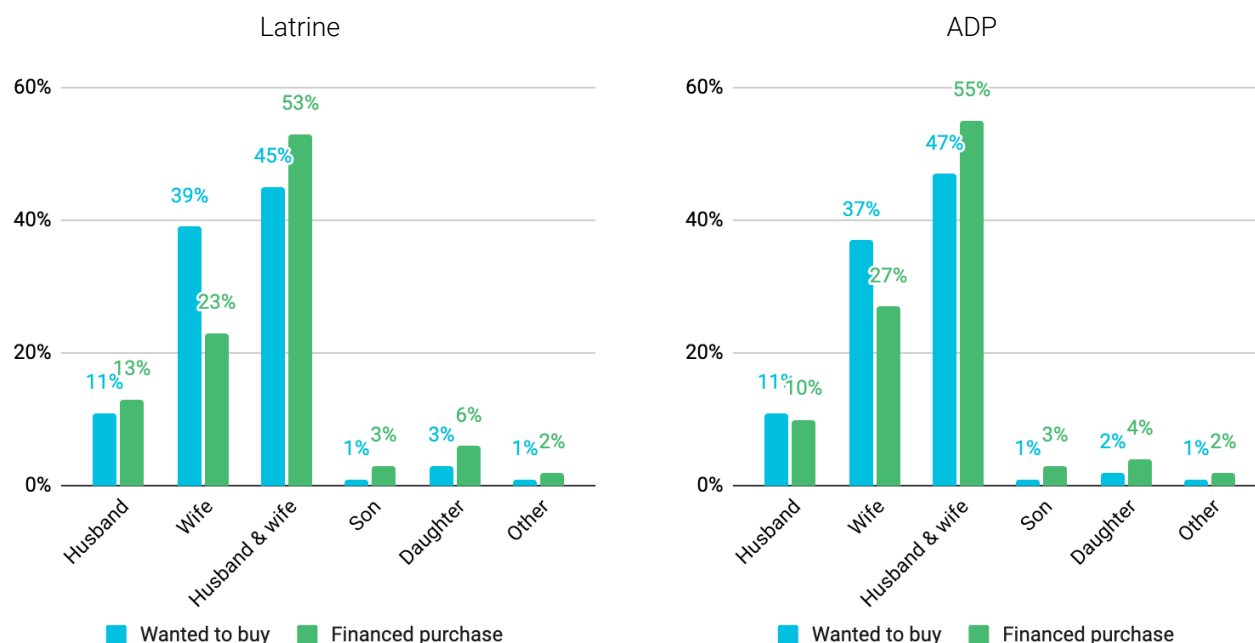


Table 3 shows the reasons a household wanted to buy the latrine or ADP. They could select more than one option so percentages total up to more than 100%. 85% of customers listed convenience and 44% cited security as a reason to purchase their latrine. For the ADP, a majority of customers (54%) purchased the product due to their old pit filling up or clogging, followed closely by convenience (44%). Only a small portion of customers (14% for the latrine and 7% for the ADP) listed peer or community pressure as a reason for buying their latrine. 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 3: REASONS TO PURCHASE LATRINE OR ADP

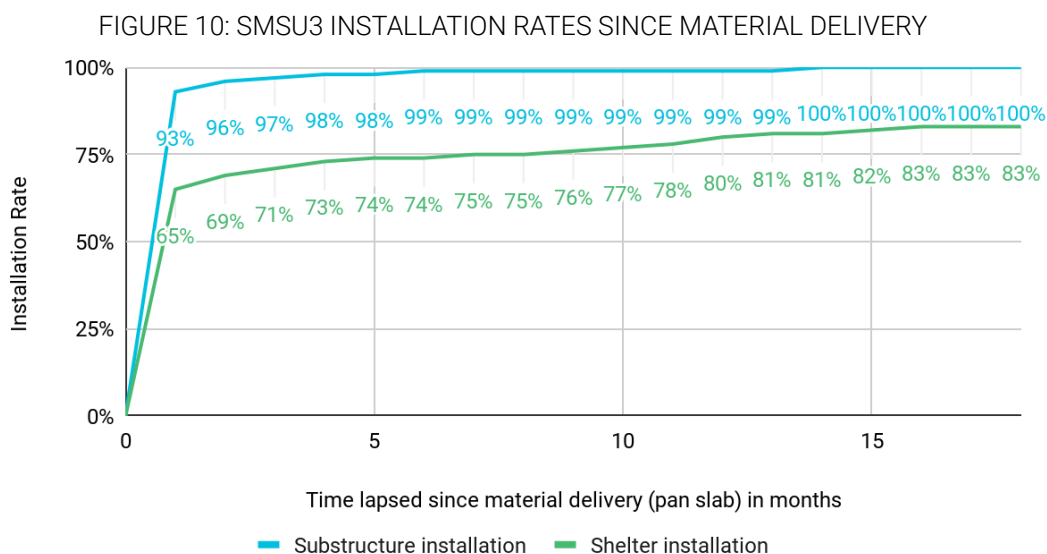
	Latrine	ADP
Convenience	85%	44%
Old pit filled up/clogged	—	54%

Security	44%	15%
Health reasons	39%	21%
Privacy	30%	9%
Social Status	17%	1%
Peer / Community Pressure	14%	7%
Future savings	1%	5%
Use of waste for agriculture	–	1%
Other	4%	3%

INSTALLATION

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 program itself. As such, iDE continually strives to reduce the “installation lag” of both underground latrine components and superstructures.

Figure 10 shows the shelter and below-ground installation rates. The sampling method includes customers who have purchased their latrine 12-18 months ago (instead of 6-12 months as was done previously) in order to capture the lag we see in shelter installation. Within the first month of ownership, 93% of Easy Latrines are installed. 83% of customers have a shelter installed 12-18 months after latrine purchase. 100% have the below-ground or substructure installed. Shelters are being installed more quickly—in SMSU3, 80% of customers have their shelters installed within 6-12 months compared to 63% of customers at the end of SMSU2.



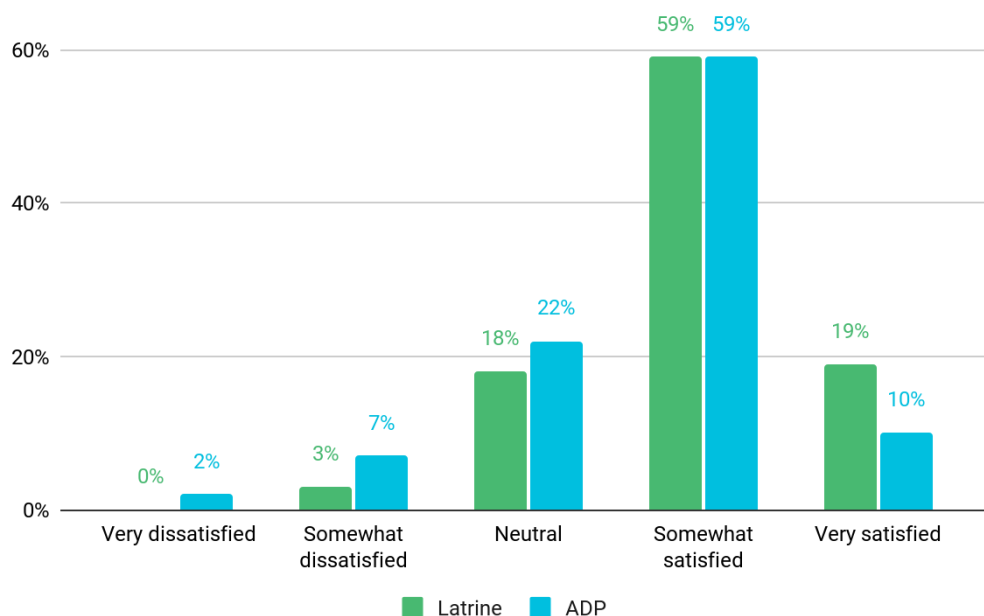
We also analyze below-ground installation rates by IDPoor classification to check for income marginalization and ensure there are no biases in installation for IDPoor households. All households have similar installation rates⁶ for both shelters (82% non-poor, 87% IDPoor 1, and 83% IDPoor 2) and below-ground structures (100% non-poor and IDPoor 1 and 99% IDPoor 2), indicating no bias against the poor.

⁶ Installation rate refers to installation within at least 12 to 18 months.

SATISFACTION

Through the customer survey, customers reported their satisfaction with the Easy Latrine and ADP products and the service provided by the LBO. We see in Figure 11 that 78% of customers are somewhat or very satisfied with their latrine, though only 19% of those customers report being very satisfied, and 69% of customers are somewhat or very satisfied with their ADP, though only 10% of those customers report being very satisfied.

FIGURE 11: SMSU3 SATISFACTION RATES WITH LATRINE AND ADP PRODUCTS



To better understand what could be leading to dissatisfaction, customers were asked about the primary issues they had with their products. 88% of customers did not experience any challenges with their Easy Latrine product. We see in Table 4 that the most commonly reported issues are related to Easy Latrines not properly flushing and smell. These can be a product of poor latrine pan quality, improper installation, a full latrine pit, or environmental challenges including high groundwater or flooding. Challenges associated with the ADP are more complex and are discussed in the [Addressing FSM with ADP](#) section below.

TABLE 4: SMSU3 EASY LATRINE CHALLENGES EXPERIENCED BY CUSTOMERS

Challenge	Percent of customers
Does not flush	5%
Smells	4%
Pit is full	3%
Flooding	1%
Lack of water to flush	1%
Requires lots of water to flush	1%
Other	1%

Table 5 presents the intentions of customers to upgrade or change their latrine. 84% said they would build a new shelter or upgrade their existing shelter. Note that only 23% 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. However, since the midterm report⁷, this number has grown from 9 to 23%, indicating that FSM may be a growing priority for customers.

TABLE 5: INTENTIONS FOR LATRINE UPGRADES IN NEXT 3 YEARS

Upgrade	Percent of customers
Build new or upgrade shelter	84%
Build a water reservoir	47%
Build a space to shower	41%
Install a second pit	23%
Other	10%
Install a basin to wash hands	9%
Connect to piped water	3%

NON-PROGRAM-CONNECTED LATRINE SALES

The non-program 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 non-connected sales versus iDE-connected sales (ratio = # non-iDE sales / # iDE 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 6 we see that the non-program-connected ratio for SMSU3 is 2.9 compared to 0.8 at the end of SMSU2. This ratio means that for every SMSU Easy Latrine sold there are approximately three non-iDE connected latrines sold in the target area. Kandal is the province with the highest ratio of non-program-connected to program connected sales. That is, for roughly every one SMSU latrine sold in Kandal, approximately 7.5 other latrines are sold. Kampong Thom has the lowest ratio at 1.3. Notably, all provinces have a ratio greater than one. iDE program-connected sales did not account for the majority of new latrines, indicating a mature and actor-diverse market.

TABLE 6: NON-PROGRAM-CONNECTED RATIO COMPARISON

	SMSU1	SMSU2	SMSU3
Kampong Thom	0.2	0.0	1.3
Kandal	5.0	2.9	7.5
Oddar Meanchey	0.4	0.2	3.1
Prey Veng	1.0	1.4	4.9
Siem Reap	1.5	0.4	1.6
Svay Rieng	0.6	0.7	2.0
All provinces	1.1	0.8	2.9

⁷ iDE, 2021. [SMSU3 Mid-term Assessment, July 2018 to December 2020](#)

SECTOR FINANCING

Key Findings:

- Through iDE-facilitated sales, households have directly invested \$8.7 million in WASH products throughout SMSU3. SMSU3 invested a total of \$1.05 million in targeted subsidies supporting 40,200 low income households without a toilet by covering in part the cost of latrines and shelters.
- The world's first development impact bond in the WASH sector not only mobilized private and public funding for sanitation, but also proved that flexible funding arrangements with aligned partners result in resilient programs.
- iDE has built the capacity of sub-national governments to locally subsidize latrines for poor households. Since 2020, in areas where the PPP team was active, local governments have supported in allocating nearly \$19,000 towards sanitation subsidies which have enabled 428 households to purchase toilets.
- The overall social return on investment ratio for SMSU3 was 3.3, meaning that for every dollar spent in grant funding, \$3.30 was gained by a latrine purchasing household through income savings and improved productivity.

There are three funding sources for the WASH sector, known as the 3Ts: taxes, tariffs and transfers. In the SMSU3, transfers are the non-repayable financial resources injected into the program from donors. Taxes are allocations from national and local governments towards supporting WASH budgets. Tariffs include user fees to service providers and user expenditures on self-supply; in the case of SMSU, they are the payments made from households to invest in WASH products and services. In this section, we will review each of these three sources and their combined role in achieving sanitation coverage results at scale.

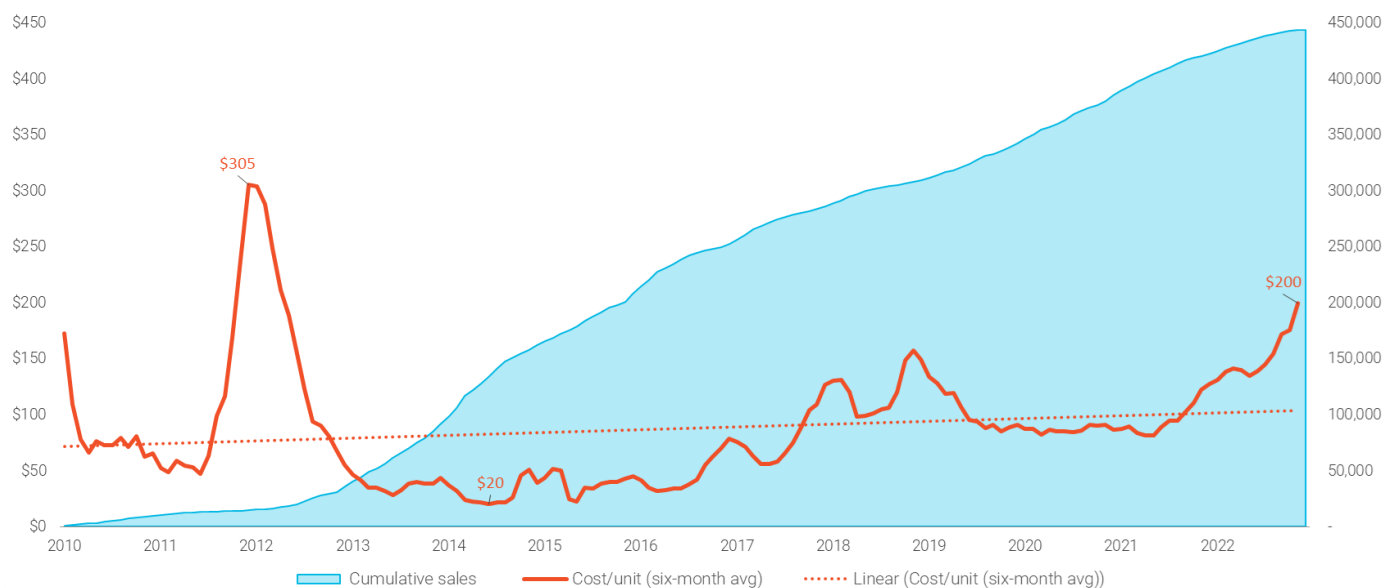
TRANSFERS: ASSESSING PROGRAM COST-EFFECTIVENESS AND VALUING FLEXIBLE FUNDING

Between July 2018 and December 2022, a total of US \$16 million in donor funding was invested into the SMSU3 program to achieve the WASH results detailed above. SMSU3 was designed as a cohesive program, incorporating and harmonizing funding from multiple donors, ensuring streamlined management, clear objectives and unified teams.

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 idea, 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 12 compares cumulative product sales and the dollar amount the program spent in enabling each sale. The figure demonstrates that early investments in key program components like product design, information technology infrastructure, and personnel drove up costs for short periods of time in 2010 and 2011-2012. As program implementation continued, rapidly rising sales and lower program expenditures led to improved cost-effectiveness over the course of SMSU. Notably, we have seen a rise in per-unit program costs since 2016 as the market matures and remaining non-latrine owners become harder to reach and poorer. Between 2019 and 2021, cost-effectiveness stabilized around a per-unit program cost of about \$87 as we deployed new implementation features such as targeted subsidies and increased engagement with local government and other partners. Since 2021, as program expenses remained steady and sales operations declined, we have seen an increase in cost per latrine, up to \$200 per latrine at the end of 2022.

FIGURE 12: SMSU PROGRAM COST-EFFECTIVENESS OVER TIME



As an additional step of financial assessment, iDE also compares the ratio of money spent in terms of grant funding relative to the aggregate increased or saved income generated by participating households, calculated with a three-year rolling average of our impact and scale indicators for each project in each country-program. For July 2018 to December 2022, iDE generated a ratio of \$3.30 earned per household purchasing a latrine product for every US \$1.00 spent. To arrive at an income impact estimate for the households reached, we rely on data from the World Bank's Water and Sanitation Program Economics of Sanitation Initiative⁸ to estimate the average annual net household savings achieved by households that have purchased an improved latrine. This initiative has done detailed analysis of economic impacts in various regions, detailing cost savings, improved productivity and monetized health impact, as well as reductions in diarrheal disease, due to improved sanitation. We use the findings from these studies to model the household-level economic impact of iDE-connected latrine sales. It is important to note, that this ratio does not capture non-income impacts, such as quality of life and improved health outcomes, and as a financial metric only partially reflects the full impact on the project connected households.

SMSU3 stands apart from its predecessor programs by integrating a DIB into its funding structure. In November 2019, the Stone Family Foundation, the U.S. Agency for International Development, and iDE launched the Cambodia Rural Sanitation DIB. The first of its kind in the WASH sector, the DIB combined private and public capital with iDE's on-the-ground implementation expertise to accelerate the Government of Cambodia's efforts to reach universal access to sanitation. The DIB is on track to surpass its four-year objective to achieve 1,600 ODF villages. In addition to crowding-in private finance to de-risk the public sector, the DIB's structure was flexible by design, allowing for greater resilience and adaptation, ultimately leading to greater impact. The ability to quickly adjust implementation tactics to adapt to conditions on the ground was especially key in supporting speedy responses to what were fluid situations at the village, commune, district and provincial level during the COVID-19 pandemic. This ensured that iDE both achieved the intended milestones and supported the government to respond to COVID-19.

⁸ World Bank Water and Sanitation Program, 2012. Economic Assessment of Sanitation Interventions in Cambodia.

USERS: HOUSEHOLD INVESTMENT IN WASH THROUGH iDE-FACILITATED SALES

Donor funding is often perceived to be the predominant share of overall WASH funding in low- and lower-middle-income countries, and household contributions are likely under-reported in national WASH accounts and global estimates⁹. By working through markets, iDE is able to leverage households' investments in WASH. While iDE provides affordable WASH products, throughout SMSU3, households have cumulatively invested over \$8.7 million in WASH infrastructure¹⁰, indicating there is a strong demand for these products. This figure likely under-reports the total investment from households that gain access to sanitation by not including expenditures other than direct payments to LBOs. To support low income households in purchasing toilets, SMSU3 has invested \$1.05 million in targeted subsidies to offset the required user investment. These targeted subsidies have helped to support 38,941 IDPoor households to purchase latrines. The notably low abandonment rates among toilet owners in target provinces—only 0.1%—support the hypothesis that when people invest their own money, they are more likely to maintain positive behavior change.

TAXES: PUBLIC SECTOR FUNDING COMPLEMENTED WITH COMMUNITY FUNDS

iDE's PPP team directly encourages provincial and sub-provincial governments, specifically Commune Committees of Women and Children (CCWCs, local female authorities), to allocate more money towards WASH, to support reaching ODF status. These social funds can be used to help subsidize the purchasing of latrines for poor households, which iDE helps to identify through census surveys. In instances where there is limited funding, iDE has encouraged local governments to host social events and engage with higher income households to raise money for the social fund. Since 2020, in areas where the PPP team is active, local governments have supported in allocating nearly \$19,000 towards sanitation subsidies which have enabled 428 households to purchase toilets. Over \$13,000 has come directly from community donations (donations from higher income households), \$2,500 from local savings groups (fundraising by village leaders), and nearly \$3,000 from Provincial Departments of Rural Development. Additionally, other NGOs have begun to provide subsidies—NGOs have provided over \$25,000 to subsidize 132 latrines in the areas we work.

⁹ WHO & UN-Water, 2021. [Reflecting on TrackFin 2012-2020: key results, lessons learned and the way forward](#)

¹⁰ This value is calculated by subtracting the value of subsidies provided to IDPoor households from LBOs' total net revenue.

LATRINE BUSINESS SUSTAINABILITY

Key Findings:

- We saw improvements in the percentage of LBOs who demonstrated positive sustainability dimensions ('Quick-Look' sustainability metrics) for all dimensions between 2020 and 2022. While no LBOs met all five sustainability criteria, nearly half (49%) met at least three.
- At the end of the project, 19% of LBOs (n=11) believe they would be able to sell WASH products at the same rate as they are now, and 74% (n=43) believe they could still sell WASH products, but the volume would be much lower. 93% of all business owners reported confidence in continuing to engage in the sanitation market after iDE's exit.
- 91% of all LBOs have a plan for adapting their business when SMSU3 is over, with only 2 LBOs claiming they have not thought at all about this transition.
- LBOs offering a diversity of products in addition to the Easy Latrine, including ADPs, Soft Shelters, Ring Shelters, Easy Shelters and Interlock Shelters, are more profitable overall.

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 LBOs, as the ability 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, and business capacity.

An LBO that is offering a range of products 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 has reached 88% coverage of pour flush latrines in SMSU3 areas. 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 from two iterations of an LBO Sustainability Survey. The first survey was conducted in Q4 2020 and compares with delivery data from July 2018 to November 2020. It was conducted with 69 of 70 active LBOs (as of Q4 2020). The second round of surveys was conducted with all 58 active LBOs as of Q4 2022, covering sales and activities from July 2018 to November 2022. The LBO Sustainability Survey 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 and the same. Over the course of SMSU3, iDE has supported 117 total LBOs, recruited 42 new LBOs, and currently has 58 active LBOs (December 2022). Table 7 shows a snapshot of the highest, mid, and lowest tier performers of LBOs.

TABLE 7: SNAPSHOT OF SMSU3 LBOS

	Monthly volume of Easy Latrines sales (average)	Monthly volume of shelter sales (average)	Monthly revenue (average)
Highest tier performers (Quintile 5)	46.6	7.9	\$4,587
Mid tier performers (Quintile 3)	11.1	0.1	\$865
Lowest tier performers (Quintile 1)	Less than 1 (0.1)	0	\$5
Average	16.6	1.9	\$1,523

DIVERSITY OF PRODUCTS

Through SMSU3 sales, 117 LBOs have achieved a total net revenue of \$9.8 million (see Table 2 in [Diversifying Product Offerings](#) section). Not only are LBOs profiting from the sale of diverse WASH products, they are able to use this revenue to invest in their own businesses to continue providing aspirational and affordable sanitation products and to continue diversifying their offerings.

Throughout SMSU2 and SMSU3, iDE introduced a number of new WASH-related products to LBOs for production and delivery. For sustainability and resilience, it is critical for LBOs to diversify beyond the production and delivery of the Easy Latrine, especially as latrine coverage increases and the remaining customer base is quite small. Many LBOs 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 and approximately how many LBOs are diversified across WASH products.

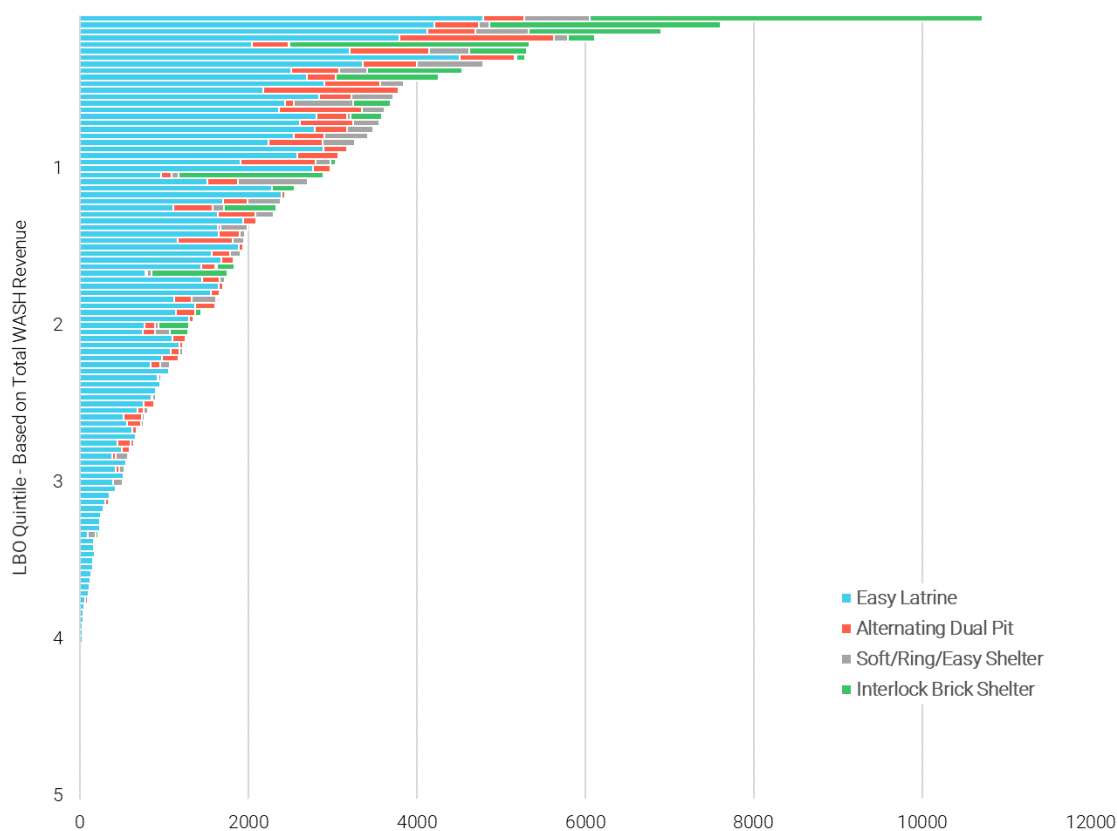
TABLE 8: NUMBER OF LBOS PROVIDING SANITATION PRODUCTS IN SMSU3

Product Category	2018	2019	2020	2021	2022
Easy Latrine	72	68	70	66	58
ADP	13	46	54	53	53
Any Shelter Type	28	42	62	63	55
Interlocking Bricks	4	4	8	12	12
ASU	-	-	-	-	31

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.

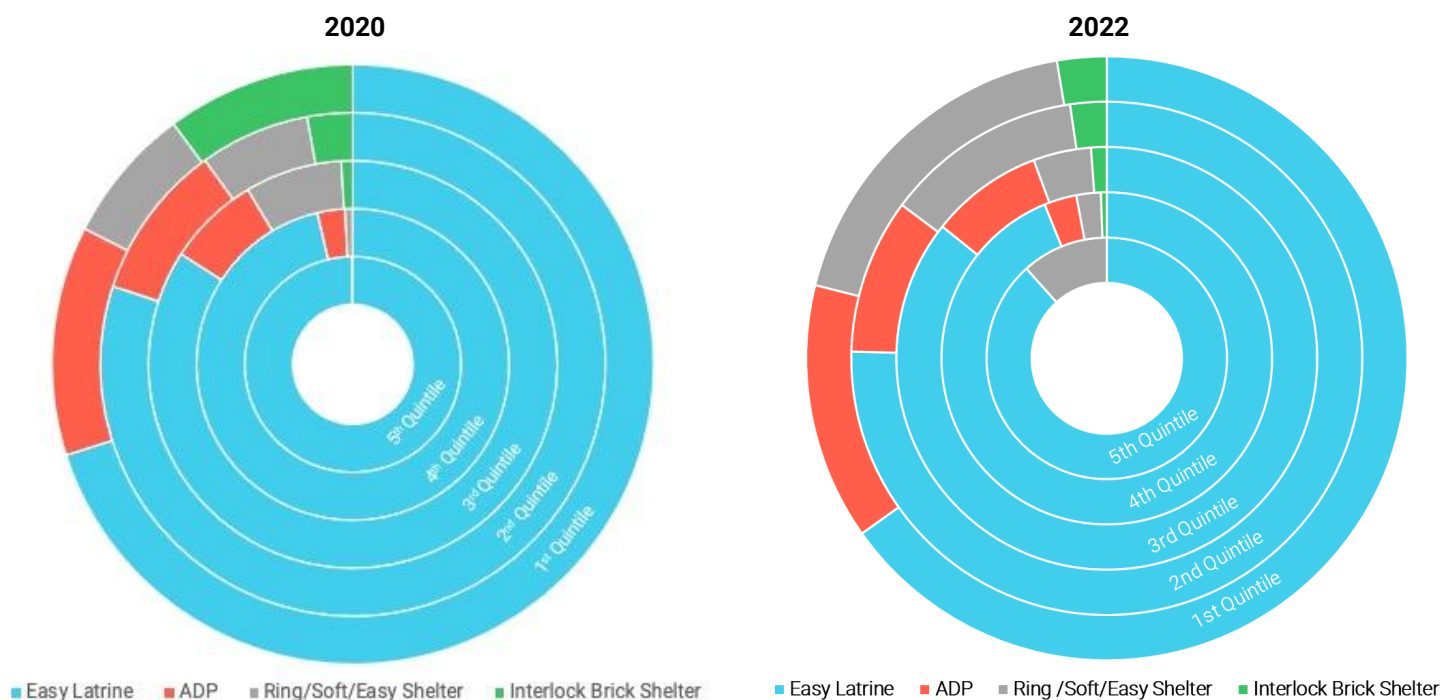
There is a fairly even distribution of ADP revenues and shelter sales across the top performing LBOs, with a few LBOs beginning to see significant growth in the shelter side of their businesses. Furthermore, the distribution of total earnings is largely skewed to the top quintile of LBOs, but LBOs across the top three quintiles are earning revenues from ADP and shelter sales when comparing the full range of LBOs (Figure 13).

FIGURE 13: 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. However, the remaining market for Easy Latrines is limited with currently 88% household coverage of latrines in program areas (see [Sanitation Coverage](#) section). As such, LBOs offering products besides the Easy Latrine, including ADPs, Soft Shelters, Ring Shelters, Easy Shelters and Interlock Shelters, are more profitable overall. As shown in Figure 14, Easy Latrines make up 65% of total monthly revenue for the highest performing LBOs, compared to 86% of monthly revenue for 3rd quintile LBOs and 88% of monthly revenue for the lowest performing LBOs. Of the 58 active LBOs, 34% of them (n=20) are earning at least 30% of their WASH-product monthly revenue from sources other than the Easy Latrine.

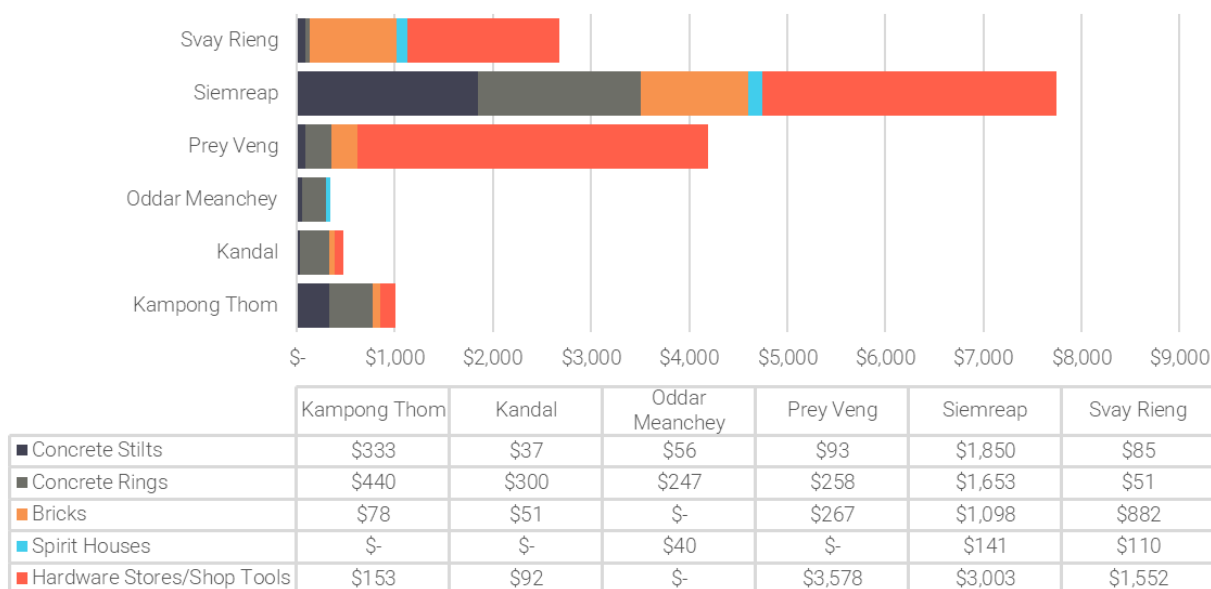
FIGURE 14: PERCENTAGE OF MONTHLY REVENUE, BY LBO QUINTILE AND PRODUCT TYPE



A compelling example of LBOs self-investment in diversifying product offerings can be seen in interlocking brick machines. Interlocking bricks were originally introduced into the program in 2017 through a pilot with one LBO in Siem Reap. Through two learning exchange trips organized by iDE, interest in the technology quickly grew and LBOs both within and outside Siem Reap began investing in the machinery. Not only can interlocking bricks be used to produce customizable, disability-accommodating latrine shelters, they have proven to be highly versatile and we have seen significant demand from customers for use in homebuilding and other construction. Since the pilot, eleven LBOs have invested in \$10,000 interlocking brick machines to grow their businesses. Nine other LBOs currently purchase bricks through business-to-business sales with machinery-owning LBOs, extending their reach and operational sustainability beyond iDE's support.

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. 42 out of 58 active LBOs claimed to have earned at least \$1,000 in the previous 12 months from non-WASH business channels, and 19 out of 58 claimed to have earned at least \$10,000 in the previous 12 months. In Figure 15, below we see the largest non-WASH channel for active LBOs was having a hardware store where they can sell materials and tools, followed closely by the sale of concrete rings and concrete house stilts, both of which involve the same skills necessary to produce concrete 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.

FIGURE 15: ANNUAL REVENUE FROM NON-WASH BUSINESS CHANNELS, BY PROVINCE & PRODUCT



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 the Salesforce order management system, which are verified by iDE order records. We have summarized median WASH product revenues and revenue from non-WASH sources in Table 9 above. Overall we see about 12% of total monthly revenue in the past 12 months 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 cannot verify.

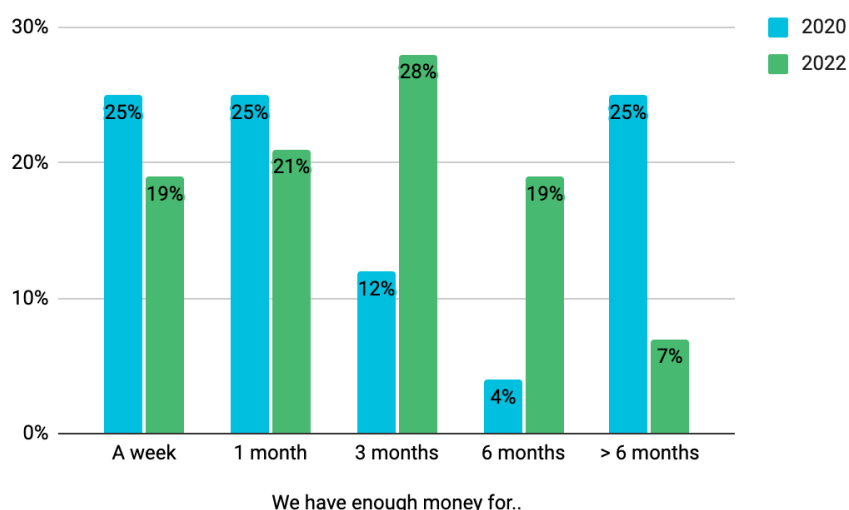
TABLE 9: WASH VS NON-WASH MONTHLY REVENUE OF ACTIVE LBOS IN SMSU3

	Monthly Revenue from non-WASH Channels (self-reported)	Monthly Revenue from WASH product sales (Salesforce)	% of total monthly revenue from non-WASH channels
Median 2020	488	1,074	16%
Median 2022	258	1,812	12%

Overall, LBOs are becoming increasingly more diversified in terms of WASH product offerings. However, only a third (34%) of active LBOs are earning meaningful revenue from products other than the Easy Latrine (greater than 30% revenue from other products). 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 perceptions of businesses' financial stability, each active LBO was asked about how long they have enough money on hand to operate. As opposed to an even split across all categories observed in 2020, we find LBOs are relatively evenly split between having enough for one week, one month, and six months, while the plurality of LBOs had enough for 3 month and the lowest proportion had longer than six months (Figure 16).

FIGURE 16: LBOS' PERCEPTIONS OF FINANCIAL STABILITY



REVENUE WITHOUT iDE SALES

iDE categorizes sales made to the government or another NGO, without the support of an iDE sales agent or an iDE-organized referral, as an institutional sale. The proportion of institutional sales compared with iDE-facilitated sales is still quite low with a ratio of about 25.7 iDE-generated per institutional sale. Since the start of SMSU3, 5,503 institutional sales have been delivered compared to over 140,000 iDE-facilitated sales. Since 2020, the number of institutional sales has decreased, with about 103 sales per month (as compared to 120 per month in 2020), while the number of LBOs selling to institutional buyers has increased to 46 LBOs (more than doubled since 2020).

In addition to institutional sales, LBOs have engaged in retail sales directly to households by LBOs over the course of SMSU3. All active LBOs have sold products via retail channels without support from iDE sales agents. 26% of LBOs sold more than 5% of their total quantity via retail channels.

The rates of institutional and retail sales have not changed much over time, staying below 10% of total product sales during the entire program period, and generally between 1-5% any given month since the beginning of SMSU3 (Figure 17). 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 17: PERCENT OF TOTAL PRODUCT SALES DURING SMSU3, VIA RETAIL AND INSTITUTIONAL CHANNELS



According to self-reported data, 16-17% of WASH product sales revenue comes from non-iDE generated sales and 16 out of 58 LBOs earn more than 20% of their WASH product revenue from non-iDE generated sales. In terms of geographic coverage, most LBOs (48 out of 58) are operating solely within iDE's target areas, with 10 LBOs operating in one additional province outside of iDE's intervention areas.

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. 19% of LBOs (n=11) believe they would be able to sell WASH products at the same rate as they are now, and 74% (n=43) 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 (91%) do have a plan for when SMSU3 is over, with only 2 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. LBOs are largely only operating within the sales territories under the SMSU3 program, although there are some already operating outside of SMSU3 target areas and others have plans to expand to such areas after the end of their engagement with the project. 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.

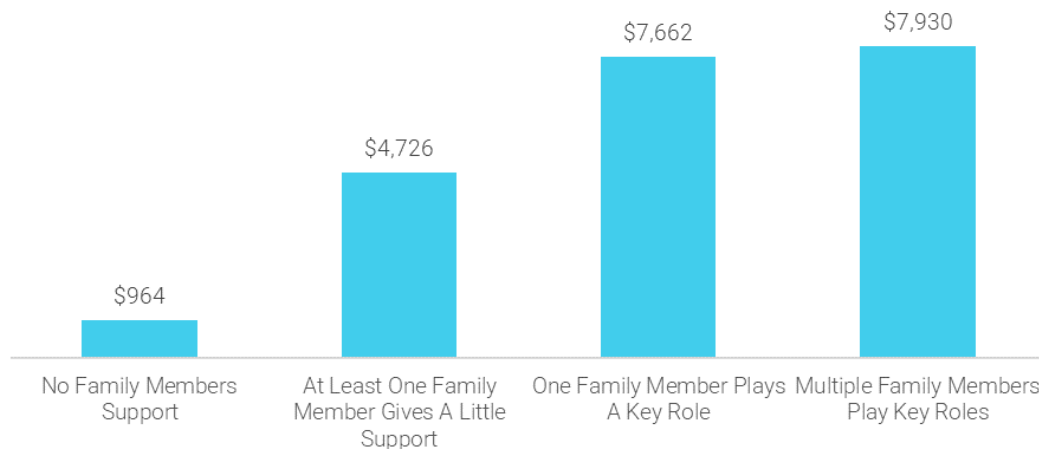
BUSINESS CAPACITY

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 58 active LBOs, only 12% are registered with either the General Department of Tax, Ministry of Commerce or Ministry of Industry, Science, Technology and Innovation, nearly unchanged since 2020. 48% of LBOs are interested and intend on registering their business. However there is a significant barrier in that 81% 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 three LBOs are part of a business network including other LBOs, material suppliers, other similar local business owners, NGOs other than iDE or local authorities. 55% of LBOs estimate this network to be between 5-10 people or higher, while 40% have a network of between 1-5 people. 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 three 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 no family member providing support in operating the business. In comparison, LBOs with at least one other family member playing a key role and LBOs with multiple family members playing key roles earn considerably more from WASH product sales. This difference is substantial, with the leading two groups making over \$6,500 more per month than LBOs with no family support.. This may indicate that a degree of family support plays a significant role in LBO success (Figure 18).

FIGURE 18: 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. When asked whether the LBO tracks their revenue and profits for all sales, including non-iDE products, 67% said yes (up from 50% in 2020). Understanding revenues and costs, and tracking these figures for different business channels is critical for ongoing business sustainability and growth. Somewhat surprisingly, those who regularly track revenues and costs are only slightly more likely to claim to have businesses that make enough money 9-12 months of year (69%; 27 of 39), compared to those who do not track revenues and costs (63%; 11 of 19).

QUICK-LOOK SUSTAINABILITY METRICS

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 Table 10 below:

TABLE 10: QUICK-LOOK LBO SUSTAINABILITY METRICS: THRESHOLDS AND % OF LBOS

Sustainability Dimension	Quick-Look Metric	% LBOs 2020	% LBOs 2022
Product diversity	D1: More than 20% of iDE-generated WASH product revenue is from products other than the Easy Latrine.	42%	57%
	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%	36%
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%	52%
Business Capacity	BC1: The LBO business is formally registered with a relevant ministry	10%	12%
	BC2: The LBO engages members of family in at least one key role	76%	95%

Using this set of quick-look metrics, we have identified 9 active LBOs (16%) in the network that meet four out of the five criteria for sustainability, and there are 19 (33%) who meet three out of five. The largest group, 23 LBOs (40%), satisfy two out of the five metrics, whereas 7 (12%) of LBOs meet just one metric. There are no active LBOs that satisfy all five, largely because there are still so few which have formally registered their businesses. Comparing the quick-look metrics over time, we see improvement across all five dimensions from 2020 to 2022, indicating a general improvement in the sustainability of the active LBOs over time. While the change in metrics, such as Revenue without iDE sales (R1) and Business Capacity (BC1), is marginal, the other three metrics each showed a greater than 10% change to the good.

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 and into the CR-WASH-SUP program.

PROGRESS TO ODF

Key Findings:

- SMSU3 is making progress in getting communities to ODF status. As of November 2022, iDE has supported 1,867 villages to file an ODF claim which contributed to the first ever three provinces to declare ODF status in Cambodia.
- 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.
- 96% of non-latrine owners in high coverage areas reported sharing a latrine. Of these households sharing a toilet, 10% are IDPoor and 90% are non-poor. Therefore, to reach 100% toilet access, behavior change efforts targeting sharing preference is required.

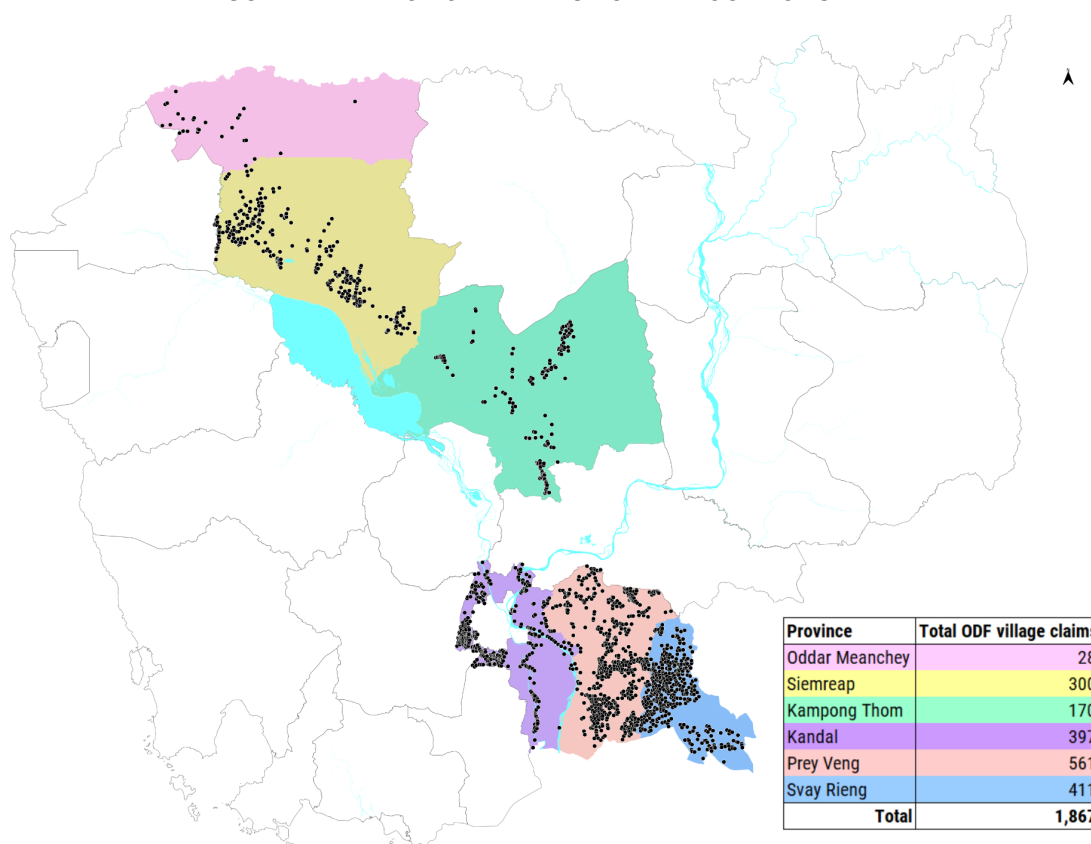
Aligning with the Cambodian government's goal to reach nationwide ODF status in 2025, in early 2019, iDE launched the Grassroots PPP Department to complement iDE Cambodia's traditional sanitation marketing activities by accelerating the achievement of ODF status at the village level. ODF status in Cambodia is reached when at least 85% of the households in a village own a toilet and the remaining have access to latrine through sharing. Understanding the benefits of household ownership, iDE's PPP team still pushed the limits of villages to reach 100% sanitation coverage.

By facilitating connection and collaboration between LBOs, civil society, and sub-national local authorities, the PPP Department supports the further development of a sustainable sanitation ecosystem, to and beyond ODF status. The PPP team operates in communes with sanitation coverage of 85% or more by targeting the remaining households who are still without a toilet as a prerequisite to achieving ODF status. The PPP model and activities are described in detail in a tactic report¹¹ iDE updated in 2021.

As of November 2022, iDE has supported 1,867 villages to file ODF Claims. Of these 1,867 claims, 1,225 have been verified by the Cambodian Government. We are currently supporting 377 villages that are in the process of filing. PPP activities vary greatly by province depending on sanitation coverage, as reflected in Figure 19. In April 2022, the government celebrated Svay Rieng as the first ever province in Cambodia to declare ODF status. By the end of 2022, Prey Veng and Kandal followed to become the second and third provinces to ever declare ODF status. As shown in Figure 19, three of the six provinces of iDE program areas where PPP activities focused were declared ODF. During government ODF celebration events, iDE's PPP activities were officially recognised by the government as one of the key interventions to accelerate progress towards ODF.

¹¹ iDE, 2021. [Tactic Report: Reaching Open Defecation Free Status with grassroots partnerships](#)

FIGURE 19: MAP OF ODF VILLAGE CLAIM LOCATIONS

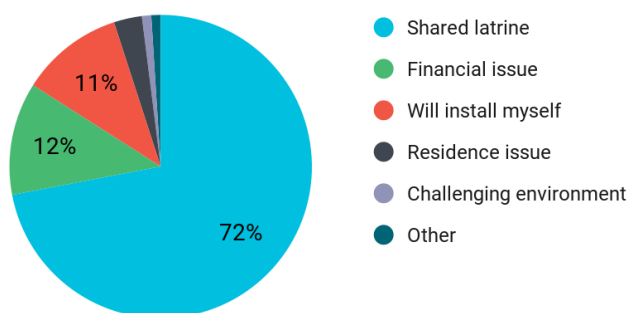


REASONS FOR NOT OWNING A LATRINE

SMSU 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. 12% of non-latrine owners in the survey sample are registered as IDPoor (compared to 17% of the general population of the sample), indicating the population of non-latrine owners is not disproportionately made up of IDPoor households.

Figure 20 highlights non-latrine owners' main reasons for not owning a latrine. Note, respondents could only choose one response and highlighted their *main* reason for not owning a latrine, while there may be interacting factors. It is often assumed that non-latrine owners' primary barrier to owning a latrine is lack of financial resources. However, in high coverage areas close to achieving ODF, non-latrine owners may be less inclined to invest in a toilet because they have the option of sharing. We found 72% of non-latrine users claim the main reason they have not invested in a toilet is their preference for sharing a toilet, while 12% of non-latrine owners claim financial issues. To note, among IDPoor households, 60% stated a preference for sharing and 26% stated financial reasons as compared to non-Poor households of whom 74% stated a preference for sharing and 10% stated financial reasons as their main objection. Although financial interventions such as subsidies or micro-financing are useful solutions to achieve ODF, additional behavior change and capacity building efforts may be required to reduce sharing preference and reach 100% sanitation coverage.

FIGURE 20: NON-LATRINE OWNERS' MAIN REASONS FOR NOT OWNING A LATRINE



NON-LATRINE OWNERS' SHARING PREFERENCE

96% of the 38,059 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, confirms a similar result: 90% of all non-latrine owners surveyed in high sanitation coverage areas (over 85% coverage at the district level) claim to be sharing.

Of those non-latrine owners who reported sharing a latrine, 10% are IDPoor and 90% are non-poor. This indicates that poverty is not likely a key reason behind preference in sharing a toilet. Among the 4% of the households reporting open defecation, 26% are IDPoor and 74% are non-poor, indicating that poor households are slightly more likely to prefer open defecation over sharing a latrine.

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 defecating¹². Of those non-latrine owners who reported sharing a latrine, 9% claimed to be either sharing with a non-family member or using one more than 50m away. Therefore iDE's findings indicate that self-reported latrine sharing totals may be inflated by approximately 9%, underscoring the importance of asking qualifying questions on latrine sharing while conducting ODF verifications.

MIGRANT STATUS' LINK TO TOILET OWNERSHIP

24% of non-latrine owning households have decision makers who are migrant workers who are usually away from the village, whereas 76% have decision makers that all live and work in the same village. Of those who migrate, 78% are short-term migrants (away for less than one year) and 22% 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.

¹² Causal Design, 2019. [Understanding Shared Latrine Use and Dynamics in Rural Cambodia](#)

FECAL SLUDGE MANAGEMENT (FSM)

Key Findings:

- Overall, common FSM practices in rural Cambodia are generally unsafe. Households have a low level of understanding of safe FSM, and there is a lack of access to trained rural FSM services. This is a crucial challenge to address as latrine coverage in rural Cambodia increases and the need for FSM grows.
- To address the challenge of rural FSM, iDE has scaled and delivered 22,227 ADPs, an on-site technology to treat FS through storage and lime treatment. Results from FS samples showed that the ADP was effective at reducing pathogen concentrations to safe levels in two of three pits. This calls into question the effectiveness of the standard two-year storage treatment in real-world applications.
- In our research, most households did not follow the recommended ADP operational practices, and all households that emptied their pit did not wait the World Health Organization (WHO)-recommended two years, risking direct exposure to untreated waste. To achieve SMS, household practices are very important aspects that must be considered when designing FSM products.

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 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.

FSM intentions¹³. 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 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.

Household preferences for FSM¹⁴. 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 SMS 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

¹³ Harper et al. 2018. [Intentions towards FSM in rural developing communities](#)

¹⁴ Harper et al. 2021. [Household Preferences for Rural FSM Services in Cambodia: A Discrete Choice Experiment](#)

potential for safe FSM practices. In addition, a discrete choice experiment was administered as part of the FSM Survey to 1,461 households. The goal of the discrete choice experiment is to describe which attributes of FSM services are preferred by rural households and what they are willing to pay for those attributes.

Findings from these studies are summarized below:

- **Common rural FSM practices in Cambodia are generally unsafe.** These practices include unsafe self-emptying, modifying pits for open discharge of blackwater (pit piercing), allowing floods to wash out pit contents (flooding out), or reverting to open defecation, all of which can be harmful to both public and environmental health. Households in rural Cambodia will likely continue to perform unsafe FSM practices unless access to desirable, affordable, and safe FSM products and services is improved.
- **Rural households have a low understanding of safe FSM.** While 91% of surveyed households understood that pathogens are present in FS, 14% believe that untreated FS disposed into a body of water is safe, and only 9% understood what emptying practices could be used to safely manage FS. 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.
- **Households vocalize a strong aversion to contact with dangerous 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 express an acceptance for using human FS as fertilizer and a preference for self-emptying.** Despite the aforementioned aversion to “merok,” 20% of households believe disposing of untreated FS onto a field is safe and 87% of households 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.
- **Preferences for FSM are impacted by poverty level.** IDPoor households intended to self-empty slightly more often than non-IDPoor households (23% vs. 20%) and intended to install a new pit less often (21% vs. 25%). 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.
- **There is a lack of access to trained rural FSM services.** 82% of households reported no access to trained FSM service providers in their communities. Even if households desired safe FSM practices, many reported difficulty in actually applying those practices. 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.
- **Customer satisfaction with WASH products and services can increase latrine use and safe 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. Implementers and businesses promoting sanitation should focus on product quality, customer satisfaction and service as a critical component of ensuring dedicated, sustained and safe use of sanitation systems.
- **The need for FSM will only increase in rural Cambodia.** Of all surveyed households—whose latrines are on average 2.8 years old—only 11% have ever had a pit fill. As the vast majority of latrine owners in rural Cambodia are first-time owners and have not yet been forced to consider FSM, the WASH sector must proactively engage the population and apply evidence to promote rural FSM safety. This will be critical to ensure the sustainability of public health gains from Cambodia’s expansion of basic sanitation coverage.

ADDRESSING FSM WITH ADP

To address the challenge of FSM, iDE created the ADP. The product was piloted in 2017 and, based on learnings from the pilot, scaled to five provinces in 2018. In SMSU3, 58 LBOs have delivered 22,227 ADPs to rural households.

The ADP is based on a traditional alternating twin-pit concept with two additional components: a pit gauge and a lime treatment service. The pit gauge functions like a visual alarm clock, signaling to households when their pit 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-connected LBOs during ADP installation. With an ADP, customers can theoretically alternate pits back and forth and safely empty stabilized waste sustainably into the future.

During routine quality assurance checks of ADP products, iDE staff identified some cases of ADP pits filling prematurely, which prompted further investigation. Using a call center, iDE deployed a questionnaire to a random sample of 1,750 ADP owners and 1,750 owners of the Easy Latrine to compare the proportion of products filling up within 1.5 years of installation (considered premature as a typical pit for a toilet used by one family should last at least two years). Preliminary findings have shown that about 25% of ADPs filled prematurely, while only 6% of Easy Latrines filled prematurely. The discrepancy in premature pit filling incidence rates between the two products is not believed to be related to any product design defects as the ADP uses the same pit design as the Easy Latrine. Two hypotheses explained these findings:

1. iDE is more likely to sell ADPs to people whose existing latrine pit has filled up prematurely because they live in environments with dense and saturated soil (e.g. clay) and/or a high groundwater table.
2. The ADP upgrade pit is installed too close to the original pit (less than the 1.35 m design standard), causing a reduced infiltration zone for the new pit due to clogged soil around the old pit.

iDE addressed both hypotheses by improving its ADP sales and installation processes to reduce the likelihood that ADPs will be installed in challenging environments that impede their functionality. iDE also proceeded in developing a study to evaluate—in real-world conditions and at scale—the biology of the ADP and related household behavior.

ADP EFFICACY

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 years¹⁵. There is also uncertainty around if and how households actually alternate pits when they fill. To answer these questions, iDE has done research on the effectiveness of ADPs, focusing on biological and behavioral determinants, with the goal of 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.

MICROBIAL HAZARDS IN ADP LATRINES TREATED WITH LIME IN RURAL CAMBODIA¹⁶

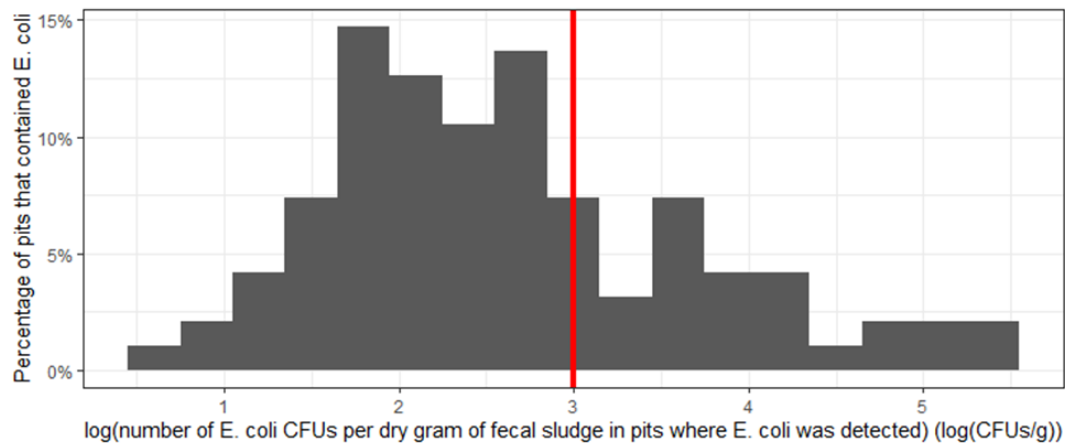
ADPs treat FS by inactivating pathogens using storage treatment with lime. In this study, we enumerate the fecal indicator bacteria *Escherichia coli* (*E. coli*) and fecal coliforms in 147 pits after two years of storage treatment with lime and compare detected concentrations to relevant standards.

¹⁵ WHO, 2018. [Guidelines on sanitation and health](#)

¹⁶ Harper et al. 2023. Microbial Hazards in ADP Latrines Treated with Lime in Rural Cambodia. Article submitted for publication January 2023

A two-year storage treatment with lime mixing reduces pathogen concentrations to safe levels in two of three latrine pits in rural Cambodia (Figure 21). While this proves that iDE's ADP product has enabled SMS at scale in rural Cambodia, these results also highlight that, even after the WHO-recommended two years of storage treatment, there is a one-in-three chance that a household emptying their own pit would be exposed to health hazards. The strong base resistance of *E. coli* likely allowed *E. coli* to persist in these pits despite lime and storage treatment.

FIGURE 21: *E. COLI* COLONY FORMING UNITS (CFU) PER DRY GRAM OF FS IN PITS THAT CONTAINED *E. COLI*



Note: The red line indicates the threshold above which risks to public health exist.¹⁷

With high concentrations of pathogenic bacteria found in real-world pits after the WHO-recommended two years of storage treatment, even with lime, the effectiveness of storage treatment in real-world applications is called into question. Although incomplete lime mixing may have led to the *E. coli* detections, none should have been detected after two years of storage treatment. Thus, the timing of storage treatment should be re-evaluated as a practical and effective on-site FS treatment method in relatively shallow lined latrine pits due to a high prevalence of pour-flush toilets, and in regions like rural Cambodia that have relatively high groundwater and experience regular flooding.

HOUSEHOLD PRACTICES WITH ADP IN RURAL CAMBODIA¹⁸

While the ADP exists to treat FS on-site while maintaining latrine functionality, households must perform recommended practices, particularly regarding how and when they switch between pits, to achieve safe on-site FS treatment and disposal. We surveyed 770 rural households with FSM experience to evaluate at scale how they operate and maintain their ADPs across five Cambodian provinces.

Most households did not follow the recommended ADP operational practices, and all households that emptied their pit did not wait the WHO-recommended two years, risking direct exposure to untreated waste. When their pit filled, 31% of households chose to empty their connected pit immediately and 34% pierced their pit to prevent it from filling and becoming dysfunctional. These unsafe practices have been linked to a desire for convenience and to reduce costs by avoiding service provider fees as well as a lack of access to affordable, convenient FSM services beyond ADP installation and lime treatment. Households also typically waited until their pit was full or nearly full before considering switching their connection, putting them at risk of latrine dysfunction and their pit overflowing. Thus, due to the lack of as-designed use of ADPs, an argument could be made that current recommended ADP

¹⁷ European Commission, 2001. [Evaluation of sludge treatments for pathogen reduction](#)

¹⁸ Harper et al. 2023. Household Practices with ADP Latrines in Rural Cambodia. Article submitted for publication January 2023

practices and/or design features are not universally practical or at least do not always match with Cambodian households' desires when managing their FS. Household behavior change and potentially product design modifications will be needed to improve the safety of FSM practices. The absence of Cambodian government regulation or enforcement of safe household sanitation results in all household FSM being essentially voluntary, further limiting the potential impact of FSM solutions that depend on household behavior, like the ADP.

Certain results of this study related to flood proneness are important to consider with regard to achieving SMS in climate-vulnerable regions. Flood-prone households were more likely to have switched their pits, likely because their pits filled more frequently due to flooding, which is increasingly likely due to climate change. Also, flood-prone households typically did not perform FS treatment as often. This is consistent with iDE's research (see [SMS & Climate Change](#) section), particularly around how flood proneness increases challenges related to latrine functionality, leading to unsafe FSM practices households employ to improve or restore functionality. Climate vulnerability, particularly flooding, is thus closely linked with household sanitation behaviors

Findings from this research indicated that the knowledge, education, and experience of households does not necessarily lead to safer sanitation practices. Education level did not positively correlate with safer sanitation practices, however education levels and FSM knowledge were generally low. With significantly higher knowledge and education, it is possible that household FSM practices would improve. Additionally, households that experienced more pit-overflow events typically performed recommended emptying practices less frequently. Desensitization and increased comfort dealing with FSM (despite doing so unsafely) may explain this finding. It can be generally inferred that other factors beyond education and knowledge will be necessary to motivate safer household FSM practices.

SECTOR RECOMMENDATIONS TO ACHIEVE RURAL SMS

Based on these findings, we have generated the following recommendations:

- When designing FSM solutions, both technical (treatment and disposal) and behavioral (household practices around technology/service) aspects must be considered and incorporated into design and delivery.
- Additional treatment methods beyond storage (i.e. hydrated lime) and appropriate use of these methods should be considered when promoting ADPs to reduce risk of pathogen resistance.
- Conduct follow-up research designed to better understand the relationship between initial pathogen levels, lime treatment, and storage treatment.
- iDE's recommended FSM practices and product/service designs should be further adjusted to better match the desires of Cambodian households when managing their FS.
- The sector supports increased affordable access to trained rural FSM service providers, especially for households unable to expand sanitation systems by installing new latrine pits
- The sector develops more practical tools for implementers, government, and households themselves to easily, accurately, and affordably monitor their FSM situation and progress towards sustained SMS.
- The government develops and implements mechanisms, regulations and enforcement of safe rural FSM practices, including the facilitation of enabling environments for service providers.
- Sanitation implementers in the public, private and NGO sectors assess context-specific climate risks to FSM (including infrastructure and behavior) and incorporate into policies, products, services, and delivery approaches.

GENDER EQUALITY, DISABILITY & SOCIAL INCLUSION (GEDSI)

Key Findings:

- Latrine usage rates are consistent between men and women, while the elderly have the highest usage rate (97%). This indicates a high degree of equity in access to and use of sanitation facilities in program areas.
- iDE has conducted gender-focused capacity training to the private sector, public sector, and its own staff. These trainings have supported female entrepreneurs, empowered female local authorities to advocate for WASH in their communities, and supported iDE to mainstream gender equality into program activities.
- In collaboration with University of Technology Sydney's Institute for Sustainable Futures (UTS-ISF), iDE has supported the development, testing, and implementation of the WASH-GEM—a tool that aims to assist practitioners and researchers in exploring gender outcomes associated with WASH programs for women and men.

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

1. 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. This is discussed in the [Sales, Installation & Satisfaction](#) section above.
2. We look at the intra-household use behaviors after a household has purchased and installed its latrine. Questions 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 (SSI)¹⁹.
3. We test and scale effective models for advancing do no harm principles. In this area, we have focused on deploying a deposit restitution policy that aims to mitigate the risk of domestic violence.
4. We are supporting women entrepreneurs and local authorities. We support female LBOs through capacity building and training programs like our partnership with SHE Investments and female local authorities through gender-focused post-ODF training of trainers.
5. We are mainstreaming gender principles in our programming through regular training and follow-up with our staff. We follow these trainings with qualitative research to better understand organizational levels of empowerment and gender norms.
6. Through our work with UTS-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.

¹⁹Jenkins et al. 2014. [Measuring the Safety of Excreta Disposal Behavior in India with the New Safe San Index: Reliability, Validity and Utility](#)

INTRA-HOUSEHOLD LATRINE USE

To study intra-household latrine use, we adapted a tool from the 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, usually, or never use the latrine, or that latrine use is inconsistent between household member types - such as school aged boys may use it less frequently than married men.

Table 11 shows the average SSI score for SMSU3 and the average by province, with an average overall score of 89.2, indicating that latrines are used “usually/mostly” across household groups.

TABLE 11: SSI SCORES, BY PROVINCE
Note: 0-100 RANGE, WHERE 100 = ALL MEMBERS USE THE LATRINE ALWAYS

	2019	2021
Kampong Thom	90.2	90.2
Kandal	90.2	92.8
Oddar Meanchey	85.2	88.7
Prey Veng	87.3	87.4
Siem Reap	88.2	90.2
Svay Rieng	83.5	85.9
All provinces	87.8	89.2

The SSI is a helpful tool as it not only provides an overall score measuring intra-household latrine use, but also gives us the opportunity to look at different types of household members and their defecation practices. Table 12 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 group. We see a pattern of latrine use that appears to be higher based on age or marriage status (which are likely correlated) within a household. Note that the rate for infants is quite low, as latrine “use” is defined as infant feces being properly disposed of in the latrine. Across all provinces and household groups (excluding infants), we observe an increase in latrine usage since 2019. This is a promising finding as it indicates that preference for using a latrine is increasing.

TABLE 12: PERCENT OF HOUSEHOLD MEMBERS ALWAYS USING THE LATRINE (BY MEMBER GROUP)

	2019	2021
Elders	79%	97%
Married Women	76%	95%
Married Men	74%	93%
Unmarried Women	67%	93%
Unmarried Men	67%	92%
Girls	62%	74%
Boys	57%	73%
People with disabilities	79%	86%
Infants	6%	5%

DO NO HARM

Gender-based violence 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 lifetimes²⁰. It is anticipated that iDE Cambodia's programming would witness examples of violence happening within target communities. As such, iDE must engage in an exploration of the potential impact of our work in the given context and incorporate the principle of 'Do No Harm' wherein our interventions do not expose clients to additional risks due to our actions and investigate the broader social, economic and political context of the communities where our work is undertaken.

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 gender-based violence for themselves or their communities.

We also investigated evidence that some households experience increased domestic violence after a woman solely makes 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, are obligated to pay a deposit of \$5 to secure their order and deter order cancellations. In the past, when households canceled 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, 4,831 households have received their deposit after canceling orders, 4,093 of which are IDPoor households.

²⁰ Ministry of Women's Affairs, 2015. [National Survey on Women's Health and Life Experiences in Cambodia](#)

GENDER FOCUSED CAPACITY BUILDING

PRIVATE SECTOR: FEMALE ENTREPRENEURSHIP

In January 2019, iDE Cambodia partnered with SHE Investments to pilot a business training and peer mentorship program with eight female LBOs. Due to the success of that pilot, the program was scaled-up to further support LBOs, specifically focusing on empowering female entrepreneurs. This approach aligns with recent research on the power of peer mentoring in comparison to other mentorship models and the benefits of networking for women in male-dominated industries²¹.

SHE Investments is a social enterprise that provides gender-focused and culturally tailored business incubator and accelerator programs for women in Cambodia²². In the scale-up of this program, SHE Investments conducted Train the Trainer sessions for iDE Sanitation Marketing Trainers and Sanitation Business Advisors. These iDE staff then worked with LBOs for 8 days of training between October 2020 and November 2021. Baseline and endline surveys were conducted with participants at the beginning and end of the trainings to understand the program's impact.

The pilot of this program worked with only female entrepreneurs. While the scale-up was extended to male LBOs, the training continued to be gender-focused, specifically focusing on barriers faced by women entrepreneurs. In total, 65 participants (27 females), representing 47 LBOs across six provinces completed the training. In this section, we focus on the impacts experienced by female entrepreneurs.

Individual Business Impacts

- The average monthly income for many female participants increased, with an average increase in income of \$24 per month for each female entrepreneur. While several of our participants cited decreases in income, this likely can be attributed to the COVID-19 pandemic, as the program took place during late 2020 through 2021.
- In general there were positive impacts on business financial practices. There was a 16% increase in women recording business revenue and 13% increase in women separating their personal and business finances. While participants cited slight decreases in their personal savings accounts over the course of the training, in general, there were increases in business savings accounts.
- The impact of participation extended beyond the entrepreneurs directly participating to their employees as well. In general, female business owners increased the minimum wage for staff (a total of 28% increase across all female LBOs).

Broader Impacts: Networks & Confidence

- Of women interviewed, a majority said that the program increased their confidence in decision making, particularly in financial decision making at home.
- Most women cited that the programming had a moderate to high impact on the growth of their business network.
- When asked what the most impactful aspects of the training were, increased revenue and profit and scale-up/expand business were the most common responses.

While quantitative outcomes of the second round of SHE Investments training were not as significant as the pilot, almost all participants said that the program had moderate to high impact on their businesses including: increases in revenue, increase in scale, growth of business network, and confidence in business decision making and financial

²¹ Morantz, 2021. [Tapping the Power of the Peer](#)

²² [SHE Investments](#)

decisions at home. As this round of implementation took place between 2020-2021, there were significant challenges due to COVID-19 that may have impacted program outcomes. The program was supposed to be completed in 6 months, but took over a year. Additionally, during the pandemic, there were disruptions to business that likely could account for negative outcomes seen in data (i.e. fewer businesses with access to finance, fewer female employees, and instances of decreased revenue/income).

PUBLIC SECTOR: PROGRESS TO ODF & POST-ODF TRAINING

To support progress towards ODF and promote sustainability after ODF claims, iDE's PPP team worked closely with 2,632 "Sanitation Champions," including district, commune, and village level government authorities as well as other influential community members. Of those champions, 45% are women including CCWCs and District Committees of Women and Children (DCWCs), under-resourced female government representatives who hold the mandate of facilitating improved WASH services. iDE regularly coached Sanitation Champions to use the data to make evidence-based decisions to improve sanitation coverage and eventually claim ODF status.

With the goal to improve gender equality in the WASH public sector, iDE designed its PPP activities to target women in the public sector and increase their capacity as WASH leaders and role models to their communities. Early 2022, iDE introduced a post-ODF training of trainers targeting CCWC and DCWC representatives with the goal to empower them to advocate for safe and sustainable sanitation. In 2022, iDE conducted the post-ODF training of trainers to 145 local sanitation champions, including 92 CCWC across 9 districts. The curriculum includes three modules– (1) ODF sustainability and FSM, (2) handwashing, and (3) MHH and child feces management. The 92 CCWCs then disseminated these post-ODF messages to over 3,400 individuals including village level authorities and community members. 51% of the individuals who received post-ODF information from the CCWC were female.

STAFF: GENDER MAINSTREAMING

Since 2018, iDE has conducted four annual gender mainstreaming trainings for all staff. The purpose of this training is to increase staff awareness of gender and integrate gender equality into program implementation. The training curriculum is updated each year to reflect program needs. After the second training, we partnered with UTS-ISF to conduct qualitative research on the impacts of the training for our team. We summarize our key lessons learned into two categories: positive impacts and areas for improvement.

Positive impacts:

- The SMSU3 gender mainstreaming approach was very effective in supporting managers and officers to think critically about how they engage with gender equality in the workplace.
- The training was effective at 'rippling out' from the workplace to the home and the community.
- The training was effective at creating a shared definition of gender equality for the team. This included a good foundation on the importance of rights of women within Cambodian society and law.

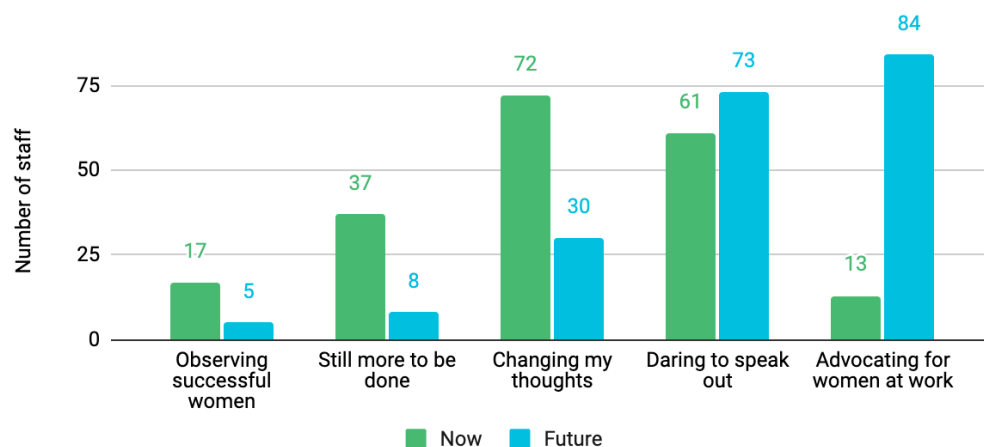
Areas for improvement:

- We can strengthen the impact of the training on agent level staff. This may include critically reflecting on the power-balance between trainers and agent level staff.
- We can help support staff to move from observers to doers and help to solidify that gender equality is not a job for women, but must incorporate all genders and benefits all.
- We can help support staff to think critically about 'why' gender equality is important. Peace, prosperity, happiness, and progress were all mentioned.

Building on these lessons learned, in 2021, training focused on 1) MHH, 2) sexual harassment in the workplace, and 3) gender mainstreaming. In 2022, the training was updated to focus on 1) iDE's GESI policy, 2) gender inequality and domestic violence, 3) positive parenting, and 4) business training.

As a result of the 2021 gender training, staff representatives were selected to observe and monitor gender-related progress within iDE and to provide quarterly updates on this progress. This is an ongoing effort. As part of the 2022 gender mainstreaming, staff were asked to reflect on their perceptions of, from a GESI perspective, what things are like now and what they wanted things to look like in the future (Figure 22). While a majority of staff members in the training were currently at the stages of “changing my thoughts” and “daring to speak out”, most had hope for the future of taking a more active role in gender equality, shifting towards “daring to speak out” and “advocating for women at work”.

FIGURE 22: STAFF PERCEPTIONS OF GENDER EQUALITY AND HOPES FOR THE FUTURE



WASH-GENDER EQUALITY MEASURE (WASH-GEM)

SMSU has been collaborating with UTS-ISF to develop and test the 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.

In Cambodia, in 2019 and 2020, the WASH-GEM went through three rounds of in-country testing: rapid, exploratory and validation piloting. The validation piloting was conducted in three provinces (Kandal, Prey Veng and Kampong Thom) to rural households and a sub-group of iDE program-connected LBOs.

Based on this testing, UTS-ISF developed an online WASH-GEM tool for WASH implementers globally. In May 2022, iDE participated in the first round of the WASH-GEM tool implementation testing and provided feedback to UTS-ISF with the goal to finalize the online tool and make it accessible and user-friendly for users globally. Through the WASH-GEM findings in the implementation testing, iDE sought to understand the impact of two GESI-focused program activities: SHE Investments training to LBOs and post-ODF training to local authorities.

Data collection for the WASH-GEM is done through individual interviews, with men interviewing men and women interviewing women. Interview data is then used to calculate scores (between zero and one) for domains and

themes related to gender equality. The measure has five domains based on empirical evidence, practical experience and academic literature. The five domains—Resources, Agency, Critical Consciousness, Structures, and Wellbeing (see definitions below)—explore changes associated with WASH programs in both WASH-related and beyond-WASH activities and include 18 themes across the five domains. The themes draw on a wide breadth of WASH-gender experience and academic literature. The WASH-GEM tool seeks to expand beyond women’s empowerment in WASH to explore the gender dynamics between women and men. The process of using the WASH-GEM in programs is just as important as the results themselves. The use of the WASH-GEM also helps to raise consciousness about gender equality for staff through sensemaking workshops.

DEFINITIONS

Resources refers to the tangible and intangible material, human and social resources that someone has, owns or uses individually or collectively in exercising agency.

Agency is the ability to define goals and act upon them through processes of decision-making, bargaining, negotiation and resistance.

Critical Consciousness is the process of becoming aware that gender norms and inequalities exist and can be changed.

Structures refers to the individual perceptions of the informal and formal institutional rules that govern collective, individual and institutional practices, such as social norms, recognition and status. A higher score indicates that a person perceives and experiences (in the case of mobility) the world as more gender equal.

Wellbeing is a state of positive mental health that is foundational for individuals to realize their abilities, cope with the normal stresses of life, work productively and fruitfully, and make a contribution to their community.

Here we present preliminary findings and scores from the validation piloting and implementation testing phases. The findings are presented by domain, and each domain is scored based on a scale of zero to one. Scores are not to be compared between domains, but over time or between subgroups such as gender, age or education.

Taken together, the findings from these WASH-GEM phases give us an overview of gender equity in rural households, the private sector, and the public sector. Additionally, in the implementation testing findings, we can begin to evaluate the impact of iDE GESI-focused training on gender equality in the private and public sectors.

VALIDATION PILOT (RURAL HOUSEHOLDS AND LBOS)

In the validation pilot, iDE interviewed households who had purchased toilets from iDE connected LBOs, as well as a small subset of LBOs, across three provinces. Results are summarized in Table 13.

TABLE 13: WASH-GEM VALIDATION PILOT RESULTS

	Resources			Agency			Critical consciousness			Structures			Wellbeing		
	Women	Men	sig.	Women	Men	sig.	Women	Men	sig.	Women	Men	sig.	Women	Men	sig.
Cambodia	0.83	0.77	***	0.63	0.61	*	0.63	0.65	ns	0.57	0.53	***	0.81	0.81	ns
Kampong Thom	0.78	0.73	***	0.66	0.6	***	0.63	0.63	ns	0.54	0.57	*	0.76	0.78	*
Kandal	0.84	0.83	ns	0.6	0.6	ns	0.63	0.7	***	0.59	0.49	***	0.84	0.82	**
Prey Veng	0.86	0.75	***	0.63	0.62	ns	0.64	0.59	***	0.56	0.52	***	0.84	0.82	*

sig. = statistical significance: *p < 0.05, **p < 0.01, ***p < 0.001, ns is not significant

Total participants: n = 1497

GENDER EQUALITY

Resources. Women perceived themselves to have more social capital, time and financial resources than men, which leads to a higher overall resource score. In the Prey Veng this was due in part to having more free time and spending less time collecting water compared to women from other provinces.

Agency. Women and men were assessed to have similar levels of agency, with women having slightly higher access to WASH knowledge and higher autonomy in the home. This likely relates to the historical roles that women have played within Cambodian homes, especially during more recent times of conflict. When exploring agency in relation to gender, age, wealth, education and province, age remained the biggest driver of agency within the results. In Kampong Thom, on average, women had higher scores than men driven mainly by women's belonging to community groups and confidence in their decision-making within those groups.

Critical Consciousness. The results suggested that men may have slightly higher levels of critical consciousness than women. However, when comparing the importance of gender, education, age and province, education had the most significant influence on critical consciousness, as it accounted for 60% of the score (from a Relative Importance with traditional Ordinary Least Squares regression), while province accounted for 17% and gender for 13%. Secondary educated women had slightly higher average scores than men.

Structures. Women perceived social structures to be somewhat more gender-equal than did Cambodian men. However, these scores are in the mid-range (reminder that maximum is 1.0), indicating a significant opportunity to strengthen Structures as an enabler of gender equality for both women and men. Interestingly in Cambodia, men were significantly more likely to note that they believed they had to ask permission to travel than women – leading to a higher score of structures than women. This could be due to a perception that permission is closely related to 'informing' or due to a direct restriction of male mobility. Otherwise, there were only minor differences in women and men's scores around gendered norms.

Wellbeing. Men and women were assessed to have similar levels of wellbeing when compared across all four themes, though men's WASH-related stress was slightly higher than women's.

MHH

In rural households, most women have access to sanitary menstruation products; however, there were slightly lower levels of access in Kampong Thom and Prey Veng than the other regions. Access to facilities is slightly less common, with the highest access in Prey Veng and lowest in Kampong Thom. There was significant stress associated with MHH in rural households. Almost 1 in 5 women in Prey Veng reported experiencing severe stress from managing their menstruation while women in Kampong Thom have the most overall levels of some stress. Women LBOs cited the lowest levels of MHH stress.

RECOMMENDATIONS

Based on findings from the validation pilot, iDE updated its annual staff gender mainstreaming training to include an MHH component to increase awareness and enable open conversations between men and women (see [Staff: Gender Mainstreaming](#) section). Additionally, in January of 2022, iDE launched a training of trainers post-ODF curriculum which includes MHM content. (See [Public Sector: Progress to ODF & Post-ODF Training](#) section).

IMPLEMENTATION TESTING (LBOS AND LOCAL AUTHORITIES)

In the implementation testing, iDE surveyed two subsets of both LBOs and local authorities (four groups total). The subsets had either received a GESI-focused training or not. LBOs received gender focused business training through SHE Investments. Local authorities received post-ODF training from iDE staff. Results are summarized in Table 14.

TABLE 14: WASH-GEM IMPLEMENTATION TESTING RESULTS

	Resources			Agency			Critical consciousness			Structures			Wellbeing		
	NT	T	sig.	NT	T	sig.	NT	T	sig.	NT	T	sig.	NT	T	sig.
LBO	0.79	0.8	ns	0.52	0.55	ns	0.64	0.71	*	0.59	0.58	ns	0.8	0.82	ns
Local authority	0.77	0.76	ns	0.51	0.57	***	0.73	0.81	***	0.62	0.67	**	0.84	0.85	ns
	Women	Men	sig.	Women	Men	sig.	Women	Men	sig.	Women	Men	sig.	Women	Men	sig.
	NT	T	sig.	NT	T	sig.	NT	T	sig.	NT	T	sig.	NT	T	sig.
LBO	0.8	0.79	ns	0.52	0.55	*	0.66	0.69	ns	0.61	0.57	ns	0.77	0.85	***
Local authority	0.76	0.77	ns	0.56	0.52	**	0.82	0.72	***	0.69	0.59	***	0.83	0.87	*

sig. = statistical significance: *p < 0.05, **p < 0.01, ***p < 0.001, ns is not significant

NT = no training, T = trained

Total participants: n = 360, LBO n = 123, local authorities n = 237

GENDER EMPOWERMENT CHANGES EXPERIENCED

Resources. Neither LBOs nor local authorities with training cited statistically significant differences in the Resources domain compared to those who received no training. In general, men with training ranked slightly lower than those without and women with training ranked slightly higher than those without. This is not a surprising finding given female LBOs and government officials already had access to resources through their work in the private and public sector. For those without training, men cited having more Resources than women; for those with training, women more than men, which shows Resource changes moving in a more equal direction, though neither change was statistically significant.

Agency. Local authorities with training cited statistically significant higher levels of Agency than those who received no training. LBOs with training also cited higher Agency than those without; however, this finding was not significant. In particular, for LBOs, men with training statistically have significantly higher levels of WASH Knowledge than men without. Interestingly, LBOs with training cited lower levels of Autonomy than those without.

For local authorities, those with training ranked statistically significantly higher in the themes of WASH Decisions, WASH Knowledge, Household Influence, Self Efficacy, and Collective Agency.

Critical Consciousness. For both LBOs and local authorities, those with training cited higher levels of Critical Consciousness than those without training, suggesting that both trainings may have increased awareness of gender norms and inequalities and their belief that they can be changed. Of all subgroups, trained female LBOs cited the largest increase compared to untrained female LBOs; however, this was not statistically significant.

Structures. Within the Structures domain, local authorities with training cited statistically significantly higher than those without training. In particular, trained local authorities cited significant increases in gender equality in the theme of Gendered WASH Norms (i.e. perceptions of gendered WASH responsibilities such as collecting water,

promoting hygiene, and building/maintaining water systems), compared to the untrained. There was not a statistically significant difference in the overall Structures domain between trained and untrained LBOs. However, in the themes of Mobility (being prevented from or needing permission to travel) and Community Gendered Norms (perceptions of gender roles in leadership, education, decision making, and caretaking), trained LBOs cited statistically significant lower levels of gender equality than those without training, with the theme of Mobility showing a large decrease. One possible explanation is that the training increased awareness of those participants to inequalities they may not have noticed before, but our next step will be to delve deeper into this finding through sensemaking workshops with relevant stakeholders.

Wellbeing. For both LBOs and local authorities, there were no significant differences between trained and untrained in the overall domain of Wellbeing. Local authorities with training had statistically significantly higher levels of Physical Health than those without training. Like the Structure domain, our next step will be to delve deeper into this finding through sensemaking workshops with relevant stakeholders

MHH

In the private sector, most LBOs cited having access to sanitary menstruation facilities and products. However, there were notable barriers to participation. 19% of girls sometimes or always stay home from school due to their period, and 32% of women sometimes or always stop participating in normal activities outside of the home. Dealing with menstrual hygiene causes mild or severe stress for 13% of women.

In the public sector, local authorities cited more significant challenges to access of products and facilities: 14% of women sometimes or never have access to sanitary products while 17% of women sometimes or never have access to facilities needed to manage their menstruation. Barriers to participation were also a significant issue in the public sector. 26% of girls (children of local authorities) sometimes or always stay home from school due to their period, and 35% of women sometimes or always stop participating in normal activities outside of the home. Dealing with menstrual hygiene causes mild or severe stress for 9% of women.

RECOMMENDATIONS

Overall, based on the WASH-GEM findings, post-ODF training for local authorities seems to have had a greater impact on perceptions of gender equality than SHE Investments training for LBOs. In particular, based on statistically significant differences between those with training and those without, post-ODF training for local authorities may have positively impacted perceptions of gender equality in the Agency, Structures, and Critical Consciousness domains, whereas LBOs only cited statistically significant difference in the Critical Consciousness domain. While statistical significance does not necessarily correlate to the impact of trainings, and there may be impacts of training on gender equality that are not reflected in this data, it should be noted that the trainings were not designed to address each domain. For example, it is more reasonable to see changes in Critical Consciousness (awareness of gender norms and inequities) than Structures (perceptions of formal and informal rules that govern practices around gender equality). Bearing this limitation in mind, going forward, trainings for both LBOs and local authorities could have a stronger focus on increasing gender equality in the Resources and Wellbeing domains, while training for LBOs should also prioritize gender equality in the Agency and Structures domains.

In order to tailor programming to have the most effective GEDSI outcomes as possible, iDE will conduct a sensemaking workshop to continue to analyze data from the WASH-GEM implementation testing phase. In this participatory sensemaking workshop, participants will generate tangible recommendations for training for LBOs and local authorities to improve gender-related outcomes both within and beyond WASH.

CLIMATE VULNERABILITY & RESILIENCE

Key Findings:

- As climate change increases the frequency and irregularity of heavy storms and floods, increased toilet abandonment, dysfunction, and unsafe household sanitation practices, including discharging FS openly, are likely to increase in climate-vulnerable regions. These issues will be magnified for the poorest households in rural communities, due to difficulties in managing and paying for maintenance of sanitation systems and a lack of service availability and/or affordability.
- To meet the needs of households living in SCE, iDE has launched the ASU—a septic-tank-like upgrade to a standard latrine pit, that increases the functionality of toilet systems installed in dense, saturated soils and/or high groundwater areas.
- Based on iDE research, offering targeted sanitation subsidies increased the likelihood of successful sales conversions for climate-resilient latrine products among vulnerable households by 32% without distorting the market.

SMS & CLIMATE CHANGE²³

With climate events increasing in frequency and severity, effects on human life, particularly those most vulnerable, are projected to increase in coming decades. Defined as climate vulnerability, risks from climate events can take many forms, including flood damage to basic infrastructure, like household toilets. In this study of households in rural Cambodia, we investigate how climate vulnerability correlates with toilet dysfunction and abandonment.

The link between climate vulnerability and sanitation is clear in the results of this study: climate vulnerability negatively impacts toilet functionality and encourages unsafe sanitation practices, such as latrine abandonment. As climate change increases the frequency and irregularity of heavy storms and floods, increased toilet abandonment, dysfunction, and unsafe household sanitation practices, including discharging FS openly, are likely to increase in climate-vulnerable regions. Ultimately, without improvements to strategies, products, and services that mitigate climate shocks, water sources and the environment will become contaminated more frequently and heavily, and sickness among people will increase. These issues will be magnified for the poorest households in rural communities, due to difficulties in managing and paying for maintenance of sanitation systems; and a lack of service availability and/or affordability. Rural households living in flood prone areas are also more likely to face challenges with latrine functionality and more frequent occurrences of pit fillings.

Despite progress in reducing open defecation through new latrines sold, lack of access to FSM solutions coupled with toilet dysfunction and infrastructure damage during the rainy season can lead to households performing unsafe sanitation practices, endangering public health. To mitigate these negative health and environmental impacts, sanitation programs and technologies must focus on climate resilience and encourage safer practices by improving access and ease to achieve SMS in climate-vulnerable areas.

Based on our findings from this research, we have generated the following recommendations:

- Define and contextualize climate vulnerability on a national level by studying impacts of climate hazards on sanitation infrastructure and household sanitation behaviors.
- Access to affordable sanitation products and FSM services is critical in climate-vulnerable regions, with attention to not only uptake but also maintenance.

²³ Abdel Sattar et al. 2023. Effects of Climate Vulnerability on Sanitation Access, Sanitation Infrastructure Functionality, and Households' Sanitation Practices in Rural Cambodia. Submitted for publication Jan 2023.

- Sanitation programs' focus must broaden and become more holistic to include climate vulnerability.
- Develop climate-relevant metrics of SMS that facilitate climate-resilient design and monitoring.
- Participatory and evidence-based approaches to climate smart sanitation product, service, and metric designs should lead the way.
- Future research should test practical implementations of climate-resilient sanitation.

ALL SEASONS UPGRADE (ASU)

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 SCE and FSM are critical to ensure that rural Cambodians can safely manage their sanitation, despite increasing climate risks. In high groundwater 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.

ASU PILOT

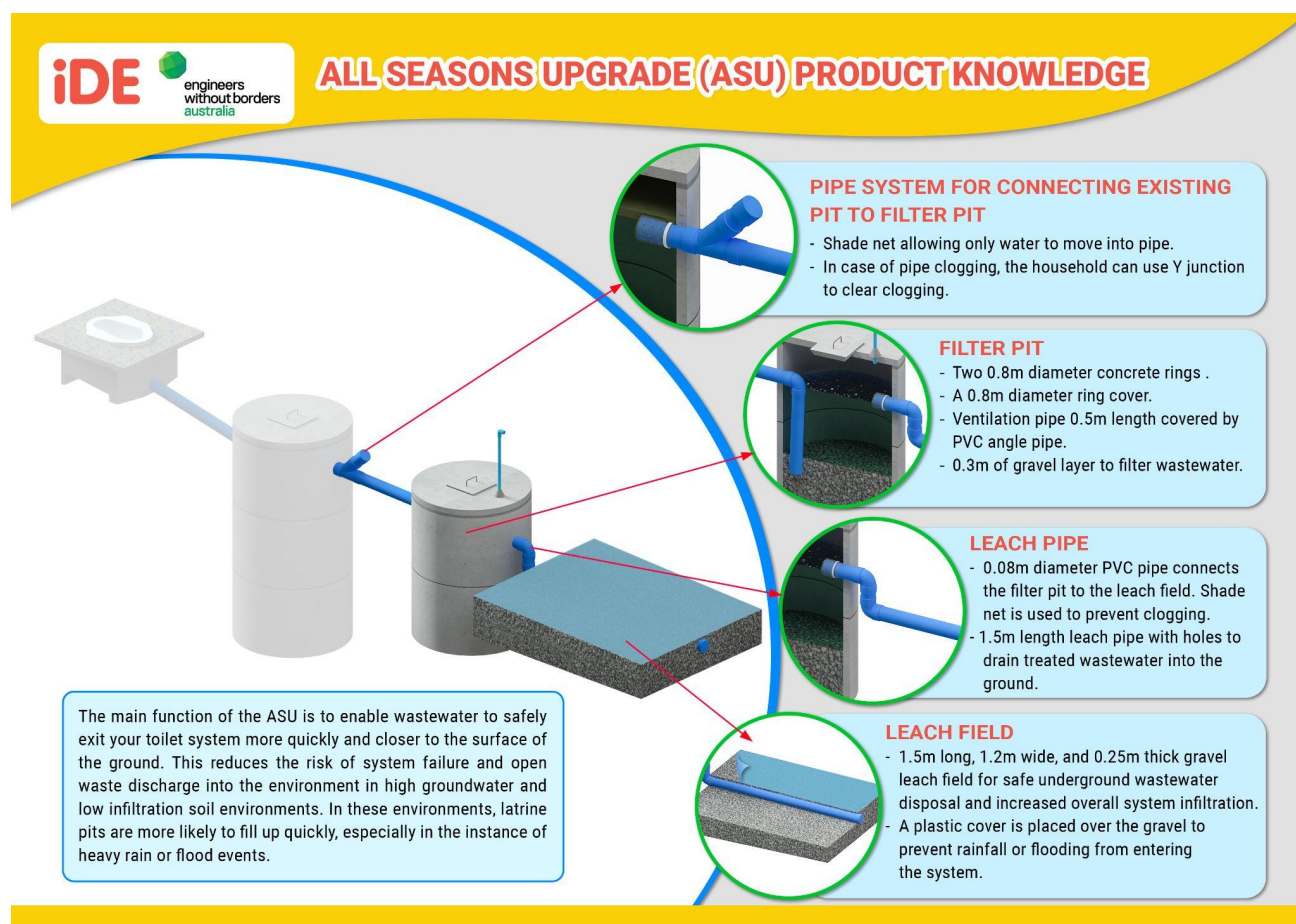
Between 2019 and 2020, iDE and EWB Australia deployed a one-year field test pilot of the ASU product to: (1) test the treatment effectiveness of the ASU to meet standard levels of safe disposal into the environment and (2) understand the functionality and contextual appropriateness of the ASU product. We used biochemical oxygen demand, total suspended solids, 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.

ASU SCALE-UP

In 2021, iDE and EWB managed to make further cost reductions to the ASU design (Figure 23) while maintaining the same functionality. The ASU is a latrine upgrade product that attaches a gravel filter pit and leach field to an existing pit latrine. It aims to divert the existing pit content into a filter pit to undergo primary treatment. It then releases the treated content through a high infiltration leach field, minimizing households' exposure to untreated FS, improving latrine functionality, and reducing environmental pollution.

FIGURE 23: ASU PRODUCT DESIGN OVERVIEW



In 2022, using door-to-door sales and qualitative and quantitative surveys to households and LBOs, iDE conducted a sales trial of the ASU to evaluate the marketability and scalability of the product in rural areas. Results from this trial showed that at a cost of approximately \$83, the ASU is valued by customers primarily because of its innovative design to improve functionality of their toilets in high groundwater and clay environments. It also showed that customers were satisfied with the ASU as it allowed them to maintain functionality of their toilet throughout the rainy and flood season. However, the households did not seem to always understand or prioritize the treatment functionality of the ASU to improve public health and environmental safety. LBOs found the ASU manufacturing and installation simple. However, the ASU cost needed to be adjusted as LBOs found that digging the leach field especially in clay environments can take longer than originally expected.

After a successful pilot and sales trial, iDE moved forward with scaling up the ASU to four provinces. 31 LBOs showed interest in adding the ASU as a product into their inventory and were trained by iDE to sell, manufacture and install the ASU. Remarkably, even without sales support from iDE, three of those LBOs took on the challenges to market and sell three ASUs by themselves by the end of 2022. As of November 2022, 79 ASUs have been sold and installed to rural households. The ASU and continuing to work in SCE in Siem Reap will be a priority for iDE through the CR-WASH-SUP extension in 2023 and 2024.

CLIMATE TARGETED SUBSIDIES²⁴

The increasing global risk of climate-related disasters exacerbates the likelihood of traditional sanitation solutions failing and exposing communities to harmful pathogens. This risk is ubiquitous in Cambodia's flood-prone Tonle Sap Lake region, which has some of the lowest rates of sanitation coverage in the country. Our research designed and tested a targeted subsidy mechanism to deliver sanitation subsidies to climate and socioeconomically vulnerable households in the region.

In a randomized controlled trial, offering targeted sanitation subsidies increased the likelihood of successful sales conversions for climate-resilient latrine products among vulnerable households by 32%, indicating that subsidies are effective at increasing market-based sanitation uptake. This translated to higher sales closing rates at the village level. Communities with subsidies achieved higher rates of safe sanitation coverage than those without.

Under iDE's previous targeted subsidies mechanism, eligibility for a subsidy was predicated on a household's IDPoor status alone. The novel eligibility assessment developed through this research incorporated the Poverty Probability Index (PPI) assessment for assessing the vulnerability of households who had not qualified through the IDPoor system and added additional dimensions of household and community-level climate vulnerability. The higher sales closing rate associated with a subsidy offer among households who qualified under this mechanism suggests that incorporating the PPI vulnerability assessment increases the mechanism's efficacy at reaching households who otherwise would have been unwilling or unable to purchase a latrine and increasing the sanitation coverage rate in the target communities. Household-level climate vulnerability was also associated with an increase in the marginal probability that a household would purchase a latrine if offered a subsidy, suggesting that the mechanism improved accessibility to safe sanitation solutions for households most affected by climate-related weather events.

Village-level regression results revealed that the impact of offering targeted subsidies was comparable regardless of the climate vulnerability status of the community. Nevertheless, it is clear that offering subsidies increased the sales closing rate overall across all treatment communities. This suggests that scaling the subsidy mechanism will increase the coverage rate of climate-appropriate sanitation solutions within target communities. Sanitation coverage is believed to have disproportionately positive benefits for villages determined to be more vulnerable to climate-related events, for whom the health and environmental risks of no or unsafe sanitation are also higher. Further research is required to confirm this assumption, however.

Despite the relatively high subsidy eligibility rate overall, the research team did not identify any evidence of widespread market distortion occurring either as a result of ineligible households waiting on a subsidy or manipulation of the mechanism by households. The difference in the latrine purchase rate among ineligible households in the treatment and control groups was negligible and not statistically significant, suggesting that the vast majority of ineligible households in treatment areas were not waiting on a subsidy to purchase a latrine. Additionally, when asked to provide a reason why they had not purchased a latrine, almost no households selected the 'waiting for subsidy' option, suggesting that this was not a significant factor in their decision-making.

The study also indicated areas for improvement of the subsidy tool, namely areas for reducing subjectivity of subsidy eligibility by prioritizing observable and predefined identifiers of climate and socioeconomic vulnerability (e.g. designated poverty registration, flood high water marks on property, and historical flood-mapping). iDE intends to apply these learnings into an at-scale climate-targeted subsidy mechanism in future interventions.

²⁴ Kozole et al. 2023. Impact of Targeted Subsidies on Access to Safe Sanitation for Vulnerable Households in Cambodia. Submitted for publication January 2023

COVID-19

In response to the COVID-19 pandemic in 2020, iDE quickly adapted and embedded COVID-related activities and precautions into its program. Sales presentations to households and meetings with government officials were conducted with social distancing and adequate protective equipment, beginning with a conversation about COVID-19 awareness and prevention. When Cambodia's surge in COVID-19 occurred in February 2021, iDE implemented a revision of its COVID-19 strategy to address fear and misinformation around the vaccination campaign.

iDE's COVID-19 advocacy efforts 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 CCWCs, where iDE staff also regularly provided 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 reaffirmed our resolve to advocate for WASH as a critical public health need in the communities where we work. Since the onset of COVID-19 pandemic, iDE:

- Distributed UNICEF-produced and government-endorsed COVID-related material including 155,252 leaflets, 10,776 posters, and handwashing promotion signboards with soap to 7,938 households.
- Participated in national WASH sector working group meetings to align and support COVID-19 response and advocacy activities.
- Continuously distributed personal protective equipment including masks and hand sanitizer to all provincial field offices.
- Trained all 192 field-based staff to promote COVID-19 prevention and vaccination to stakeholders at the household, government, and private sector levels.
- Prototyped and tested hygiene-improving products including low-cost handwashing devices and a bidet product.
- Continued to sell handwashing facilities integrated into latrine shelters: a cumulative total of 3,060 since the beginning of SMSU3.

In August 2021, iDE received a "Certificate of Appreciation" from His Excellency Ouk Rabun, Minister of Rural Development, in recognition for iDE's effort and integration of vaccination promotion within our Sanitation Marketing activities²⁵. iDE's success in maintaining "business-as-usual" level operations throughout the pandemic proves a level of sanitation market adaptation and resilience in the face of unperceived global health events like the COVID-19 pandemic. As community awareness around COVID and vaccination has been reached at scale in rural Cambodia, SMSU3 ended its COVID-related efforts in July 2022 in order to free resources for other WASH program priorities.

²⁵ iDE, 2021. [Addressing two health crises at once](#)

ANNEX: METHODS

While 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 November 2021 as data collection resources then shifted to complete the latrine count. Latrine sales data is inclusive of all sales from July 2018 to November 2022.

The key indicators of success for this program are grouped around four objectives: (1) ODF status of villages in program areas; (2) SMS including FSM; (3) entrepreneur and enterprise sustainability and (4) GEDSI. Key indicators for those objectives include:

- Sales through program-connected enterprises
- Sales to IDPoor households through program-connected enterprises
- Changes in latrine coverage
- Intrahousehold use by household member type, including people with disabilities and women and girls
- Household adoption and use of SMS
- Sustainability of program-connected enterprises
- Progress to ODF status in program areas

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

Continuous data collection:

- Sales data from program-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)
- 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
- A quarterly business profile update, collecting key business data from each active latrine business

Static data collection:

- A customer survey (customers who have purchased within the last 12 to 18 months) to better understand our customers and the challenges they face
- A biennial latrine count to estimate changes in coverage at district level and calculate sales through other non-program-connected enterprises in program areas
- A latrine business sustainability survey to understand revenue earned outside of iDE sales

Research:

- Data collection and research on households' FSM practices, behaviors and attitudes conducted in association with the University of Colorado Boulder
- Research exploring the effects of climate vulnerability on sanitation access, sanitation infrastructure functionality and households' sanitation practices in rural Cambodia
- Innovation and Impact research on the impact of climate targeted subsidies on access to safe sanitation for vulnerable households
- Research on the effectiveness of ADPs, focusing on both biological and behavioral challenges
- Supporting UTS-ISF with testing/validation and an implementation of the WASH GEM with full data collection focusing on gender equality and its connections with WASH.

SALES TRACKING

iDE's team of research assistants collects sales data from each program-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 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 Monitoring and Evaluation 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. Research assistants complete field verification reports and sync to the Salesforce database. If there are at least two misreported cases per LBO, the monitoring and evaluation team conducts follow-up checks for all deliveries of the LBO during the month.

In this report, non-program connected sales figures are calculated based on the latrine count.

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. The most recent customer survey was completed in 2021 and was the first survey that included customers with both Easy Latrines and ADP products. 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. Twenty customers are randomly selected per LBO, with additional customers selected for replacement as needed during field work.
3. Research assistants 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 Monitoring and Evaluation Coordinator regularly checks data to ensure results are complete and accurate.

LATRINE COUNT

iDE conducted the most recent latrine count between July to November 2022 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 midterm of SMSU3 was completed between January and July 2020.

iDE research assistants worked with local leadership to draw a sketch map of the village, identifying the location of

all households. The research assistant visited each household to record the following data:

- latrine ownership (yes/no/shared/abandoned)
- superstructure installation (yes/no)
- latrine type (wet/dry)
- whether the latrine was subsidized (yes/no)
- IDPoor status (1/2/none)

While surveys are administered at a household, the results are aggregated to the village level. iDE's 201,489 household observations are collapsed to 750 primary sampling units for analysis. Table 15 presents the sample profile for the most recent latrine count.

TABLE 15: LATRINE COUNT SAMPLE PROFILE

PROVINCE	DISTRICTS	VILLAGES	HOUSEHOLDS
Kampong Thom	7	105	24,589
Kandal	10	150	51,759
Oddar Meanchey	4	60	12,329
Prey Veng	12	180	50,015
Siem Reap	11	165	42,449
Svay Rieng	6	90	20,348
Total	50	750	201,489

Research assistants collected household data using paper forms, which were field checked and further validated by the Monitoring and Evaluation Manager at iDE's head office in Phnom Penh. The Data Officer entered the data at the Phnom Penh office. The SMSU Monitoring and Evaluation Coordinator conducted field verification of latrine count data.

LATRINE BUSINESS SUSTAINABILITY

Every quarter, research assistants 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. The 30 minute survey was conducted in 2020 and again in 2022 to all of the active LBOs in SMSU3.

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 [Latrine Business Sustainability](#) section of this report brings together all three sources of data for an analysis.