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CREATING VIABLE AND SUSTAINABLE SANITATION ENTERPRISES

Case Study: A Retrospective Analysis of Rural Sanitation Enterprises in Nigeria

MARCH 2020

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ACRONYMS AND ABBREVIATIONS

CBP	Cement Block Producer
CLTS	Community-Led Total Sanitation
COGS	Cost of Goods Sold
DIY	Do-It-Yourself
GMVA	Gross Margin Variance Analysis
GPPC	Gross Profit Per Customer
HP	High Profit
IYC	Infants and Young Children
LGA	Local Government Area
LP	Low Profit
MBS	Market-Based Sanitation
MFI	Microfinance Institution
OD	Open Defecation
P&L	Profit and Loss
SanMark	Sanitation Marketing
STS	Sustainable Total Sanitation
USAID	United States Agency for International Development
USD	United States Dollar
WADI	Water and Development Indefinite Delivery Indefinite Quantity Contract
WASH	Water, Sanitation, and Hygiene
WASHPaLS	Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability
WET	Water Easy Toilet

GLOSSARY OF TERMS

Term	Definition
Capital asset	Equipment (e.g., a truck or mold to cast concrete components) with a useful life spanning multiple years. Capital assets, unlike raw materials, are not "consumed" in the manufacturing and sale of each toilet; their useful life depends on their frequency of use, quality, and maintenance, and their value can depreciate (see definition below).
Cash net profit	The revenue earned from the sale of toilets in excess of all cash expenses incurred by an enterprise. Cash net profit is the amount available to the entrepreneur to take home as income and/or re-invest in the business. Cash net profit differs from the net profit as per conventional accounting norms, which include non-cash expenses such as depreciation (see definition below).
Cost of Goods Sold (COGS)	In the sanitation context, COGS consists of expenses incurred by an enterprise exclusively for the procurement of raw materials and manufacturing or assembly of a toilet or its constituent components. It includes the cost of raw materials (e.g., cement), components (e.g., pans), and labor costs for workers involved in manufacturing, assembly, and installation.
Customer	Member(s) of a household that purchase(s), use(s), and oversee(s) the construction, operation, and maintenance of a toilet.
Demand activation	Direct sales and marketing activities carried out to persuade customers to convert product awareness and interest into a purchasing decision. Demand activation is distinct from "demand generation," which drives increased awareness and interest in hygienic sanitation behaviors and improved sanitation products and services.
Depreciation	The decline in the value of the equipment (e.g., trucks and molds) due to routine wear and tear. A depreciating asset will eventually be replaced after its utility is exhausted. Depreciation is a non-cash expense; while the enterprise makes full payment to purchase the equipment, its cost is spread over its useful life of multiple years and recognized annually. Example: The total cost for a mold with a lifespan of four years is paid in full in Year 1; however, a portion of this cost will be recognized (as a non-cash expense) each year over the four-year period.
Expenses	The expenses incurred by sanitation enterprises comprise costs directly incurred on producing toilets and/ or related services, and other indirect costs not linked to the production of each toilet, but required to operate the business. These expenses include COGS, operational expenses, and other expenses.
Gross Margin Variance Analysis (GMVA)	An analytical method to compare gross profits of the same enterprise from two different periods or budget vs. actual gross profit and identify drivers of differences. In our context, the method has been adapted to compare the gross profits of two different sanitation enterprises and identify the significant drivers of differences in the gross profits. The five drivers analyzed in our context are: "number of customers", "price", "cost", "product mix", and "additional sanitation-related products". The graphical representation of a GMVA comparison is called a "GMVA bridge."
Gross profit	The difference between revenue from the sale of toilets and the Cost of Goods Sold (COGS). Gross profit is a metric of an enterprise's efficiency in converting raw material and labor expended into revenue from the sale of toilets. High gross profit implies that the enterprise is generating significantly more revenue over its costs.

Term	Definition
Market actor	In the sanitation context, an entity from the private, public, or non-profit sector that is not subsidized by donors or philanthropic entities, and participates directly or indirectly in the market by interacting or transacting with other market actors (e.g., sanitation enterprise, input supplier, financial service provider). Non-market actors include entities that are subsidized to play a specific role in the market (e.g., an NGO that implements programs to develop a sanitation market).
Net profit	The difference between an enterprise's total revenues and expenses (as defined above), including non-cash expenses (e.g., depreciation) expressed in absolute terms (e.g., USD). Net profit shows the amount that an enterprise has earned (or lost) over a definite period (typically a quarter or a year).
Non-market support	Financial or operational assistance provided to a sanitation enterprise by a non-market actor to help the enterprise function (e.g., providing a cash grant or supplying free molds to enterprises). Non-market support might impact the enterprise's profitability, viability, and sustainability (see below).
Operating expenses	Expenses on overheads that are required for the enterprise's functioning. Examples of operating expenses include expenses towards rent, utilities, commissions paid to sales agents for selling toilets, maintenance of equipment, etc.
Other expenses	Expenses on items that are unrelated to the core business of the sanitation enterprise. Example: interest payment on a loan taken for purposes not related to the products or services of a sanitation enterprise.
Profit	The difference between revenue and expenses. Profit is expressed in absolute terms (e.g., USD). A negative profit is termed a loss.
Profit and loss statement (P&L statement)	A statement providing a summary of the enterprise's revenues and expenses, to arrive at a profit (or loss) for the enterprise. A P&L statement summarizes an enterprise's financial performance over a definite period (typically a quarter or a year).
Profitability	Profit relative to the revenue of an enterprise expressed as a percentage. Higher profitability indicates an enterprise is able to retain a higher share of revenue after accounting for expenses. Two enterprises with the same profits (e.g., USD 1,000 annually) may have different profitability relative to revenue. The one earning USD 1,000 as profit from sales of USD 10,000 is more profitable (generating a surplus of 1,000/10,000 = 10 percent) than the one earning USD 1,000 from sales of USD 50,000 (2 percent surplus).
Revenue	Revenue for sanitation enterprises is the money received by selling toilets and related services (e.g., installation) if offered and charged separately. Sanitation enterprises typically sell toilets as whole units (i.e., a package comprising the necessary components), individual toilet component(s) (e.g., cement rings, pit covers), or both. Enterprises typically provide two related services to customers—delivery and/or installation of toilets—and either charge separately or include them in the price of the toilet.
Subsidy program	In the sanitation context, an initiative run by a government or non-government entity to provide financial assistance to a customer by paying a part of or the entire price of the toilet purchased by them.
Sustainability	The likelihood that an enterprise remains viable over an extended period of time (i.e., multiple years) and continues operations without external, non-market support.
Viability	A subjective measure of profit relative to a variety of explicit or implicit factors considered by an entrepreneur (e.g., minimum income expected; income from other non-sanitation specific enterprises; time and effort; or financial investment and risk).
Working capital	The money required by a sanitation enterprise to finance its operational and other expenses. An enterprise needs working capital to meet immediate expenses such as raw materials, laborers, rent, and utilities.

PREFACE

The Water, Sanitation and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) project is a 5-year task order implemented by Tetra Tech in collaboration with several non-governmental organizations and small-business partners— Aquaya Institute, Family Health International (FHI 360), FSG, and Iris Group—that contribute expertise in state-of-the-art WASH programming and research. Distinguished academics, practitioners, and policymakers from across the WASH sector regularly provide expert perspectives to the project through an internal research working group and an external WASHPaLS Advisory Board.

WASHPaLS supports the Agency's goal of reducing morbidity and mortality in children under five by ensuring USAID programming employs high-impact, evidence-based environmental health and WASH interventions. The project identifies and shares best practices for achieving sustainability, scale, and impact by generating evidence to support the reduction of open defecation and movement of communities up the sanitation ladder while also focusing on novel approaches for reducing feces exposure to infants and young children (IYC). Specifically, the project:

1. offers USAID missions and technical bureaus ready access to thought leaders and analytical expertise across a wide range of WASH themes in response to their needs (Component 1);

2. generates evidence through implementation research to increase the sector's understanding of and approaches to sustainable WASH services, the effectiveness of behavioral and market-oriented approaches to sanitation, and measures to disrupt pathways of fecal exposure to infants and young children (Component 2);

3. administers a small grants program on innovations in hygiene behavior change (Component 3); and

4. engages and partners with national and global stakeholders to promote the use and application of WASHPaLS-generated evidence and global best practices by practitioners and policymakers, tapping into broad coalitions and dynamic partnerships (Component 4).

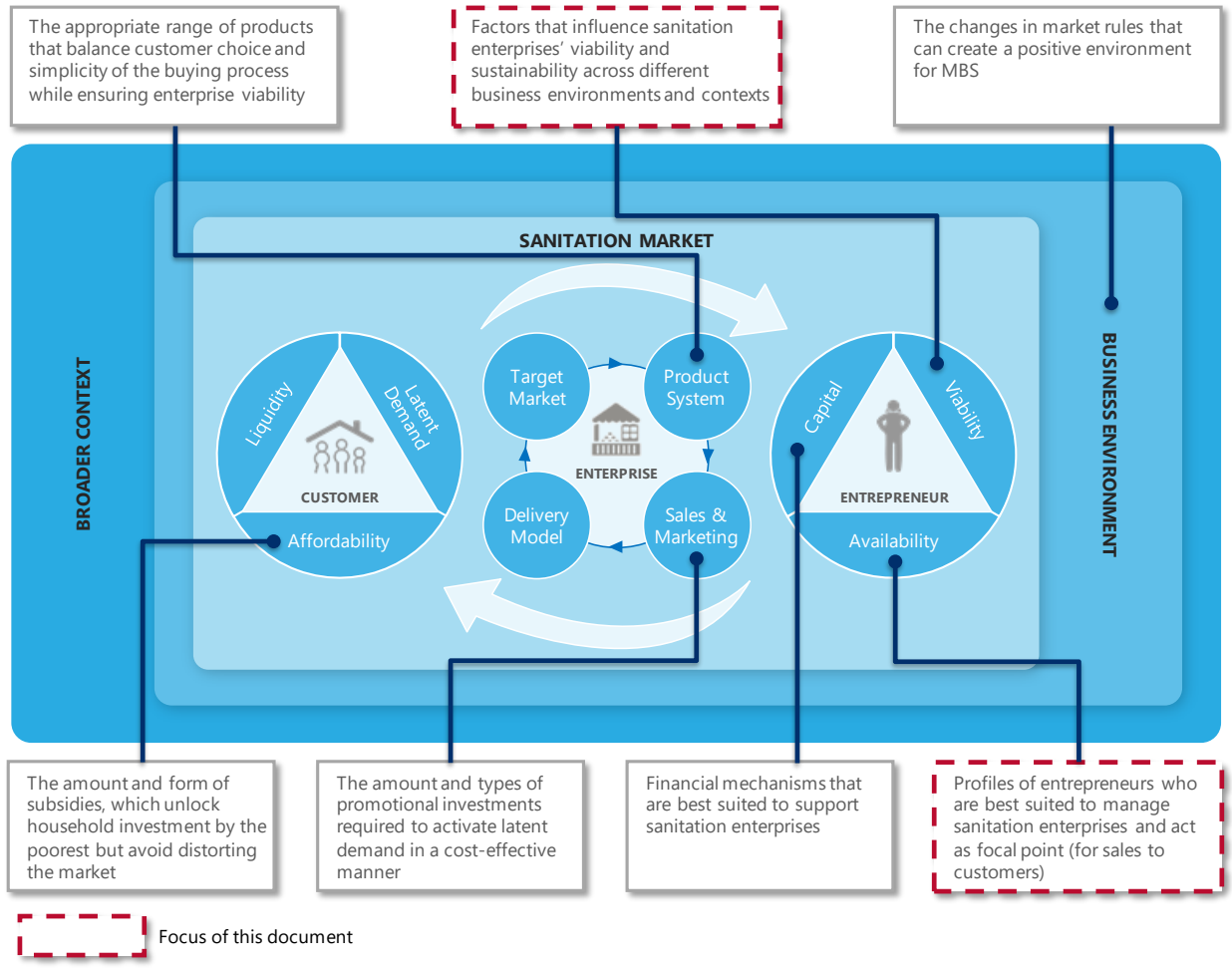
Among the first tasks of WASHPaLS was the production and dissemination of three in-depth desk reviews focusing on community-led total sanitation (CLTS), market-based approaches for sanitation, and hygienic environments for IYC. The desk reviews identified gaps in evidence-based implementation and provided a basis for identifying areas in need of further investigation and implementation research. This case study presents findings and recommendations on one of those areas of research undertaken to support market-based sanitation (MBS), namely, how to ensure the viability and sustainability of rural sanitation enterprises.

EXECUTIVE SUMMARY

Universal access to basic sanitation is a long-standing challenge despite decades of interventions by governments, donors and funders, and civil society. Even though the importance of the private sector for the supply of toilets was recognized as far back as the 1980s, few development programs applying market-based sanitation (MBS) approaches have scaled. The objective of the Water, Sanitation and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) project is to better understand the barriers to scaling MBS interventions and improve programming globally.

The USAID/WASHPaLS *Scaling Market-Based Sanitation: Desk Review on Market-Based Rural Sanitation Development Programs (2018)* highlighted the barriers sanitation markets face to scale, and identified some remedial interventions at the three levels of the sanitation market system—the core **sanitation market** itself, the **business environment**, and the **broader context**. The desk review identified multiple questions for further exploration of areas with inadequate evidence (Figure A). This case study provides carefully collected evidence to understand ***how sanitation enterprises can be made viable and sustainable?***

Figure A: Sanitation Market System and Barriers to scale



This research addresses the enterprise **viability**[1] and **sustainability**[2] questions, for which we conducted retrospective studies in partnership with three mature MBS programs in Cambodia, India (state of Bihar), and Nigeria. As part of the retrospective studies, we realized that few – if any – MBS programs were tracking the financial performance of sanitation enterprises. Therefore, the project team interviewed enterprises that had received technical support from MBS programs to build detailed financial statements. We then undertook comparative analyses to identify the contextual and strategic choices (factors) that drove differences in performance among enterprises within the same program. We also assessed how enterprise-specific support provided by a particular MBS program influenced enterprise viability and sustainability.

This case study examines the experiences of sanitation enterprises that were supported by the WaterAid Sustainable Total Sanitation *(STS)* intervention in Nigeria. We present research findings and make recommendations directed at MBS program implementers to help improve the viability and sustainability of the sanitation enterprises they support.

We did not observe standalone sanitation enterprises in Nigeria. Entrepreneurs more often operated their sanitation enterprise alongside another related business such as concrete products manufacturing or construction material retail, with which it shared such select costs as rent, utilities, or transport. An entrepreneur's strategic decisions made exclusively for the sanitation enterprise are reflected in its *gross profit*, a quantity dependent on its ***number of customers***, the ***price*** of the various products offered, the ***costs*** of manufacturing various products, and the ***relative quantities*** of products (each with different profits) sold by the enterprises.

We utilized Gross Margin Variance Analysis (GMVA) to compare the gross profits of pairs of different sanitation enterprises to identify the significant drivers of differences in their respective gross profits. In the *STS* context in Nigeria, entrepreneurs sought to increase the number of their customers by either ***targeting niche markets or taking active measures to acquire new customers.*** The former strategy, enabled by high tenancy rates and landlord preference to maintain separate sanitation facilities for tenants, helped enterprises primarily target affluent customers. Enterprises implementing this strategy aimed at achieving high profit margins to counterbalance lower sales. The latter strategy was followed by the largest sanitation enterprise in the *STS* intervention, achieving high profits by deploying multiple acquisition strategies to increase sales. The enterprise expanded its sales agent network beyond those trained initially by WaterAid, offering sales commissions and additional monetary incentives to motivate agents (such as plumbers and masons) who were well-positioned to sell toilets to customers looking for home improvement or construction. Finally, it customized product design to meet local preferences while reducing both manufacturing costs and retail prices, which also helped in attracting customers.

Importantly, our analyses revealed that ***sustainability is a challenge for all enterprises*** because of dependence on WaterAid for a critical component: plastic latrine pans, for which there existed no alternative, local, commercial supplier at the time of our field visits. Financial independence (i.e., the ability to meet both recurring operational and capital expenses) varied across enterprises, with some unable to afford capital equipment such as expensive molds. Notwithstanding the enterprises' ability to meet financial obligations independently or fulfill entrepreneur incentives, the dependence on WaterAid for operational needs risked the longer-term continuity of sanitation enterprises.

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[1] Viability is a subjective measure, evaluating profit relative to a variety of explicit or implicit factors considered by an entrepreneur (e.g., minimum income expected, income from other non-sanitation specific enterprises, time and effort, or financial investment and risk).

[2] Sustainability is the likelihood that an enterprise remains viable over an extended period of time (i.e., multiple years) and continues operations without external, non-market-based support.

1. INTRODUCTION

1.1. CONTEXT FOR THE STUDY

Inadequate access to sanitation remains a significant problem globally. According to the UNICEF-WHO Joint Monitoring Programme,[3] 2 billion people still do not have access to basic sanitation facilities, while 673 million people still practice open defecation. Inadequate sanitation is linked to the transmission of numerous communicable diseases—particularly cholera, dysentery, hepatitis A, typhoid, and polio—with a disproportionally large effect on children. The scale of investment required to deliver sanitation services to hundreds of millions of people around the world that currently lack access is likely beyond the capacity of public finance alone.

Market-based sanitation (MBS)—through which private sector actors supply toilets and related services to individual households—is a promising approach to deliver onsite sanitation products and services to low-income populations that are not connected to centralized wastewater collection and conveyance systems. Successful MBS interventions in Southeast Asia and Bangladesh demonstrate the promise of this approach, but the consistent achievement of scale of such interventions has been a challenge. A USAID desk review[4] on MBS interventions identified a range of barriers to scaling sanitation market interventions, which included, among others, an inadequate supply base for toilets.

A central strategy of many MBS programs is to increase the participation of local entrepreneurs in the sanitation value chain, but fostering viable and sustainable sanitation enterprises can be challenging. While the USAID desk review identified a range of tactics and factors that enabled enterprises to grow and thrive, more evidence on the key drivers of enterprise performance was needed. Furthermore, the review determined that implementers of MBS programs typically have a limited understanding of the viability and sustainability of the enterprises within their programs because most do not track the financial performance of enterprises. Monitoring enterprise performance is often limited to the number of toilets sold, which alone does not provide a complete picture; high sales volumes do not necessarily correspond to large profits and *vice versa*. Consider two hypothetical sanitation enterprises: *Acme* and *Best.* Both sell toilets, albeit at different prices, and in different numbers (Table a). Despite *Best* selling only a third of the toilets as *Acme*, it generates a higher *overall* profit because of significantly higher profit *(price less cost) per toilet*. Meanwhile, while both enterprises are, strictly speaking, profitable, they are not necessarily *viable or sustainable* (see Box 1).

Table a. Acme and Best enterprise summary

Metric	*Acme*	*Best*
Price per toilet (a)	*USD 50*	*USD 80*
Cost per toilet (b)	*USD 40*	*USD 40*
Profit per toilet (p=a-b)	**USD 10**	**USD 40**
# of toilets sold (q)	**30**	**10**
Total Profit (p * q)	**USD 300**	**USD 400**

[3] United Nations Children's Fund (UNICEF) and World Health Organization, (2019). Progress on household drinking water, sanitation and hygiene 2000-2017. Special focus on I\inequalities. New York: United Nations Children's Fund (UNICEF) and World Health Organization.

[4] USAID, (2018). Scaling Market Based Sanitation: Desk review on market-based rural sanitation development programs. Washington, DC.: USAID Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability (WASHPaLS).

Box 1: Profit, profitability, viability, and sustainability

Profit is the revenue generated by an enterprise in excess of its costs, expressed in absolute terms (USD).

Profitability refers to profit relative to the scale of an enterprise, such as **profit margin—**the ratio between profit and sales expressed as a percentage. Two enterprises may have equal profits (say, USD 1,000 annually), but one earning USD 1,000 in profit against USD 10,000 in sales is more profitable (10% margin) than another one earning USD 1,000 against USD 50,000 in sales (2% margin).

Viability refers to profit *relative* to one or more of explicit or implicit factors considered by an entrepreneur (e.g., minimum income expected; income from other non-sanitation specific enterprises; time and effort; or financial investment and risk). Unlike profit, or profit margin, which are specific numerical quantities, viability is a subjective measure which varies from entrepreneur to entrepreneur: an enterprise that makes a profit might be considered viable by one entrepreneur but not by another. Improving viability is in large part a function of increasing profits.

Sustainability refers to the *likelihood* that an enterprise remains viable *over an extended period* of time (i.e., multiple years) and continues operations without external, non-market-based support.

To aid MBS program implementers gain a better, more nuanced understanding of the factors influencing the viability and sustainability of enterprises so that they can better tailor the technical support provided, we analyzed the performance of sanitation enterprises supported by MBS interventions in Cambodia, India (state of Bihar), and Nigeria. This case study analyzes the enterprises supported by WaterAid's Sustainable Total Sanitation *(STS)* intervention in Nigeria and is organized as follows:

- Overview of the *STS* intervention and sanitation context in Nigeria,
- Description of the methodology used to analyze the viability and sustainability of the enterprises,
- Background on the three enterprises selected for this comparative case study,
- Findings on the viability and sustainability of the three enterprises, and
- Recommendations.

1.2. BACKGROUND OF THE STS PROGRAM

The *STS* intervention was implemented from July 2012–March 2018, with an aim to increase household demand and private sector supply of high quality, affordable toilets in the rural and peri-urban communities of the Ekiti and Enugu states in Nigeria. WaterAid Nigeria implemented the intervention in collaboration with WaterAid UK, Nigerian Local Government Area[5] (LGA) officials, and local civil society organizations.

The *STS* intervention took a three-pronged approach to achieve its objectives:

- Generate demand through community-led total sanitation (CLTS).
- Strengthen the sanitation supply chain through sanitation marketing (SanMark).
- Undertake randomized controlled trials on CLTS and SanMark to generate evidence of impact.

The project also employed an action learning methodology to support process improvements and a component on influencing sanitation policy and practice in Nigeria. A formative research phase from 2012 to 2013 and the execution of CLTS from 2013 to 2016 preceded the implementation of the

[5] Local Government Area (LGA) is an administrative unit within a state in Nigeria

SanMark activities from 2016 to 2018. This case study focuses on the enterprises that were part of the program's SanMark component, which consisted of three key activities:

1. **Product Development:** WaterAid developed a "water easy toilet" (WET) design based on customer preferences identified during formative research and marketing campaigns. WaterAid initially promoted the WET as a one-toilet model—an offset toilet with a pipe connecting to a pit. Suppliers introduced variations to this model in response to additional customer preferences. This resulted in five variants of the model: three interface/substructure variants for building a new WET and two interface-only variants for upgrading an existing dry pit toilet (see Table 1 and Figure 1). Customers still arranged independently to build a superstructure based on their design preferences and budgets[6].

Table 1: Types, variants, and retail prices of products sold by STS partner enterprises

PRODUCT TYPE	PRODUCT VARIANT	NO. OF INTERFACES	LOCATION OF INTERFACE	PRICE RANGE (USD 2017/18[7])
Combined interface/ substructure (building a new toilet)	Dual Set	2	One above pit; one away from pit	74-106
	Offset	1	Away from pit	97
	Direct Pit	1	Above pit	51-86
Interface-only (upgrading an existing toilet)[8]	Offset Conversion	1	Away from pit	17-24
	Slab Conversion	1	Above pit	16-19

Figure 1: Dual set (left) and offset conversion (right)

Source: WaterAid

2. **Business Model Development:** to simplify the purchasing process, WaterAid promoted a "one-stop shop" model that offered customers all substructure and interface products and services required to build a toilet at a single location.[9] WaterAid recruited cement block

[6] Typical prices of superstructure are not known and are likely to vary considerably from customer to customer.

[7] 1 USD = 350 Naira; used throughout this case study.

[8] The offset conversion and slab conversion allowed customers to upgrade an existing pit or unimproved toilet by adding an interface comprising an offset chamber and an integrated SATO® pan (offset conversion), or sealing the pit with a slab and integrated SATO® pan (slab conversion).

[9] Customers of one-stop shop retailers still must arrange for superstructure materials and installation separately.

producers (CBPs) as one-stop shops because they had the skills (i.e., fabricating concrete products, running a product-oriented business) and access to raw materials (e.g., cement) required for manufacturing the WET. CBPs were responsible for aggregating the substructure and interface materials and components required to manufacture toilets as well as for sales, delivery, and installation.

3. **Business Development Support:** WaterAid supported CBPs in setting up their sanitation enterprises through:

   - Training on manufacturing toilets;
   - One-on-one problem-solving sessions on operating the sanitation enterprise (e.g., analyzing sales, managing customers);
   - Provision of SATO® pans[10] (Figure 1) to the enterprises for USD 2.90 per unit (required for all five product variants);
   - Molds for casting concrete-based components (e.g., pit ring, pit cover, offset chamber box; see Figure 2) loaned without cost to a subset of sanitation enterprises that were invited to join the program;
   - Suggestions on the prices of different products; and
   - Recruitment of local demand activators (sales agents working on commission. typically 10% of the sale value of the toilet, paid by the enterprise).

Figure 2: Concrete pit ring mold

WaterAid identified 129 CBPs in Ekiti and Enugu, who could potentially start sanitation enterprises. Due to a research component of the grant under which this work was completed, WaterAid randomly selected 60 CBPs as a "treatment" group and another 69 as a comparison or "control" group. WaterAid invited all CBPs in the treatment group for its business development support services. Of the 60 CBPs in the treatment group, 30 attended the program, and 11 of those decided to establish sanitation enterprises and actively sell toilets. WaterAid supported and monitored these 11 CBPs in their sanitation enterprise activities from 2016 to 2018.

The 11 CBP sanitation enterprises supported by WaterAid sold 350 toilets in the 12 months from April 2017 to March 2018 (i.e., the financial year 2017/18). Combined interface/substructure products constituted 25% of overall toilets sold, while interface-only products constituted the remaining 75%.

[10] SATO stands for "Safe Toilet". SATO toilet pans are plastic pans with an automatically-closing trapdoor to block odors and insects. These relatively affordable and easy-to-install toilet pans were developed by a subsidiary of the LIXIL Group – a manufacturer of water and housing products headquartered in Japan and having commercial presence in a number of countries across the world.

1.3. SANITATION CONTEXT IN NIGERIA

WaterAid determined that prior to the intervention's inception in 2015, 42% of Ekiti's population and 40% of Enugu's population had access to improved sanitation. Open defecation (OD) was practiced by 53% of Ekiti's population and 50% of Enugu's population.[11]

Unserved households seemed to prefer practicing OD over installing low-quality toilets, which would often smell and expose them to warm air generated from pits (known as "pit heat"). Though largely out of their affordability range, they aspired to have "ideal" water-based, concrete toilets. Households that did purchase toilets tended to follow a do-it-yourself (DIY) model for installing toilets, in which they were compelled to coordinate with multiple suppliers to procure raw materials and artisans (e.g., pit digger, bricklayers, iron-benders, carpenters, and plumbers) to construct in-situ. CBPs sold concrete blocks, primarily for walls or rings for use in wells, and rarely for lining pits. Hardware retailers rarely sold ceramic squat pans directly to customers, selling instead to plumbers who, in turn, would handle frontline sales and installation.[12]

1.4. INTERVENTION PERFORMANCE SUMMARY

WaterAid's 11 CBP sanitation enterprise partners sold 350 toilets over 12 months for the financial year[13] 2017/18. [14] "Interface & substructure" products constituted 25% of overall toilets sold, while 'interface' products constituted the remaining 75%.

Unfortunately, because of the RCT research design, changes to the size and composition of the pool of CBP sanitation enterprises were not permitted. The intervention could not recruit new enterprises or replace poor performers. The RCT research design also limited the geographic scope where sanitation enterprises were allowed to sell toilets.

[11] WaterAid, (2016). Sustainable Total Sanitation deep dive in Enugu, Ekiti and Jigawa States, Nigeria.

[12] Primary research interviews with WaterAid staff.

[13] The financial year 2017/18 represents the time period between April 2017-March 2018. All enterprise data in this case study is for this time period, unless stated otherwise.

[14] FSG research

2. METHODOLOGY

To help MBS programs improve the viability and sustainability of sanitation enterprises, we sought to understand the factors that differentiated enterprises at different levels of profit. We assume that viability and, by extension, sustainability, is largely a function of profit (see Box 1). We also recognized that contextual factors often favor or limit the ability of enterprises to implement business practices to improve their profits. Therefore, we studied enterprises in both *STS* states to ensure we accounted for variation in operating contexts.

We followed a three-step process:

- **Direct interviews**: We conducted detailed interviews with all 11 entrepreneurs that were part of the STS program
- **Viability Analysis**: We categorized enterprises based on their revenues and profit, and then undertook a comparative analysis of enterprises selected from each "revenue vs. profit" category to identify the business practices and contextual factors that might explain differences in profits and thus impacted viability.
- **Sustainability Analysis:** Based on the viability analysis and our understanding of the *STS* program, we assessed enterprise sustainability.

We conclude with both general and specific recommendations for improving the viability and sustainability of sanitation enterprises, within the limitations posed by context.

2.1. DIRECT INTERVIEWS

The primary data on which this study is based come from in-person interviews with the 11 entrepreneurs who actively sold toilets as part of the *STS* program. Interviews focused on understanding economics (i.e., revenue, costs, and profit), strategic choices, and challenges faced by sanitation enterprises. We also examined the financial performance of 12 CBPs who did not start sanitation enterprises or had started but discontinued operations (collectively referred to as inactive enterprises)[15]. We also interviewed other value chain players to understand the broader ecosystem for sanitation enterprises. Figure 3 presents the detailed interview schedule. WaterAid provided extensive guidance and field support to conduct the interviews.

Figure 3: Interviews conducted and research locations

Districts	Active enterprises	Inactive enterprises	Demand activators	Input suppliers	Financial institutions
Enugu	6	5	4	2	2
Ekiti	5	7	3	3	1

[15] Eight CBPs attended WaterAid training but did not start sanitation enterprises or discontinued them because they did not sell any toilets. Four CBPs were situated near the active sanitation enterprises but were not selected by WaterAid for training or support as part of its intervention. We interviewed the latter to understand their awareness and/or lack of interest in starting sanitation enterprises after observing their neighboring CBPs who were running sanitation enterprises.

2.2. ANALYTICAL APPROACH

To understand the factors that improve viability, we undertook a comparative analysis among enterprises with different levels of revenue and profit. We also identified factors likely to affect the sustainability of enterprises in the *STS* context and assessed the performance of different enterprises with respect to these factors. Our methodology for each of these analyses is presented below.

2.2.1. ANALYSIS OF DRIVERS TO IMPROVE PROFIT

To evaluate the performance of enterprises, we needed data not only on sales volumes (collected by WaterAid) but also on prices, costs, revenues, and profits. We collected these data in our interviews with the enterprises (as well as other value chain players) to prepare profit and loss (P&L) statements for the 11 enterprises (see Appendix 7.1 for definitions and additional details on P&L Statements). The primary metric we computed to assess profit was **cash net profits**[16], which can be understood as the "bottom line" of the businesses and which exclude non-cash expenses, such as asset depreciation. By contrast, the term **net profit** includes non-cash expenses. We opted to analyze the businesses based on **cash net profits** because these small rural sanitation enterprises typically understand profit in terms of cash and do not account for non-cash expense items. **Henceforth, we refer to cash net profits as "profits" unless mentioned otherwise.**

We then classified enterprises into four categories (see Figure 4) based on profit and revenue to study the differences between high-performance and low-performance enterprises.

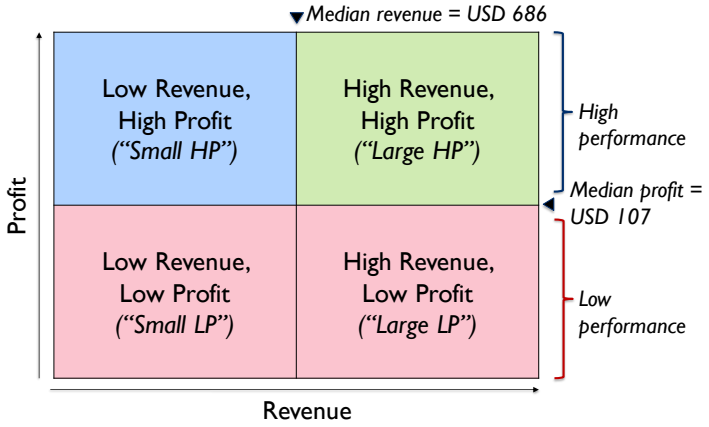
- **Profits**: we classified enterprises as either "high profit" or "low profit," using the threshold of USD17 107 (the median profit for our research sample) to separate the two classes. For reference, a full-time mason (a comparable occupation that employs the technical skills required for a sanitation enterprise) typically earns USD 940 annually.18 Since the entrepreneurs we interviewed spend the bulk of their time on their primary business of concrete block production, a small fraction of the full-time mason income can be approximated as the minimum profit expected from the sanitation enterprise.
- **Revenues**: we classified enterprises as "high revenue" and "low revenue" using the median sales revenue (USD 686) in 2017/18 as the threshold between the two classes. We hypothesized that enterprises adopt different profit-maximizing strategies at different scales. We chose the median as it is a neutral metric (i.e., it is not impacted by the presence of a few abnormally high or low values in the sample), and offered a reasonable approach to separating "high" and "low" revenue enterprises.

[16] AccountingTools, Inc. How to calculate cash profit. 7 August 2019. <https://www.accountingtools.com/articles/how-to-calculate-cash-profit.html>

[17] 1 USD = 350 Nigerian Naira (NGN); used throughout this case study.

[18] We assume mason income to be 1500 Naira (USD 4.29) per day based on interviews with entrepreneurs in our research. Conservative estimate of mason income: USD 4.29 per day X 6 days per week X 4.3 weeks per month X 8.5 months of active labor (adjusting for 3.5 months of downtime during and around the monsoon season) = ~USD 940.

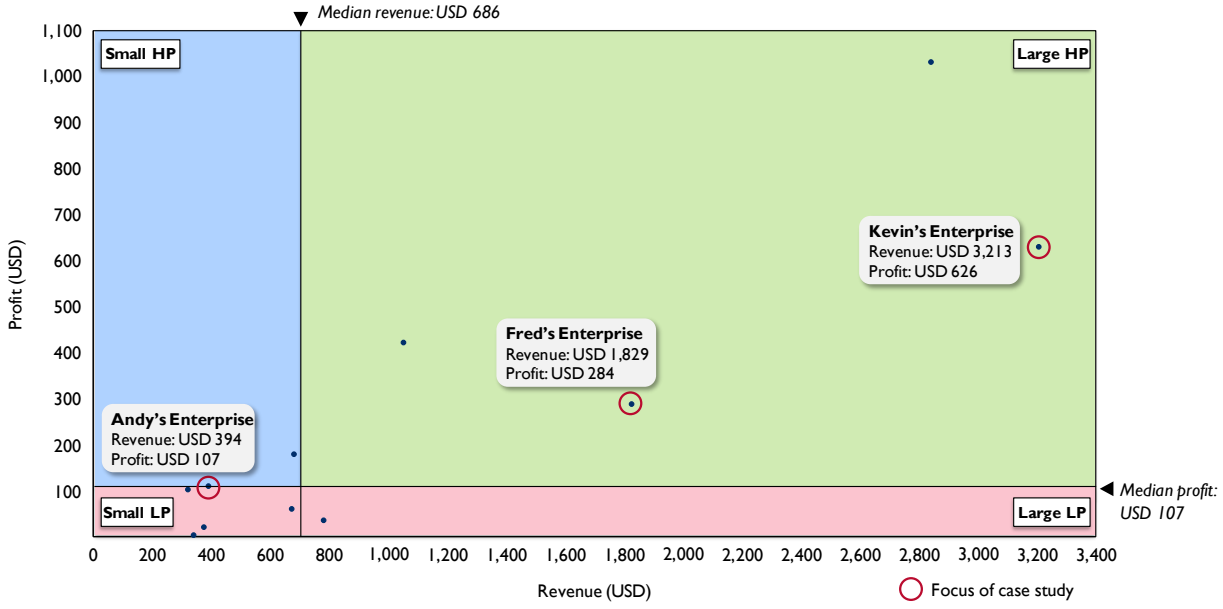
Figure 4: Enterprise performance categories



We chose to employ these thresholds, but we note that we could have used other techniques to define the business categories. These thresholds met our objectives of 1) being computationally straightforward and 2) coming up with categories that differed significantly in terms of performance to enable an analysis of differences.

In Figure 5, we plot the position of the 11 active enterprise-sample from the *STS* program relative to the four categories. Most are either in the low revenue, low profit ("Small LP") or high revenue, high profit ("Large HP") categories.

Figure 5: Profit (USD) vs. revenue (USD) for sanitation enterprises supported by the STS program (2017/18) (n=11)



To understand the strategic choices that drive enterprise performance, we selected enterprises from the "Large HP" and "Small LP" categories for further analysis (circled in Figure 5). We did not analyze the "Small HP" or "Large LP" enterprises because they were "borderline" examples and close to "Small LP" enterprises in performance and practice. We chose *Andy's enterprise*, a relatively low-performing "Small LP" enterprise that sold both interface/substructure and interface-only products, to study the

impact of selling different types of products. Our selection of the two "Large HP" enterprises (*Fred* and Kevin) was intended to highlight different strategies and market conditions revealed in interviews.

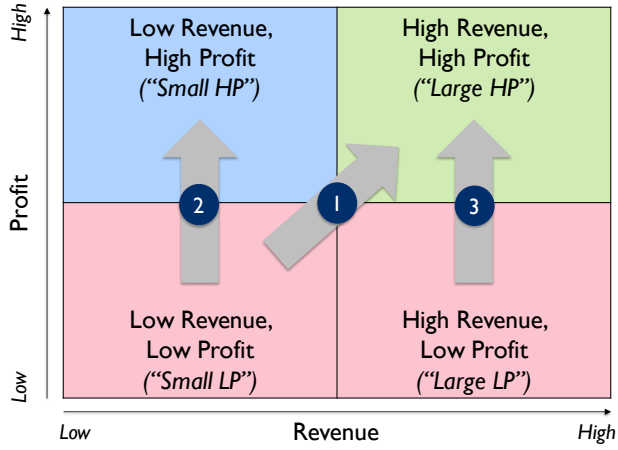
Our analyses sought to identify a range of lessons on improving viability, on the premise that enterprises in different categories employed distinct business practices, and/or operated under different conditions.

We compared *Fred's* and *Kevin's enterprises* to *Andy's enterprise* using a methodology called Gross Margin Variance Analysis (GMVA—see Appendix 7.2 for a detailed explanation). GMVA examines a measure of financial performance called **gross profits:** the difference between revenue from the sale of toilets and costs incurred exclusively for manufacturing the toilets sold (see Box 2). As GMVA can only be conducted between two enterprises at a time, we conducted the following comparisons:

- "Small LP" vs. "Large HP" (*Andy's enterprise* vs. *Fred's enterprise*), and
- "Small LP" vs. "Large HP" (*Andy's enterprise* vs. *Kevin's enterprise*).

These comparisons reflect the different paths that enterprises can take to improve viability (see Figure 6). Herein, we have examined two paths to help enterprises improve viability: Path 1 and Path 2. Path 1 reflects strategies to grow a "Small LP" into "Large HP" enterprise, considering that the majority of enterprises studied belonged to these two categories. Path 2 presents an approach to growing "Small LP" enterprises into "Small HP" enterprises. We did not analyze Path 3—the path from "Large LP" to "Large HP"—because the "Large LP" enterprise actually exhibited many of the characteristics of "Small LP" enterprises, including a small customer base and a product mix geared toward sales of low profit interface-only products. We deemed the strategies for Path 1 also to be applicable for the "Large LP" enterprise to improve its viability.

Figure 6: Potential path(s) to improve the viability of sanitation enterprises



We note that this analysis relies on cash net profits to **categorize** enterprises but on gross profits to **compare** the drivers of their performance; see Box 2 for an explanation of why this is so. GMVA decomposes the difference in gross profits between two enterprises into its constituent components, or drivers. The four drivers are the following:

- The number of customers that bought different products from the enterprises;
- The prices of the different products sold;
- The costs of manufacturing different products; and
- The relative quantities of the common, sanitation-related products (i.e., substructure and interface components) sold by enterprises (also known as *product mix*).

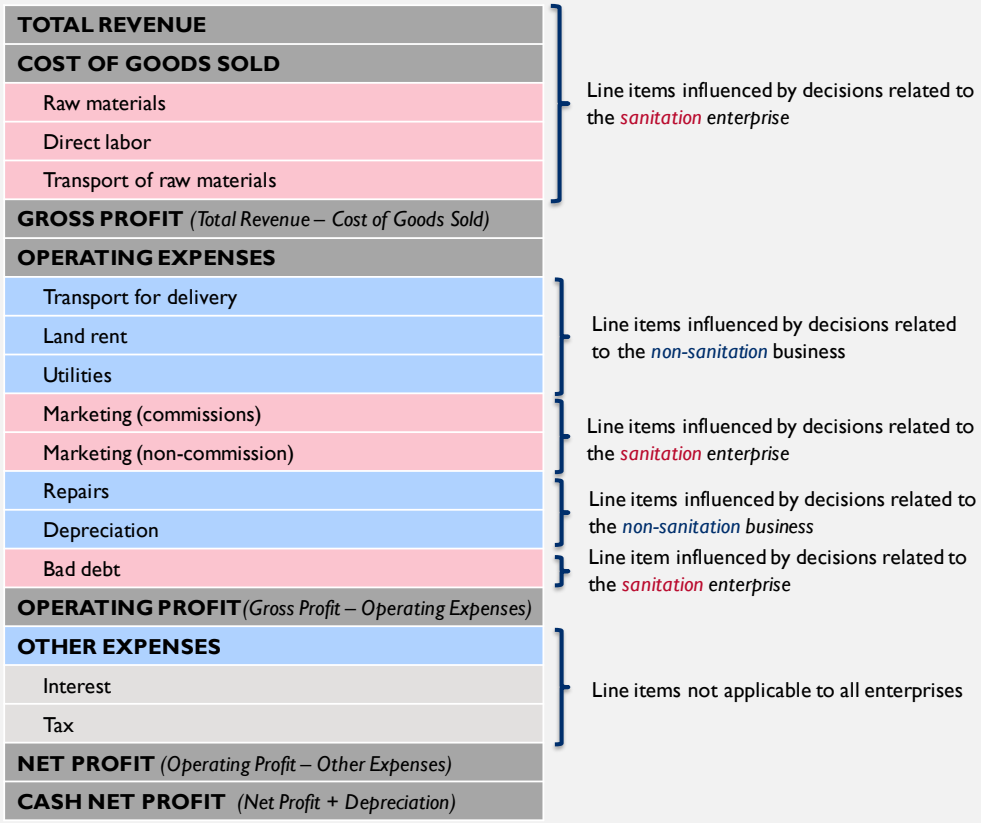
Box 2: Why use one financial measure (cash net profit) to categorize enterprises and a different one (gross profits) to compare them?

Sanitation enterprises are generally not stand-alone businesses; they function as one of multiple business lines operated by an entrepreneur. To understand how effectively a sanitation enterprise is contributing to an entrepreneur's overall financial success, cash net profits are ideal because they represent the "bottom line": profits realized after accounting for all cash expenses. The higher the cash net profit of a sanitation enterprise, the more likely an entrepreneur will deem it "viable", that is worthy of the time, investment, and opportunity cost.

Gross profits, on the other hand, are better for understanding the differences in financial performance of sanitation enterprises (as one of multiple businesses) because the measure focuses on the two most basic financial line items: revenue, and the cost of goods sold (COGS)—the costs of manufacturing toilets (see Figure 7 for a list of line items of a Profit & Loss statement). *An important difference between gross profits and cash net profits is that gross profits exclude expenses that are influenced primarily by the entrepreneurs' other non-sanitation related business (or businesses), such as rent and utilities*. Entrepreneurs are unlikely to make decisions on factors such as location of the workshop or investment in transport vehicles solely for the sanitation enterprise, as they will also consider the requirements of their other business (or businesses). Cash net profits also include other expenses such as interest payments and taxes, which are not comparable across enterprises since access to finance and compliance with tax codes vary widely considering the informal nature of most rural sanitation enterprises in developing countries.

It is also worth noting that COGS typically constitute the majority of total costs for sanitation enterprises (85% of total costs at the median level for the 11 enterprises in the *STS* program). The potential to improve cash net profits, therefore, is primarily driven by the potential to improve gross profit.

Figure 7: Line items of a Profit & Loss Statement of a typical sanitation enterprise



Our application of GMVA, in which we compare two different enterprises, is novel; the conventional application of GMVA is for a single business to compare budgeted profits to actual profits or to compare profits from different accounting periods, in order to identify the drivers that explain the differences. While we are enthusiastic about the utility of GMVA to understand profit drivers of different businesses, we offer the following limitations of the method.

First, GMVA does not account explicitly for the role of market conditions (e.g., customer preferences or availability of raw materials) in influencing viability, as they are not quantified or directly attributed to any of the five drivers. To overcome this limitation, we complemented GMVA with a qualitative analysis of the market conditions of each enterprise, and describe their role throughout the Findings and Recommendations sections.

Second, the results from the GMVA may vary depending on the enterprises selected for analysis. GMVA can only be conducted between two enterprises at a time, and different pairs of enterprises may reveal different differences in profit drivers. While our selection of enterprises for this case study was aimed at highlighting the impact of a range of drivers, we also conducted GMVA on a few other enterprise pairs to improve the external validity of our findings and arrive at broad-based recommendations in the *STS* context. Recommendations for a specific enterprise could, however, vary based on the GMVA results from comparison with another enterprise. Appendix 7.2 provides a detailed explanation of GMVA, and Appendix 7.3 illustrates additional GMVA analyses.

2.2.2. SUSTAINABILITY ANALYSIS

The three entrepreneurs highlighted herein received support from WaterAid to start and operate their sanitation enterprises; the sustainability of their sanitation enterprises depends largely on the entrepreneurs' ability to finance and operate without ongoing non-market support (e.g., management of demand activators and/or access to inputs through implementers of MBS programs). Since all the entrepreneurs in the *STS* program also operate a cement block business, sustainability also depends on the entrepreneur's perception of its viability (and, in turn, their willingness to remain invested) relative to the cement block business.

We analyzed financial and operational sustainability independently, employing a methodology for each factor outlined below:

- **Financial independence:** we estimated an enterprise's ability to pay for all recurring expenses (i.e., day-to-day operations) and their ability to make reinvestments (i.e., long-term capital expenditure such as equipment) in the absence of external non-market support provided by MBS programs. We assessed the ability to pay for recurring expenses by identifying any recurring expenses for which enterprises were dependent on WaterAid. As for recurring reinvestment expenses, in the *STS* context, these were USD 170 molds provided at no charge by WaterAid, typically requiring replacement within three years.
  - We assumed that the profits of enterprises stay at their current levels for the next three years. We calculated the share of profit that enterprises would need to set aside each year to replace the molds in three years.
  - We note that in some instances, enterprises may receive one-time financial support from WaterAid, but we did not consider such support for assessing financial independence since it will not impact future financial performance.

- **Operational independence:** This was assessed based on the determination of any ongoing (non-financial) support that enterprises received from non-market actors, or else the presence of alternate market actors to provide the same support after non-market actors exit the market.
  - We identified the ongoing non-financial support provided by WaterAid; in the *STS* context, these were the supply of molds and SATO® pans.
  - For each, we evaluated if alternate local market actors were present, based on interviews with entrepreneurs and local market actors.
  - We also note that in some instances, enterprises may receive one-time operational support (such as the initial training offered by WaterAid on manufacturing toilets), but we did not consider such support for assessing operational independence since enterprises are unlikely to need the support again in the future.

3. ENTERPRISE BACKGROUND

Kevin, Fred, and *Andy* are entrepreneurs running sanitation enterprises in Nigeria. On the surface, they share some common characteristics—they have been running cement block businesses for many years and participated in WaterAid's *STS* program. But they have distinct backgrounds, and the performance of their sanitation enterprises is very different. This section provides a brief background of each entrepreneur and their sanitation enterprise.

3.1. KEVIN

Kevin's enterprise is located in the Igbo Eze North LGA of Enugu. He started his journey as an entrepreneur many years ago with a cycle repair shop, and then shifted to manufacturing and selling cement blocks in 2009. His cement block business is flourishing, with three workshops.

WaterAid approached *Kevin* about starting a sanitation enterprise in 2015. *Kevin* was excited and saw synergies with his cement block business—he believed that customers of his cement block business, especially those purchasing blocks for home construction or improvement, would also be interested in purchasing toilets. *Kevin* trusted his entrepreneurial acumen to grow another business alongside the cement block business. His sanitation enterprise has been successful—he sold 130 toilets in 2017/18 (the highest in the *STS* program) and recently invested in a new plot of land and a truck for the sanitation enterprise.

He is bullish about the sanitation enterprise and plans to expand by setting up branches in other LGAs.

3.2. FRED

Fred's enterprise is located in the Ekiti South West LGA of Ekiti. He is a young entrepreneur and has faced many challenges in running his own business. He started a cement block business in 2013, but the business was difficult to operate, and income was unstable. When WaterAid approached him about starting a sanitation enterprise, he was skeptical of starting a new business. However, he needed extra money to stabilize his income and took the plunge.

He is grateful for the opportunity as he suffered from theft and lost a lot of money in 2017. The sanitation enterprise provided him with the means to feed his family during this difficult period. His sales volumes remain fairly low (23 toilets in 2017/18), but he is satisfied as the sanitation enterprise continues to provide supplemental income.

Fred believes the sanitation enterprise can grow because he is the only supplier of toilets in his LGA. He hopes to create alternative toilet models that are smaller and easier to transport to increase his sales and reduce costs.

3.3. ANDY

Andy's enterprise is located in the Ido Ekiti LGA in Ekiti. He started selling cement blocks straight out of school after getting a loan from his father. He has been in the business for 15 years, while also active in local politics.

He liked the idea of selling toilets when WaterAid approached him because he believed that his community would benefit from improved sanitation. However, he had limited success. It took him time

to learn the manufacturing process, and he is reluctant to invest in building a stock of toilets, as sales are slow. During 2017/18, he only sold 10 toilets.

Andy is content to continue selling toilets whenever customers ask for one, but he does not believe there is sufficient demand for toilets to justify actively investing in growing the sanitation enterprise. His focus remains on growing his cement block business, and for that, he is planning to shift to a new location closer to the city.

4. FINDINGS

The three enterprises selected for analysis differ significantly in their performance. Given that all three entrepreneurs initiated sanitation enterprises with WaterAid's support, we explore two key questions:

- What were the business practices and enabling conditions that differentiated the sales and profits of the three sanitation enterprises?
- What is the sustainability of the three sanitation enterprises after the end of the STS program?

4.1. IDENTIFYING DRIVERS TO IMPROVE PROFIT

We employed GMVA to compare the gross profits of the "Small LP" enterprise (*Andy's enterprise*) to the two "Large HP" enterprises (*Fred* and *Kevin's enterprises* respectively) and quantify the drivers of the differences in gross profits between enterprises.

While all three enterprises offered all five variants in 2017/18, none were able to sell all models on offer, as indicated in Table 2.

Table 2: Products sold (2017/18) by enterprise

PRODUCT TYPE	PRODUCT VARIANT	ANDY ("Small LP")	FRED ("Large HP")	KEVIN ("Large HP")
Interface/ substructure	Dual Set	✓	✓	✓
	Offset	×	✓	×
	Direct Pit	×	×	×
Interface-only	Offset Conversion	✓	✓	✓
	Slab Conversion	×	×	✓

The potential drivers of differences in gross profit between enterprises are:

- Difference in the number of customers that bought these products from the enterprise,
- Difference in the prices of these products,
- Difference in costs of manufacturing these products, and
- Difference in the proportion of these products sold (also known as "product mix").

Figure 8 and Figure 9 are diagrams known as GMVA "bridges" (see Box 3), breaking down these four drivers of difference in gross profits between the enterprises.

Box 3: Interpreting GMVA bridges

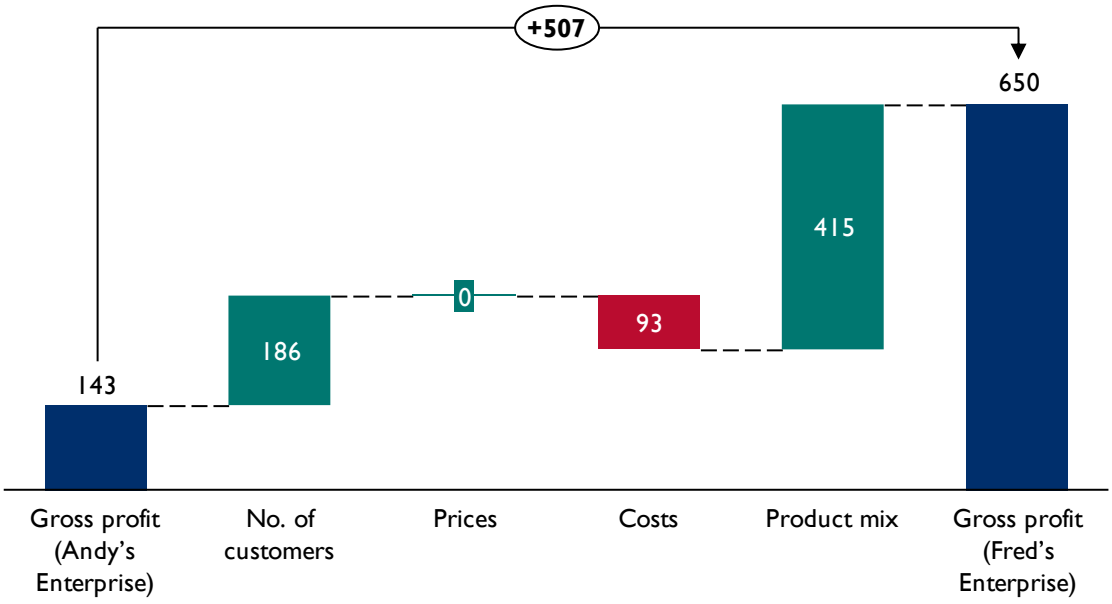
The GMVA "bridge" between two enterprises decomposes the overall difference in their gross profits (represented by the first and the last *blue* bars) into their constituent "drivers." The drivers are represented by the "floating" bars between the blue gross profit bars of the two enterprise on each end of the diagram and consist of the following:

- The **number of customers** to whom they sold,
- The **prices** charged by the two enterprises for the same product(s),
- The **costs** incurred by the two enterprises to manufacture the same product(s), and
- The proportion of the average number of units of common products sold per customer (known as the **product mix**).

The height of each bar signifies the impact of the corresponding driver on the gross profit difference between the two enterprises.

The *green* and *red colors* of each bar indicate whether the effect on gross profit difference is *positive* or *negative* with respect to the enterprise on the right. For example, if the enterprise on the right enjoys *higher prices* or *lower costs* than the enterprise on the left, the corresponding bars will appear *green* because they represent a gross profit advantage to the enterprise on the right. Conversely, if the enterprise on the right suffers *lower prices* or *higher costs* than the enterprise on the left, the corresponding bars will be red because they represent a gross profit disadvantage.

Figure 8: GMVA bridge (USD) between Andy's enterprise and Fred's enterprise

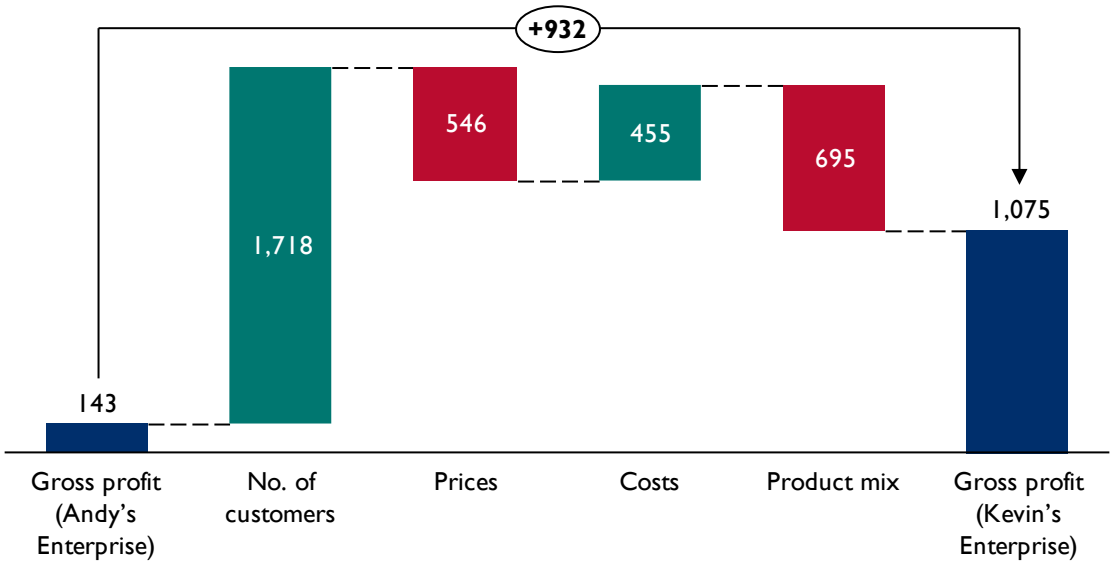


The GMVA bridge in Figure 8 shows *Fred's enterprise* earning USD 507 more annual gross profit than *Andy's enterprise* primarily because:

- *Fred* sold a significantly higher proportion of interface/substructure products, which generated approximately ten times the profit per unit compared to interface-only products (see Section 4.1.4).
- *Fred* enjoyed a larger, more affluent customer base (see Section 4.1.1).

Fred's enterprise did incur higher costs (see Section 4.1.3), but this disadvantage was more than compensated by his relatively more affluent customer base and product mix advantage (larger share of the high-profit dual sets sold) over *Andy's enterprise*. There was no difference in the prices they charged.

Figure 9: GMVA bridge (USD) between Andy's enterprise and Kevin's enterprise



Kevin's enterprise generates annual gross profits that exceed those of *Andy's enterprise* by USD 932 (Figure 9), driven by *Kevin's* larger customer base and his lower costs. These advantages offset *Kevin's* less favorable product mix and lower prices.

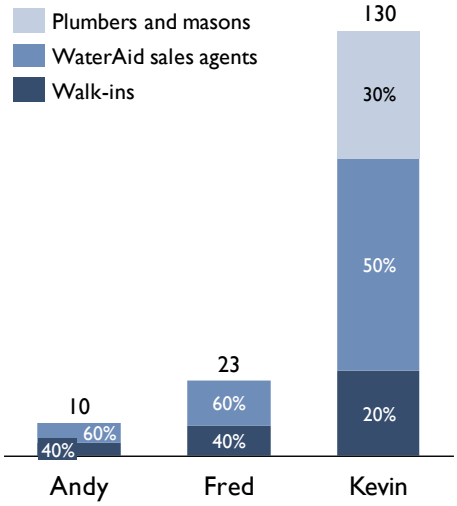
These two GMVA bridges reveal that any of the four drivers—number of customers, prices, costs, and product mix—may play an important role in differentiating the gross profits of sanitation enterprises. Each of these is discussed further below.

4.1.1. NUMBER OF CUSTOMERS

Among the three enterprises, *Kevin's enterprise* had a significantly larger customer base than the other two enterprises, driven by his greater use of demand activation initiatives targeted at acquiring new customers. These included actively investing in his sales agent network and providing his customers with greater product choice (e.g., different sizes of the offset conversion variant of the interface-only product).

Like all entrepreneurs in the WaterAid program's intervention group, *Kevin* was offered access to sales agents recruited by WaterAid and trained to sell toilets in exchange for a commission. The sales agents were looking for additional opportunities to earn income, as they had limited employment opportunities. *Kevin* recognized the potential of this sales mechanism—the agents would promote his business while he would incur a modest cost (typically 10% of the price of the toilet) only when they made a sale. He decided to leverage this sales mechanism by expanding his sales agent network beyond the agents trained by WaterAid and included local plumbers and masons as well. These tradesmen, who were already interacting with customers undertaking home construction or improvement, were an effective sales channel for *Kevin's enterprise* and contributed to a third of his sales, as shown in Figure 10.

Figure 10: Toilets sold by sales channel by enterprise



Kevin's recognition of the potential of demand activation motivated him to offer sales agents opportunities to add to their commission earnings by allowing them to sell installation and delivery services directly to customers (which *Kevin* would typically provide himself). While *Kevin* had to forego a small amount of revenue (~USD 5 for installation and delivery per toilet) for 20% of his toilet sales to his sales agents (he did the delivery and installation himself for the other 80%),[19] the arrangement provided additional incentive to the sales agents and motivated them to generate more business (i.e., new customers for *Kevin*). *Kevin* further strengthened his relationships with the agents by meeting with them frequently, in groups or individually, to take stock of their performance, understand their challenges, and design sales strategies. A motivated sales force helped *Kevin's enterprise* to not only generate the highest sales among WaterAid-supported enterprises but also keep abreast of customer reactions to his products, informing future strategy.

> *"I am open to giving anyone a commission for selling my toilets. Plumbers and masons pick up toilets from my shop. They earn an extra income while I get my asking price without having to deliver and install. It's a win-win situation."* - Kevin

Fred and *Andy* were more passive in their marketing. They limited their sales network to sales agents recruited by WaterAid and did not explore further avenues for acquiring customers. Their interactions with sales agents were strictly transactional, occurred only at the time of an order, and they did not provide any other opportunities for their sales agents to earn outside of their sales commissions.

Kevin also recognized the need to re-engineer his products to give greater product choice to customers. He adapted the standard product design by developing his own molds and reducing the sizes of his offset conversions. His smaller offset conversions were less expensive and easier to transport, contributing 42% of *Kevin's* total sales volumes. By contrast, *Fred* and *Andy* restricted themselves to the standard sizes provided by WaterAid. It is worth noting that customizing products to local conditions appears important in attracting customers—*Fred* was actively considering reengineering his products at the time of the research to attract customers with smaller, less expensive toilets.

[19] The other two enterprises did delivery and installation for 100% of their toilet sales.

4.1.2. PRICES

Kevin's enterprise charged lower prices than *Fred's* and *Andy's enterprises*, in part because he used lower quantities of materials for his smaller offset conversions and passed on the savings to customers in the form of lower prices, and in part because of his location in Enugu. Prices charged for a given toilet product were broadly similar for all enterprises within a state, but differed between states, with prices higher in Ekiti than in Enugu.

We determined that enterprises within a given state charged the same or similar prices because they mistakenly believed that prices suggested by WaterAid were contractually binding. Without exception, entrepreneurs were committed to honoring this perceived agreement to the extent that they maintained prices over time, even if it meant not acting in the face of higher costs.

> *"WaterAid suggested prices of the toilets. Since they introduced me to the sanitation business, I am selling toilets at the same prices as the start of the program." - Fred*

4.1.3. COSTS

Fred's enterprise incurred higher costs than the other two enterprises because it is located in an area lacking suppliers of stone dust,[20] a critical input for cement ring, and interface chamber production. Without local suppliers, *Fred* was forced to procure stone dust from a supplier in a different LGA at a significant premium (due to higher transport costs), paying about USD 1.50 per head pan.[21] By comparison, *Andy's enterprise* bought stone dust at USD 0.60 per head pan, and *Kevin's enterprise* procured a combination of sand and chipping stone at USD 0.80 per head pan. As

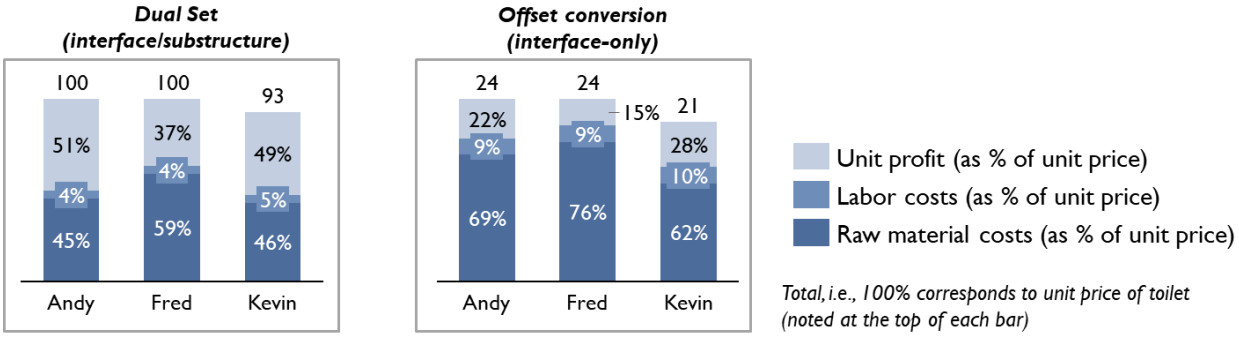
[20] Stone dust is a raw material mentioned by entrepreneurs, comprising a mixture of sand and chipping stone.

[21] Head pan is a unit of measurement typically used for construction materials. A head pan typically has a volume of ~1,000 cubic inches.

Figure 11 illustrates, *Fred's enterprise* generated lower unit profit[22] from each sale than *Andy* and *Kevin's enterprises* because it faced higher raw material costs. In spite of this, *Fred's enterprise* still realized considerably higher overall profits than *Andy's enterprise* because it sold more toilets, especially the highly profitable interface/substructure products (as illustrated by the GMVA bridge in Figure 8).

[22] Unit profit is defined as the price of one unit of a product less the cost of manufacturing one unit of the product.

Figure 11: Cost structure, profitability, and price (USD) of the dual set and the offset conversion[23] products by enterprise



Kevin's enterprise had lower costs for manufacturing offset conversions (

[23] The cost structure of *Kevin's* offset conversion is for his "average" offset conversion, as he sold different sizes of offset conversions at different prices. It is estimated as follows:

- Price of "average" offset conversion = (Total revenue from sales of different offset conversions)/ (Total number of offset conversions sold)
- Labor cost of "average" offset conversion = (Total labor cost for manufacturing different offset conversions)/(Total number of offset conversions sold)
- Raw material cost of "average" offset conversion = (Total raw material cost for manufacturing different offset conversions)/(Total number of offset conversions sold)

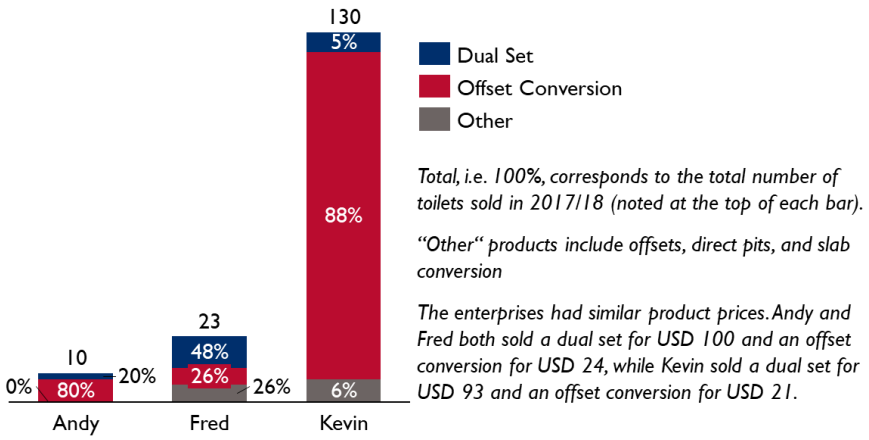
Figure 11) because it developed smaller-sized offset conversions to give a greater choice in interface-only products to customers. The smaller offset conversions required lower quantities of materials, which reduced the raw material costs for *Kevin's enterprise*.

4.1.4. PRODUCT MIX

Among the three enterprises, *Fred's enterprise* had a significantly higher proportion of sales of the more profitable interface/substructure products—selling dual sets to 48% of his customers compared to 20% and 5% for *Andy* and *Kevin's enterprises*, respectively (Figure 12). These combined interface/substructure products could be sold for higher prices and yield higher profits in both absolute dollar terms and as a percentage of the sales price (unit profit margin) (see

Figure 11).

Figure 12: Product mix of the three sanitation enterprises (2017/18)[24]



The demand for particular types of products depended on broader contextual factors. For example, *Fred* attributed the sales of interface/substructure products to local customer preferences. His typical customers were relatively affluent, more willing to buy dual sets or offsets for the convenience and hygiene of keeping the pit separate from the living area. He also noted that he had landlords as customers who bought dual sets such that one of the two interfaces was situated outside the landlord's house for tenants. *Andy* and *Kevin* did not enjoy these more favorable market conditions, and hence, could not achieve comparable sales of the more profitable interface/substructure models.

4.1.5. SUMMARY OF VIABILITY ANALYSIS

Kevin's and *Fred's enterprises* leveraged different drivers to achieve 7.5 and 4.5 times the gross profits of *Andy's enterprise*, respectively, and thus improved their viability. They were able to do so by following distinct strategies and adopting specific business practices given their local market contexts.

Kevin's enterprise primarily focused on a strategy of **customer acquisition** (elevating the number of customers profit driver). He expanded the reach of his sales network by hiring more agents, and actively invested in improving the effectiveness of his sales network, in part by engaging local tradesmen (e.g., masons, plumbers), who were well-positioned to sell toilets. He reengineered specific toilet models, thus reducing raw material costs, but passed on the benefit to customers in the form of lower prices, betting that it would attract more customers. Together, these practices more than compensated for the high proportion of his sales comprising of lower unit profit interface-only products.

Meanwhile, *Fred's enterprise* captured a **niche target market**, with sales of higher unit profit interface/substructure products (increasing the product mix driver of the GMVA bridge). *Fred's enterprise* benefited from operating in a market with a higher demand for the higher-priced interface/substructure products, especially the dual set that was popular with landlords who shared their property with tenants. These conditions brought high profits to *Fred's enterprise*, despite a small customer base, a passive approach to new customer acquisition, and relatively higher raw material costs.

[24] The offset conversion price for *Kevin's enterprise* indicates the "average" price of his offset conversions, calculated as per the previous footnote. *Kevin's* different offset conversions were priced between USD 17-24.

Andy did not take active measures to increase his customer base and did not enjoy conditions conducive to the sales of higher unit profit interface/substructure products. Hence, his enterprise was smaller in scale and generated significantly lower profits than *Fred* and *Kevin's enterprises*.

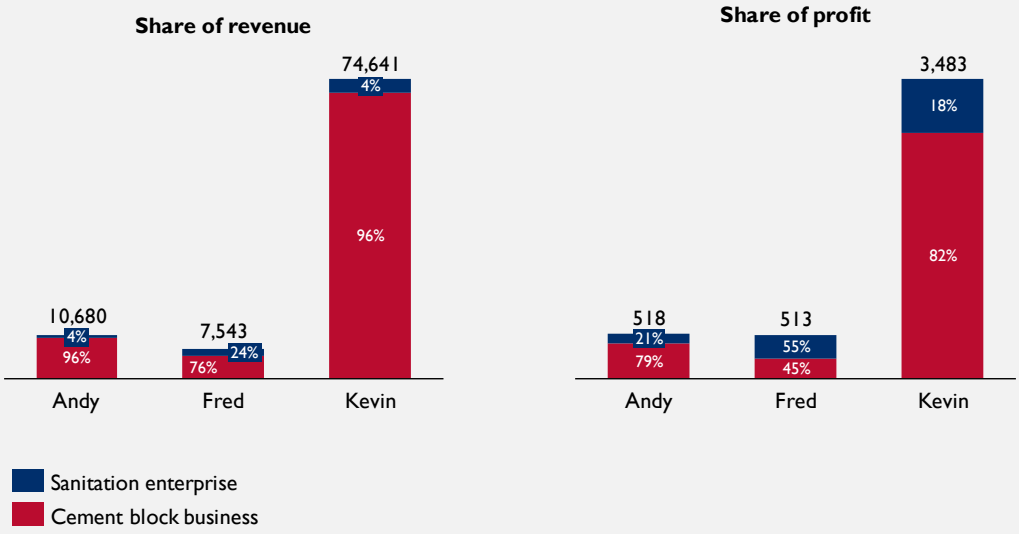
Box 4: The viability of sanitation enterprises in low-demand markets

Together, the 11 sanitation enterprises sold 350 toilets in 2017/18. One enterprise accounted for 37 percent of cumulative sales and the remaining enterprises averaged 20 toilets in the year. Considering the arguably low sales volumes and their primary business of cement blocks manufacturing, we assessed the financial incentive of the three representative entrepreneurs to *remain* invested in sanitation.

The financial incentives of the three featured entrepreneurs to *remain* invested in sanitation depends, in part, on their revenue and profits from their sanitation enterprises, relative to their cement block business (estimated based on interviews with entrepreneurs). We find that although sanitation enterprises represented small portions (4%-24%) of the entrepreneurs' annual revenues from their two business lines, they were an important part of their total annual profits realized, ranging between 18%-55% (see Figure 13). This was driven by the high profitability (i.e., the ratio between profit and sales expressed as a percentage) of the sanitation enterprise relative to the cement block business.

With such attractive profit characteristics, the entrepreneurs have the financial incentive to continue operating sanitation enterprises as an additional source of income. Sanitation enterprises, therefore, are viable as a business line even when sales are low or infrequent in low-demand markets.

Figure 13: Revenue and profit by business line as a share of total revenue and profit (USD) by enterprise (2017/18)



Total, i.e., 100% corresponds to total revenue/profit of both the sanitation enterprise and the cement block business (noted at the top of each bar)

We compared their sanitation enterprises with their primary cement block businesses, specifically the revenues and profits of these business lines. to their based on their profits from their sanitation enterprises relative to their cement block businesses. We compared the revenues and profits from enterprises' P&L statements to the revenues and profits of the cement block business) and then calculated the share of the entrepreneurs' revenues and profits from each business line.

If the entrepreneurs derive a significant portion of their overall profits from the sanitation enterprise, they are likely to stay invested.

4.2. ASSESSING SUSTAINABILITY

The previous section highlighted the different factors that can influence sanitation enterprise viability via a close analysis of three specific examples. These examples considered business performance for a given year. What can we conclude about enterprise *sustainability (*long-term *viability)*?

In the *STS* context, sustainability is driven by the enterprises' ability to finance and operate their business without ongoing non-market support from WaterAid.

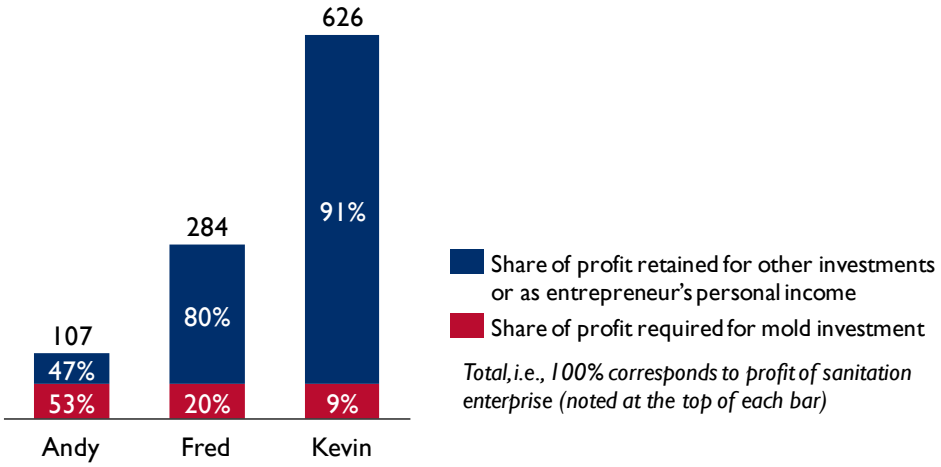
4.2.1. FINANCIAL INDEPENDENCE

In the *STS* context, the enterprises did not benefit from any direct support from WaterAid or other non-market actors for recurring expenses, but they did receive molds free of charge from WaterAid when they joined the program. Molds represent a critical capital expenditure for the sanitation enterprise, as they are required to manufacture different toilet components (e.g., cement ring, interface). They have a limited shelf life, requiring replacement about every three years or so.

We determined that *Kevin's* and *Fred's enterprises* are likely to be able to afford molds, whereas *Andy's enterprise* will struggle to do so. As Figure 14 illustrates, *Andy's enterprise* would need to set aside more than half its annual profits only to invest in molds (at a cost of USD 170)[25] in three years (i.e., the replacement period for molds). *Kevin* and *Fred* would need to set aside a significantly lower proportion, leaving the remaining profit for other investments or their personal income.

Furthermore, *Andy's enterprise* is unlikely to be able to finance its capital expenditure with a commercial loan, as access to credit was cited as a common challenge by all sanitation enterprises. Based on financial independence alone, *Andy* will likely struggle to sustain his sanitation enterprise.

Figure 14: Share of annual cash net profit (USD) needed to be set aside by each enterprise to replace molds[26] in three years



4.2.2. OPERATIONAL INDEPENDENCE

In the *STS* context, enterprises received ongoing operational support in the form of:

- Molds to manufacture toilets provided at the start of the intervention;

[25] Based on data from enterprises in Enugu.

[26] Assumes cost of molds as USD 170, and assumes that enterprises will generate their current profits for 3 years. The formula used is Share of profit needed to be set aside for mold investment = (Cost of molds)/ (Annual profit X Shelf life of molds).

- SATO® pans for the interface component, sold when requested by enterprises; and
- Sales agents to market toilets, who were recruited and trained by WaterAid.

Our interviews indicated that the three featured enterprises would be able to independently procure molds and work with sales agents without WaterAid's support; all readily provided names and locations of potential mold suppliers (such as local welders). While certain enterprises (such as *Andy's enterprise*) might struggle to *afford* the molds, availability did not seem a problem.

However, access to SATO® pans would likely become a challenge. Unlike molds, a localized supply chain for SATO® pans did not exist (at the time of field visits) where the three enterprises are situated; all three were solely reliant on WaterAid for procuring SATO® pans. In the absence of alternate suppliers, the entrepreneurs were concerned about the supply of SATO® pans once they depleted their stock.

The sales agents we interviewed stated that they would continue selling toilets because of the opportunity to earn supplemental income (USD 25-60, net annually) from a part-time activity, and their interest in "serving their community." Most sales agents were already selling other products (e.g., clothes, food) before WaterAid recruited them. They marketed toilets while they sold their primary products to customers and typically did not undertake activities or incur costs exclusively for promoting toilets. Sales agents also felt that they could continue selling toilets without ongoing support from WaterAid following the initial training.

4.2.3. SUMMARY OF SUSTAINABILITY ANALYSIS

Sustainability was a challenge for all three enterprises—particularly *Andy's enterprise*—because they struggled to operate independently without WaterAid's support for the supply of SATO® pans. In the absence of alternate, local suppliers, they would struggle to sustain the sanitation enterprise once the *STS* program ended, unless other suppliers of SATO® pan or equivalent components emerged.

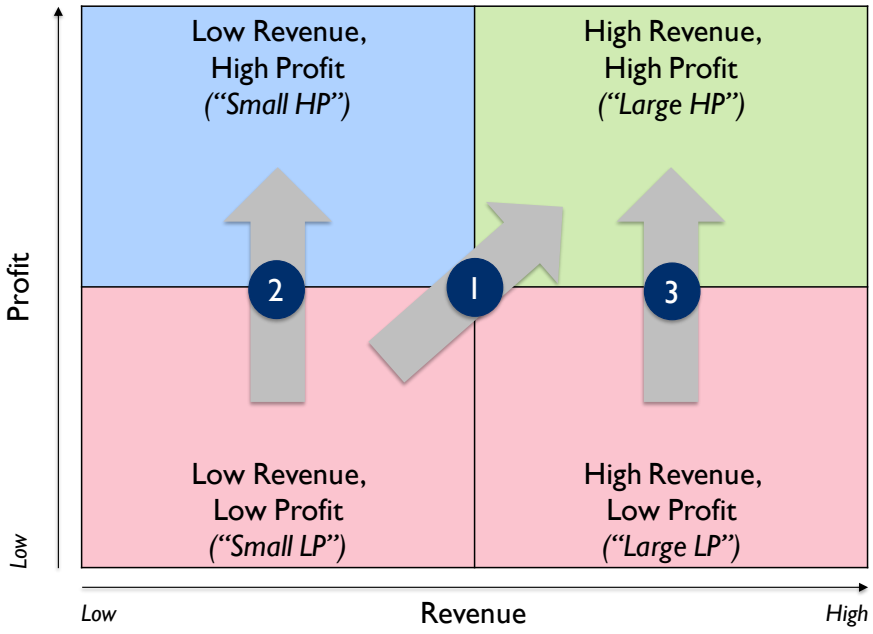
Andy's enterprise is likely to struggle to finance its business needs independently, as it will not be able to afford molds, an item of critical capital expenditure for running the sanitation enterprise. Given its current performance, *Andy's enterprise* will need to invest more than half its profits each year to recover the cost of molds in three years (the typical replacement period of molds) and is unlikely to be able to secure enterprise credit to help finance the expense.

5. RECOMMENDATIONS

5.1. RECOMMENDATIONS TO IMPROVE VIABILITY

Based on the findings from the viability analysis in the previous section, we offer recommendations on the potential paths (i.e., Path 1 and Path 2) that enterprises in the *STS* context can take to improve their profits (see Figure 15), and hence, improve their viability. The strategies are based on the profit drivers (identified through GMVA) and underlying business practices leveraged by the three enterprises we studied. We also explore options available to implementers to support these strategies.

Figure 15: Potential path(s) to improve the viability of sanitation enterprises



The analysis of the three enterprises reveals three key drivers of gross profit differences—the number of customers, the product mix, and costs—that can be targeted to improve enterprise viability in the *STS* context.

To leverage these drivers, enterprises can employ three distinct strategies:

- new customer acquisition,
- niche target market identification, and
- cost reduction.

In theory, a price enhancement strategy could improve profit, considering that enterprises adhered to WaterAid's recommended price. However, in the absence of even one example of a strategy that an enterprise can adopt to increase prices in this context, or its impact on sales, we are unable to recommend this strategy.

The applicability of the three strategies depends on local market conditions and the capacity of specific entrepreneurs running the enterprises. These strategies are explained in further detail below.

5.1.1. NEW CUSTOMER ACQUISITION

"Small LP" enterprises can adopt active sales and marketing practices and potentially iterate their product design (following the example of *Kevin's enterprise*) to target new customers and increase toilet sales. The resultant increase in revenues and the corresponding increase in profits can help "Small LP" enterprises grow into "Large HP" enterprises (see Figure 4). The effectiveness of this strategy will depend on the demand for toilets in an enterprise's context as well as (to a degree) on the entrepreneur's capacity to understand customer demand and invest in demand activation and product reengineering efforts.

Switching from a passive to an active sales and marketing approach entails recruiting and compensating sales agents to sell toilets as a complement to the entrepreneur's own marketing efforts. In particular, enterprises can partner with actors such as masons and plumbers who are well-positioned to sell toilets to their network of customers undertaking home construction or improvement. Such demand activation mechanisms appear applicable only in markets with high latent demand[27] for toilets. Nevertheless, MBS programs should still encourage enterprises to build sales networks because of the potential benefits of additional sales and the limited downside, since an upfront financial investment is not required if sales agents are paid on a commission basis (e.g., paid a fee per sale only when they bring purchase orders). Moreover, the existing commission rate in these markets appears not to be cost-prohibitive—typically amounting to 5-10% of the toilet's price, compared to unit profits ranging between 15%-50% on toilets (see

[27] Demand for a product or service that a consumer cannot satisfy because they do not have enough money, because the product or service is not available, or because they do not know that it is available; source: Cambridge Dictionary. (2019, August 15). Latent Demand. Retrieved from Cambridge Dictionary: https://dictionary.cambridge.org/dictionary/english/latent-demand

Figure 11 for unit profits of different product types for each enterprise).

Iterating product design to offer a wider product range and appeal to diverse customer preferences can also increase the customer base. However, such tactics require the entrepreneur to have the financial capacity and risk appetite to make an upfront investment (e.g., designing and purchasing molds). The entrepreneur also needs to possess an understanding of local preferences, preferably based on a history of sales interactions with customers and order fulfillment experience (e.g., difficulty while transporting and installing toilets). MBS programs can support such efforts by sharing insights on local customer preferences gathered during formative research.

5.1.2. NICHE TARGET MARKET IDENTIFICATION

"Small LP" enterprises can also grow into "Large HP" enterprises by targeting niche customer segments (potentially via sales agents) that are more likely to buy high profit interface/substructure products. Such customer segments can include wealthier households or households with tenants. Increasing sales of interface/substructure products will increase both revenues and profits because they contribute at least three times the revenue and five times the unit profit of an interface-only product sale.

This strategy is most effective in markets where typically upper wealth quintile households also lack basic sanitation, thus increasing the potential number of customers who can afford higher-priced toilets sold by sanitation enterprises. However, even in markets with a few unserved upper wealth quintile households, enterprises can benefit from this strategy because selling only a few interface/substructure products, albeit infrequently, increases profits significantly given their favorable economics.

5.1.3. COST REDUCTION

"Small LP" enterprises may be situated in markets where conditions do not permit either of the two strategies described above, which makes it challenging to grow to a "Large HP" enterprise. In such a situation, "Small LP" enterprises can still improve their performance by increasing their profits at current revenues to develop into a "Small HP" enterprise. They can achieve this through a **cost-reduction** strategy. Cost reduction is particularly appropriate for "Small LP" enterprises, which do not have to fulfill a large number of orders and can afford to adopt efforts to squeeze additional profit from their toilet sales that might not be scalable.

Enterprises can reduce manufacturing costs with the entrepreneur contributing labor instead of hiring workers. For example, an entrepreneur in Enugu (not presented in this case study) chose to manufacture toilets himself instead of hiring day laborers, because he received a small number of orders (17 toilets in 2017/18). Enterprises can also reduce the manufacturing cost of toilets by substituting materials with lower-cost alternatives to the degree that it does not impact the quality of the product. For example, a certain enterprise in Enugu (not presented in this case study) used refurbished pipes (which were practically free) instead of procuring new ones from local suppliers. This did not appear to impact product quality as the entrepreneur did not report any post-sales complaints from customers.

Such cost-reduction tactics can significantly increase the profitability of "Small LP" enterprises. For example, were *Andy* to manufacture toilets himself, he would reduce costs of dual sets by 9% and offset conversions by 11%—leading to a 24% increase in cash net profits. Similarly, *Andy* can use refurbished pipes to reduce costs of manufacturing dual sets by 12% and offset conversions by 30%, leading to a 54% increase in his sanitation enterprise's cash net profits. Combining both cost reduction practices will lead to a 78% increase in *Andy's* cash net profits, transforming his enterprise into a "Small HP" enterprise (the top left quadrant in Figure 4). While there may be an opportunity cost for *Andy's enterprise* in terms of the time required for implementing cost-cutting measures, it is unlikely to be significant given his low sales volumes.

These business practices serve as examples, and MBS programs can help "Small LP" enterprises adopt such minor modifications in the production process to reduce their costs while keeping the core product design intact.

5.2. RECOMMENDATIONS TO IMPROVE SUSTAINABILITY

As the previous sections show, enterprises that were supported by the *STS* program faced two key challenges to sustainability: lack of local suppliers of SATO® pans and unaffordability of molds. Enterprises cannot solve these challenges on their own and require systemic interventions to overcome them. The recommendations below outline potential approaches, some forward-looking and untested, that MBS programs could employ to address challenges related sustainability.

5.2.1. ADDRESSING THE LACK OF LOCAL SUPPLIERS OF A CRITICAL RAW MATERIAL OR COMPONENT

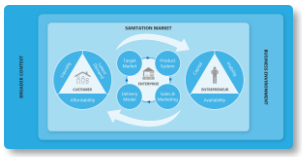
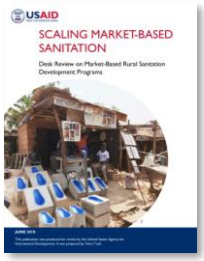
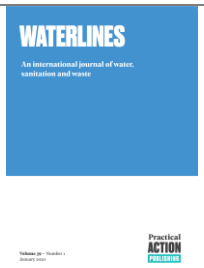
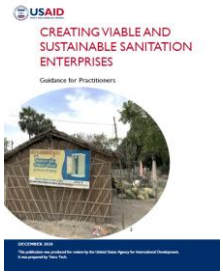
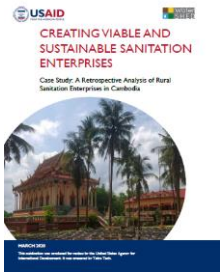
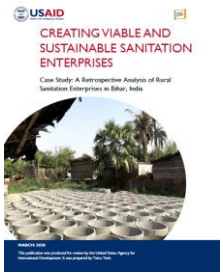
- **Establish an alternate supply chain for new components early in the program.** WaterAid developed a range of products for the *STS* program that addressed different household needs. However, the products required SATO® pans as an input, which were not available locally, and WaterAid imported and supplied the pans directly to sanitation enterprises. WaterAid eventually brokered a licensing partnership between LIXIL (SATO® pan is a business line of LIXIL) and Innoson, a Nigerian manufacturer, to manufacture and distribute SATO® pans in Nigeria. However, the supply chain localization came toward the end of the program. Collaborating with local suppliers earlier will allow programs to observe the functioning of a new supply chain and intervene if necessary.
- **Leverage local supply chains at the onset of the program**. Alternatively, programs should design products with locally available inputs, which avoids the complexity and risk of developing a new supply chain or leveraging an existing supply chain for a new component.[28]

5.2.2. ADDRESSING AFFORDABILITY OF CAPITAL ASSETS

- **Review the design of molds.** Given that many enterprises will find the current cost of molds (USD 170) unaffordable, programs can explore redesigning molds to reduce costs. While the focus of MBS programs' design interventions is typically on products (i.e., toilet components), design principles such as re-engineering can be applied to manufacturing equipment and methods.[28] A redesign involves using alternative lower-cost materials to make molds or developing a modular design so that only damaged parts are replaced instead of the entire mold. Programs can also advise enterprises on methods to extend the useful life of molds (e.g., applying a coat of oil to molds before casting), which will effectively reduce the annual financial outlay to be set aside to purchase molds.
- **Understand the challenges of accessing enterprise credit.** Enterprises will be unable to access credit to finance investment in molds, as all the entrepreneurs stated that they are unable to get credit for either the sanitation or the cement block business. However, microfinance institutions (MFIs) present in the areas where the enterprises operated demonstrated that they provide loan amounts close to the cost of molds (~USD 170) to other small businesses. In such situations, where credit for small enterprises is available, but not accessible by sanitation enterprises, programs should understand the challenges and identify potential interventions to bridge the gap.

[28] USAID. (2018). Scaling Market-Based Sanitation: Desk Review on Market-Based Rural Sanitation Development Programs. Washington, DC.: Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability (WASHPaLS).

6. APPENDIX: USAID/WASHPALS MBS RESOURCES

Domain	Resources
 **Sanitation Market System**	 [Desk Review: *Scaling Sanitation Markets*]  [Article: *Global Assessment of grant-funded, MBS projects*]
 **Sanitation Enterprise & Entrepreneur**	 **Report**: [*Creating Viable and Sustainable Sanitation Enterprise—Guidance for Practitioners*] **Country Case Studies**  [*Cambodia*]  [*Bihar (India)*]  [*Nigeria*]   [**Training Tool: *Designing Viable Sanitation Enterprises***]  **Toolkits**: ***Enterprise Recruitment & Viability and Sustainability Diagnostic*** (forthcoming)

7. APPENDIX: DETAILED METHODOLOGY

7.1. PROFIT & LOSS STATEMENTS

A Profit and Loss (P&L) Statement is a financial statement that illustrates a business's revenues and expenses in detail during a particular period (e.g., quarter, year). It quantifies the profits earned or value lost during the period and enables a comparison of performance across time periods and by component. The elements of a typical P&L statement for a sanitation enterprise are presented in Table 3. Our computation of the P&L statement for enterprises in the *STS* program was for the financial year 2017/18.

Table 3: Line items for a P&L statement of a typical sanitation enterprise

REVENUE	**Revenue generated by selling toilets, toilet components, delivery, or installation services**
(-) COST OF GOODS SOLD	Costs incurred that are directly attributed to the production of toilets
Raw Material Costs	Costs of procuring raw materials such as cement, sand, pans, pipes, etc. In most cases, this includes delivery cost from input supplier to the enterprise
Direct Labor Costs	Cost of labor for casting, delivery, pit digging, installation
Transport (raw material procurement costs)	Cost of transporting raw material from input supplier to the enterprise, if not included in raw material cost
(=) GROSS PROFIT	
(-) OPERATING EXPENSES	Non-production costs incurred in the day-to-day operations of the business
Transport (transport costs to customer)	Delivery cost incurred in delivering toilets to customers. This could be transport, rent in the case of rented transport, or cost of fuel in the case of owned transport
Land Rent	Rent paid for operating the business from a location, apportioned by share of sanitation in overall business revenue
Utilities	Costs of electricity, water, apportioned by share of sanitation in overall business revenue
Marketing (commissions)	Commissions paid to demand activators for sale of toilets
Marketing (non-commissions)	Non-commission expenses such as marketing collateral or meeting expenses
Repairs	Repairs of assets, such as molds, etc.
Depreciation	Depreciation is the annual decline in the value of assets (such as trucks and machinery) owned by a business. Assets have a limited useful life, i.e., the number of years they are expected to contribute to the business. At the end of the expected useful life, assets have scrap or salvage value. Depreciation is an accounting method to spread the asset's value over its useful life. It is a non-cash expense, i.e., it is recorded as an expense despite not resulting in a cash outflow.
Bad Debt	Credit offered to a customer of the toilet business that cannot be recovered
(=) OPERATING PROFIT	Other costs incurred in the day-to-day running of a business
(-) INTEREST EXPENSE	Interest on loans taken by the business, apportioned by share of sanitation in overall business revenue
(-) TAX	Tax paid on profit generated in the business
(=) NET PROFIT	
(+) DEPRECIATION	
(=) CASH NET PROFIT	Cash income earned (or lost) by the enterprise in the period

7.2. GROSS MARGIN VARIANCE ANALYSIS

Gross Margin Variance Analysis (GMVA) is a business analytical tool used to identify drivers of the difference between gross profits. The tool is typically used by a single business or business division to analyze the differences in performance between two time periods, or else between planned/budgeted and actual performance. GMVA can help prioritize factors that drive differences in gross profits and guide subsequent responses. For instance, if the size of the customer base is the most important driver, then a business can analyze activities that influence and bolster customer acquisition.

To illustrate the process and interpretation of the GMVA, we present the following illustrative example

Consider two widget manufacturers, Company 1 and 2. Assume that Company 1 sells widget A and widget B and that Company 2 sells widget A, widget B, and a third widget, widget C. Now consider the following set of assumptions:

Table 4: GMVA inputs example

	COMPANY 1	COMPANY 2
	CUSTOMERS	
	100	200
	VOLUMES SOLD PER CUSTOMER	
Widget A	5	10
Widget B	1	2
Widget C	-	2
	PRICE PER PIECE	
Widget A	5	6
Widget B	4	4
Widget C	-	4
	COST PER PIECE (USD)	
Widget A	3.8	4.8
Widget B	3.0	3.2
Widget C	-	2.8
	GROSS MARGIN (%)	
Widget A	24%	20%
Widget B	25%	20%
Widget C	-	30%
Total gross profit (USD)[29]	**700**	**3,200**

Company 1 generates an annual gross profit of USD 700, while Company 2 generates a gross profit of USD 3,200. GMVA allows us to break down the gross profit difference between the two companies (see Table 5 for the list of variables used for the subsequent equations).

First, we consider the effect caused by the difference in the customer base. This calculation entails increasing the number of customers only; if Company 1 sold widget A and B to 200 customers instead

[29] Calculated as the sum of (Price per piece – Cost per piece) x (Units sold per customer) x (Number of customers) for each widget.

of 100, at its current prices, costs, and volumes sold to each customer, the company would make an additional USD 700 in gross profit.

Mathematically,

(1) $Variance\ (customers) = (\boldsymbol{customers_2} - \boldsymbol{customers_1})\text{x}\ GPPC_1$

where $GPPC_1$ is gross profit per customer of Company 1.

With the adjusted number of customers for Company 1, the next source of gross profit difference is the difference in prices charged by Company 2 for the two products; if Company 1 sold widget A for USD 6 (instead of 5) and widget B for USD 4 (same price as currently charged, so no impact for widget B) to 200 customers (the customer base of company B), at its current volumes sold per customer, it would result in a USD 1,000 increase in gross profits.

Mathematically,

(2) $Variance\ (price) = [(\boldsymbol{price_{2A}} - \boldsymbol{price_{1A}})\ \text{x}\ customers_2\ \text{x}\ volume_{1\text{A}}] + [(\boldsymbol{price_{2B}} - \boldsymbol{price_{1B}})\ \text{x}\ customers_2\ \text{x}\ volume_{1\text{B}}]$

Similarly, the differences in the cost of production lead to a difference in gross profits as well. The signs are reversed (compared to the price equation) as higher costs reduce gross profit, whereas higher prices increase gross profit. The impact is computed by multiplying the difference in cost of goods sold for each product with Company 1's volumes sold per customer to the adjusted customer base, i.e., the same number of customers as Company 2. In this example, Company 2 has higher costs than Company 1; hence the impact (USD 1,040) will be negative, i.e., the higher costs reduce Company 2's gross profits relative to Company 1.

Mathematically,

(3) $Variance\ (cost) = [(\boldsymbol{cost_{1A}} - \boldsymbol{cost_{2A}})\ \text{x}\ customers_2\ \text{x}\ volume_{1\text{A}}] + [(\boldsymbol{cost_{1B}} - \boldsymbol{cost_{2B}})\ \text{x}\ customers_2\ \text{x}\ volume_{1\text{B}}]$

The three equations above consider Company 1's sales volumes sold per customer. We also have to consider the difference in volumes sold per customer of widgets A and B (the common products sold by both enterprises), referred to as the "common product mix" effect. This effect would assume that Company 1 sells 10 and two units of widgets A and B respectively, instead of five units and one unit, respectively, to the adjusted customer base of Company 2, at Company 2's prices and costs. This results in a USD 1,360 increase in gross profit.

Mathematically,

(4) $Variance\ (common\ products\ mix) = [(\boldsymbol{volume_{2A}} - \boldsymbol{volume_{1A}})\ \text{x}\ (customers_2)\ \text{x}\ (price_{2\text{A}} - cost_{2A})] + [(\boldsymbol{volume_{2B}} - \boldsymbol{volume_{1B}})\ \text{x}\ (customers_2)\ \text{x}\ (price_{2\text{B}} - cost_{2\text{B}})]$

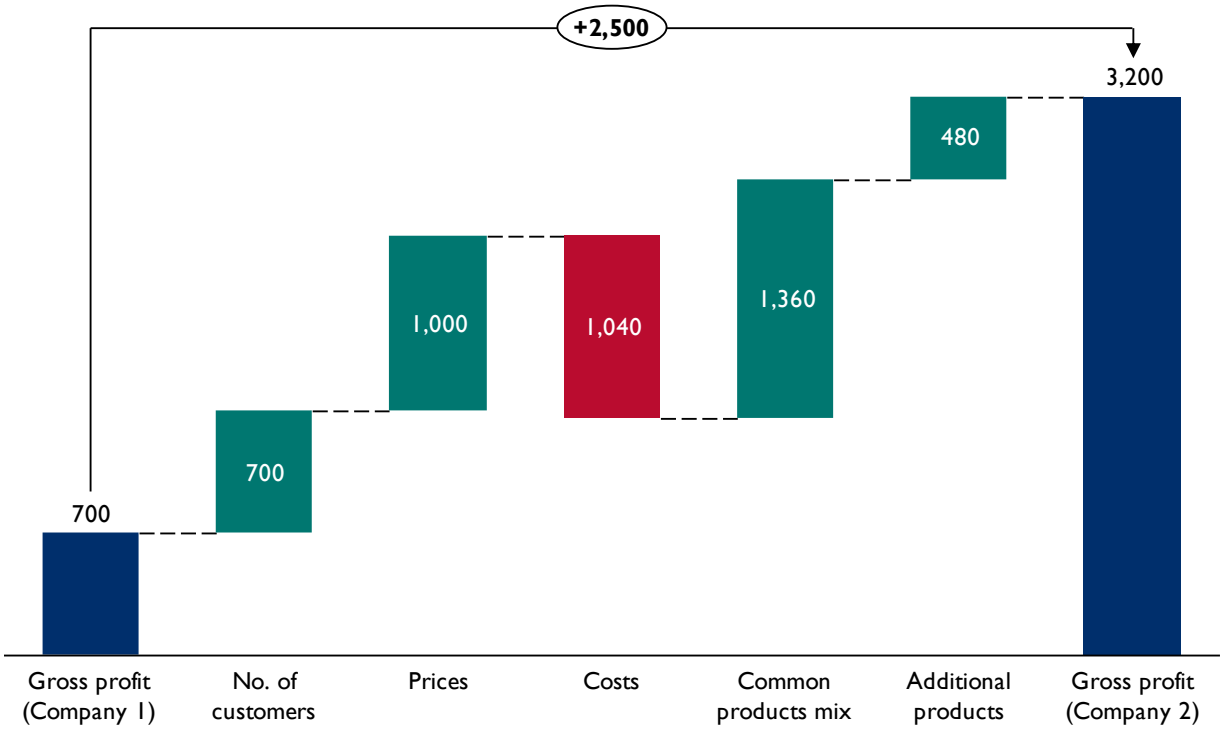
Finally, there is also a difference in gross profit attributed to the sale of widget C, an additional product sold only by Company 2. This results in a USD 480 gross profit increase.

Mathematically,

(5) $Variance\ (additional\ products) = customers_2\ x\ volume_{2\text{C}}\ x\ (price_{2C} - cost_{2C})$

The GMVA "bridge" for this example is offered in Figure 16.

Figure 16: GMVA bridge between Company 1 and Company 2



In the *STS* context, enterprises only sold common products, and there were no additional, sanitation-related products. As such, the *additional products* variance is not calculated for the GMVA bridge in the Findings section. Further, the "common products mix" is referred to as the "products mix" in our text.

Table 5: Definition of variables used in the GMVA example

VARIABLE	DEFINITION
$customers_1$	Number of customers of Company 1
$customers_2$	Number of customers of Company 2
$GPPC_1$	Gross profit per customer of Company 1
$GPPC_2$	Gross profit per customer of Company 2
$volume_{1A}$	Product (widget A) volumes sold per customer of Company 1
$volume_{2A}$	Product (widget A) volumes sold per customer of Company 2
$volume_{1B}$	Product (widget B) volumes sold per customer of Company 1
$volume_{2B}$	Product (widget B) volumes sold per customer of Company 2
$volume_{2C}$	Product (widget C) volumes sold per customer of Company 2
$price_{1A}$	Unit price for widget A product of Company 1
$price_{2A}$	Unit price for widget A product of Company 2
$price_{1B}$	Unit price for widget B product of Company 1
$price_{2B}$	Unit price for widget B product of Company 2
$price_{2C}$	Unit price for widget C product of Company 2
$cost_{1A}$	Unit cost of goods sold for widget A for Company 1
$cost_{2A}$	Unit cost of goods sold for widget A for Company 2
$cost_{1B}$	Unit cost of goods sold for widget B for Company 1
$cost_{2B}$	Unit cost of goods sold for widget B for Company 2
$cost_{2C}$	Unit cost of goods sold for widget C for Company 2

7.3. ADDITIONAL GMVA BRIDGES

In addition to the three enterprises presented in this case study, we also prepared the GMVA bridges of two other enterprises (circled in red in Figure 17)—one more "Small LP" enterprise (*Chris's enterprise*) and one more "Large HP" enterprise (*Ivan's enterprise*)—to identify any other factors that influenced viability. We compared *Chris's enterprise* to the two "Large HP" enterprises (*Fred* and *Kevin's enterprises* respectively), and *Ivan's enterprise* to the "Small LP" enterprise (*Andy's enterprise*).

Figure 17: Additional enterprises selected for GMVA

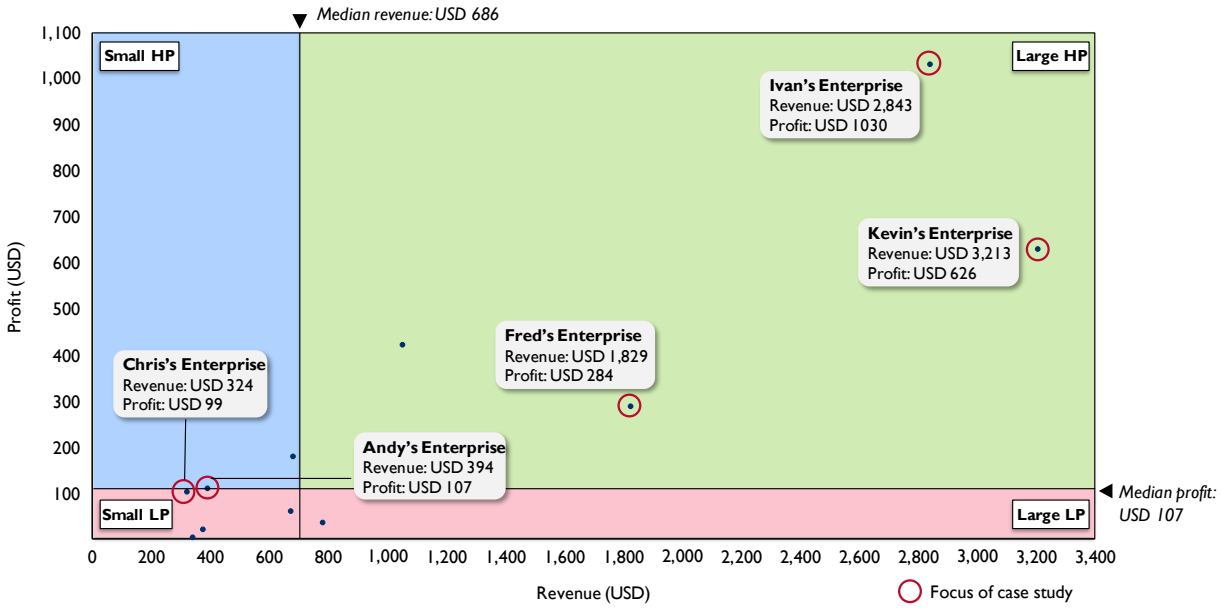


Figure 18: GMVA bridge (USD) between Chris's enterprise ("Small LP") and Fred's enterprise ("Large HP")

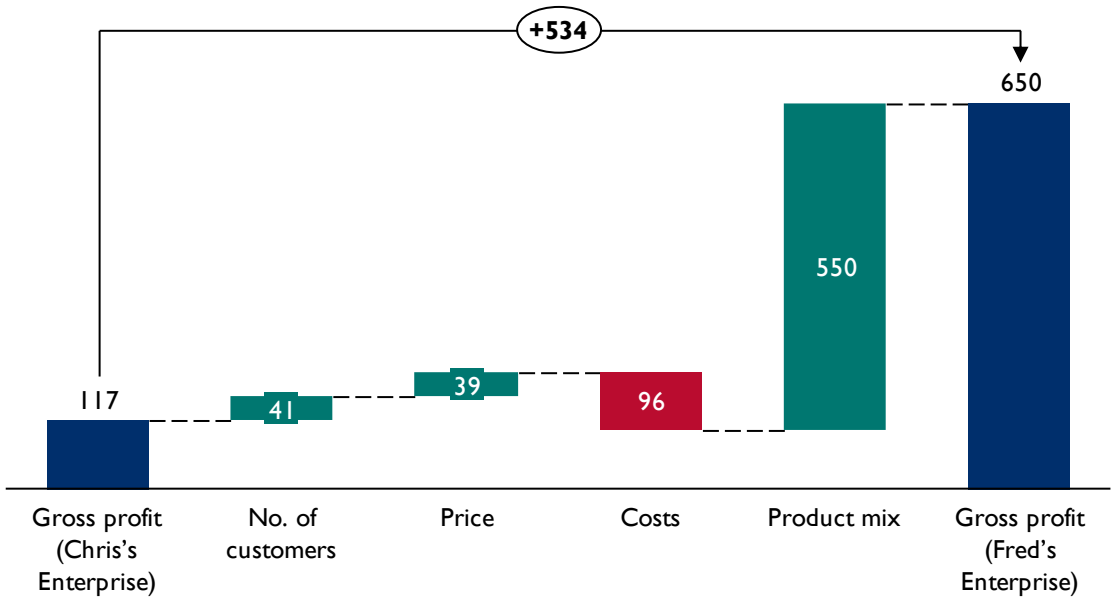
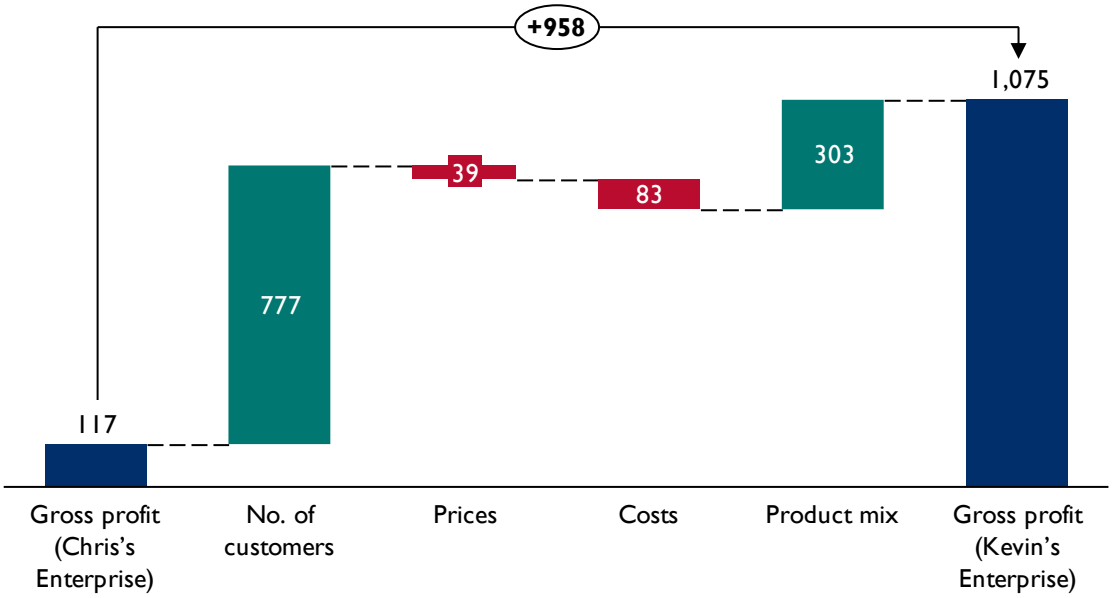
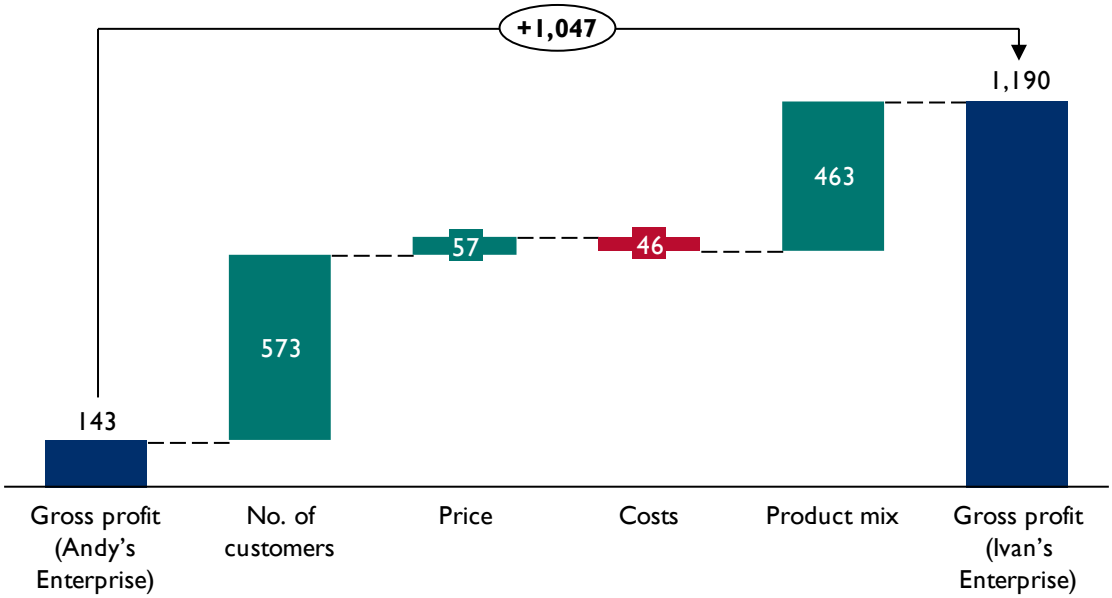


Figure 19: GMVA bridge (USD) between Chris's enterprise ("Small LP") and Kevin's enterprise ("Large HP")



The GMVA bridges between *Chris* and *Fred's enterprise* (Figure 18) and between *Chris and Kevin's enterprises* (Figure 19) highlight the costs driver as a possible lever to improve viability. *Chris's enterprise* benefited modestly from slightly lower costs, compared to the other two enterprises. *Chris* was able to reduce costs by manufacturing toilets himself instead of hiring labor, and by using local sand (which was practically free) instead of procuring sand from suppliers. We have cited the cost-reduction strategy in the Recommendations section based on *Chris's* GMVA bridges.

Figure 20: GMVA bridge (USD) between Andy's enterprise ("Small LP") and Ivan's enterprise ("Large HP")



The GMVA bridge between *Andy's enterprise* and *Ivan's enterprise* highlights the number of customers and the product mix as the key drivers of the difference in gross profits. *Ivan* had a significantly larger customer base than *Andy* (selling to 50 customers as opposed to 10 for *Andy*), and a greater proportion of sales of high-profit interface/substructure products (selling dual sets to 40% of his customers as opposed to 20% for *Andy*). This example serves to reinforce the importance of these two drivers in improving viability in the *STS* context, given that these were also the key drivers in differentiating the performance between the three enterprises selected for this case study (as detailed in the "Findings" section).

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