Global Household Water Treatment & Safe Storage Monitoring and Evaluation Project

Final Report

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Acknowledgement

The A-Team would like to acknowledge the help and support of the following individuals and institutions in guiding us through a very rich experience.

Executive Summary

The following report defines the best practices for a business in the household water treatment systems (HWTS) supply chain. The best practices included in this report are crucial to commercial business sustainability. For the purpose of this report, commercial business sustainability is defined as the ability of a business to thrive without subsidies or other monetary support from government or NGO. Business sustainability is important in this context because it empowers entrepreneurs in developing areas to provide necessary products and services to their communities in the absence of aid money that is not always available. Furthermore, successes of sustainable businesses will serve as a catalyst for further competition in this area that will allow the market to solve needs that are critical for clean household water distribution, treatment and storage. This has been proven to alleviate sicknesses amongst the denizens of our field study that can enhance economic productivity and enhance the survival rate of the populations studied. This report can be used by current HWTS businesses[1] to help revaluate and improve their operating model; it may also be particularly helpful for HWTS businesses trying to enter new markets.

Four students from the MIT Sloan School of Management with the support of the MIT Water & Sanitation faculty and research students, as well as the World Health Organization, have conducted the research for this report. The research was conducted remotely from Cambridge, Massachusetts in addition to field visits in Ethiopia and Ghana where team members met with various organizations in the HWTS supply chain.

The team identified twelve best practices. These best practices highlight the importance of strategic relationships with local experts and trusted organizations, a deep market understanding, customer education and smart inventory practices. The appendix of this report also includes a set of tools that are designed to help an implementing organization apply these best practices.

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[1] HWTS businesses may include manufacturers, distributors, wholesalers, retailers or any other intermediaries in the HWTS supply chain

List of Abbreviations

AED – Academy for Educational Development

AWD – Acute Watery Diarrhea

CDC – Centers for Disease Control and Prevention

DALY – Disability Adjusted Life Years

EDS – Every Dealer Service

HIP – Hygiene Improvement Project

HWTS – Household Water Treatment & Safe Storage

M&E – Monitor & Evaluate (Monitoring & Evaluation)

MDG – Millennium Development Goal

MIT – Massachusetts Institute of Technology

NGO – Non-Governmental Organization

PHW – Pure Home Water

PSI – Population Services International

UNICEF – United Nations Children's Fund

UNOCHA – United Nations Office for the Coordination of Humanitarian Affairs

USAID – United States Agency for International Development

VC – Venture Capitalist

WATSAN – Water & Sanitation Projects

WHO – World Health Organization

WoM – Word of Mouth

WTP – Willingness to Pay

YLD – Years Lost Due to disability

YLL - Potential Years of Life Lost due to premature death

Introduction

Household water treatment and safe storage (HWTS) is a new approach in the toolkit of public health interventions to bring safe water to over billion people in the world who need it. The implementation of HWTS also contributes to attaining the Millennium Development Goal (MDG) "to reduce by half, by 2015, the proportion of people without sustainable access to safe drinking water." HWTS typically has been part of a cluster of innovative technologies that complement other water/sanitation/hygiene interventions. As a separate stand-alone topic, HWTS has been in existence for little more than a decade. The "Safe Water System" of household chlorination and safe storage, one of the first and now largest HWTS programs, came about in response to the South American cholera epidemic of 1992. Likewise solar disinfection in PET plastic bottles (SODIS), biosand filters and the Potters for Peace ceramic pot filters were not implemented on any scale until the mid to late 1990s. Other HWTS implementation efforts are more recent still.

Until now, efforts to systematically monitor and evaluate (M&E) HWTS implementation and scalability have been largely restricted to individual organizations' initiatives. Information on M&E methods, targets, indicators, tools and results is rare and exists mainly in unpublished literature. Moreover, there has been little coordination towards a common set of methods, targets and tools.

Interest is strong among various members of the World Health Organization (WHO)-hosted International Network to Promote Household Drinking Water Treatment and Safe Storage ("the Network") to develop and widely share M&E tools. In spring 2007, a preliminary collection of M&E tools as well as a Web site for sharing these tools was put together by some Network members[2].

The "Global Household Water Treatment and Safe Storage Monitoring and Evaluation Project," is a new initiative to expand that preliminary work. The project is a collaboration between the WHO Network Secretariat and a six-person MIT team comprised of Sloan School of Management MBAs and Masters of Engineering students, together with the team advisor, Susan Murcott, Sr. Lecturer, MIT Civil and Environmental Engineering Department. The objective of this initiative is to create a compendium of M&E indicators drawn from global "best practices" as the basis for developing a common M&E framework. The compendium will be published by the WHO Network to promote growth of and to aid in scaling up organizations that implement HWTS systems.

The M&E compendium will be comprised of metrics in three main areas, with the MBA students focusing on business sustainability metrics and the engineering students focusing on behavioral and product adoption and sustained use metrics. The purpose of this document is to present the work completed by the MIT Sloan

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[2] http://web.mit.edu/watsan -> International HWTS Network Tools

MBA team. This report describes the M&E best practices recommended by the team, the approach used to determine the best practices, as well as a compilation of all the findings gathered during the study.

Business Sustainability

The focus of the MIT Sloan students' research is to provide a set of metrics used to monitor and evaluate business sustainability of organizations implementing HWTS solutions, in addition to recommending best practices that an organization should follow. While the definition of a sustainable business is broad and vaguely defined, in the context of this research, a sustainable business is commercially viable, financially optimal and has a scalable social impact; in other words, it has a social objective as well as business objectives. While the first two criteria point to traditional business definitions of 'sustainability', a social impact that is scalable enough to target as many people as needed is necessary for the organization to be truly defined as sustainable.[3]

Study Goal, Topics and Deliverables

The goal of this report is to recommend a set of best methods (or best practices[4]) for these HWTS organizations and to identify appropriate tools to implement the best practices or metrics to track the business's path to sustainability. The set of best practices aim to provide both high level insights on organizational structure and involvement of stakeholders, all the way to methods of tracking consumer satisfaction.

In order to provide a guide to the practical application of these methods, we recommend a set of metrics, or tools, for organizations to implement these practices. As most organizations targeted were in the early stages of their business and/or operated under strict confidentiality, transparent company financials were generally not available. To find these metrics and methods, the discussions with these organizations' focused on the following topics:

- Financial Performance
- Marketing
- Distribution Channels and Partnerships
- Operational Issues
- Post Sales Efforts

As the best practices of a sustainable business may vary from being highly quantifiable to very qualitative, the suggested metrics are a measure of the

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[3] Muhammad Yunus' definition of a social business in <u>Creating a World without Poverty</u> "A social business is not a charity. It is a business in every sense. It has to recover its full costs while achieving its social objective."

[4] In this report, best practices and best methods will be used interchangeably.

various sustainability criterion. However, given that these unique metrics track very different methods, compiling a 'sustainability index' would force assigning a weighting on the various methods. Therefore, a list of appropriate sustainable business best practices, indicators and metrics to 'measure' them is the outcome and deliverable for this project.

Traditionally, academic focus in the HWTS space has been on health and behavioral indicators, led by groups, such as WHO, USAID, UNICEF and other international organizations. Recently, there has been an influx of more financially viable solutions being sold to those without access to clean water. This trend is confirmed by the attention traditional investors, such as venture capitalists (VCs), are placing on water and sanitation in developing countries. These investment groups see tremendous opportunity for bottom line returns through a growing industry with a large market size.

Major groups such as the Bill and Melinda Gates Foundation, PATH, Acumen Fund and a number of notable private VC firms are focusing portfolio investments in this space. For example, the Bill & Melinda Gates Foundation awarded PATH $17 million to test new approaches that ensure low-income people in developing countries have safe drinking water in their homes. The grant, distributed over five years, will allow PATH to identify low-cost consumer products that can treat and store water in the home and to develop a commercial market for those products. Acumen fund has an entire portfolio dedicated to such commercial HWTS products, valued at $1.8M and growing. VC funds across the globe, such as Abu Dhabi-based Masdar, are increasing their investments in organizations and technologies that are focused on developing commercially viable water treatment solutions.

While this is interesting from a business stand-point, it also indicates the addition of new groups aiding in the effort to achieve the water-related MDG. The WHO Network already includes such commercially-oriented organizations. Given their traditional focus on M&E health, water quality, technology and behavioral indicators that do not focus on commercial viability extensively, there is a need for the Network and its members to have a consistent framework for assessing business sustainability metrics.

Therefore, this report will attempt to provide the Network, its partners and governments, with an understanding of these metrics, methods and approaches to assess their existing commercial solutions and potential to scale.

Approach

The team adopted a three-phased approach to develop the final compendium of best practices relating to business sustainability. Each phase was comprised of multiple steps, as described below.

Figure 1: Phases of the Project

Phase 1: Perform Preliminary Research

In Phase 1, a four-step approach lasting 8 weeks from mid October to mid December 2007 was followed to identify 'best practice' business sustainability indicators, methods and associated tools. These were subsequently validated during the Phase 2 field study in Ethiopia and Ghana.

Step 1. Identify select organizations and key players that are currently implementing HWTS solutions in developing countries. Identify appropriate partners along the supply chain that may act as useful sources to this study. Appendix A lists organizations that were identified. Organizations were identified based on a number of criteria to ensure a diverse mix. Some of these criteria included experience, geographic coverage, HWTS technology and positioning in the supply chain. A description of the criteria is provided in Appendix B.

Step 2. Interview key contacts from organizations identified in Step 1. The interviews serve to gather information on product(s) as well as to understand the commercial and financial metrics organizations currently use to assess their overall business sustainability. Appendix C provides a detailed interview guide that was used to facilitate the interviews.

Step 3. Aggregate metrics identified through interviews with all organizations. A list of all the metrics identified is provided in Appendix D,

Step 4. Analyze the metrics collected and identify key "best practices" whose validity is to be tested during the field study phase of the project. The team identified best practices, based on a number of criteria, including financial sustainability of the organization, consistency of metrics used across organizations, and metrics that have withstood the test of time. A detailed description of the criteria is provided in Appendix E.

Phase 2 – Conduct Field Study

A three-week long field study was conducted in Ghana and Ethiopia from January 6th, 2008 to January 25th, 2008 to test the validity of best practices identified in Phase 1 as well as to potentially identify other best practices. Phase 2 comprised the following key three steps:

Step 1. Identify organizations that are currently implementing HWTS solutions in Ethiopia and Ghana. Organizations were identified based on a number of criteria including presence in Ethiopia and Ghana, type of technology being implemented and role in the HWTS implementation supply chain. A detailed description of these criteria is provided in Appendix B.

Step 2. Interview key contacts from organizations that were identified in Step 1. The interviews serve to understand M&E metrics and processes employed by the organizations, to compare theses metrics and methods with those identified in the first phase and to zone in on a few key metrics and methods that best measure commercial sustainability. Appendix F provides a detailed interview guide that was used to facilitate the interviews.

Step 3. Collate findings from interviews and aggregate metrics for further analysis in Phase 3.

Phase 3 – Develop Final Results

The team spent the last three weeks of the project from February 4th, 2008 to February 22nd, 2008 to develop the final report and the compendium of best practices. Key steps in this phase included:

Step 1. Identify and analyze key take-aways from all interviews conducted to determine validation of best practices identified in Phase 1.

Step 2. Develop final report describing results of the business sustainability target for the overall project and publish final business sustainability best practices on the MIT WATSAN website[5] for public viewing.

Step 3. Relay business sustainability best practices to the two MIT engineering graduate student members of the team so that they can amalgamate the findings into the final compendium due by June 2009.

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[5] http://web.mit.edu/watsan/

Findings

Phase 1 phone interviews with manufacturers and distributors of HWTS solutions provided the team with nine potential best practice metrics and six potential best practice methods. Based on our methodology, these resulting hypothetical best practices needed to be validated through field visits in Phase 2. The results of Phase 2 were: a) Phase 1 original hypotheses for best practices that were either validated or not and b) the identification of new best practices.

Original best practices were validated in Phase 2 through confirmation of use or agreement of importance of the hypothetical best practice. In most cases, validated best practices were seen and confirmed at multiple organizations visited during the field visit.

New identified best practices during Phase 2 came about from recurring themes and topics throughout the field visits. These were then translated, as needed, into best practices and re-validated where needed against meeting notes and with relevant interviewees.

Upon review of our findings in Phase 2, five original best practice methods were validated and one was altered per consistent feedback. During the field visit, we realized that the nine original metrics were better suited to fall underneath a corresponding best practice method. In some cases, the metric was validated and joined with a method and in other cases, the metric was not validated and hence removed from our best practice list. The result was six original best practices and six new best practices. A preview of the original and new best practices is below, while a detailed discussion of the resulting best practices from both phases is in the next section.

During Phase 1, areas that seemed to be the most important to sustainable businesses implementing HWTS solutions were around social marketing and education, partnerships, affordability, and post-sales. In Phase 2, additional areas highlighted were around credibility building, government and aid agency partnerships, and supply chain perceptions. Overall our findings were augmented and complemented throughout both phases of the project.

Social marketing was a recurring area of focus in Phase 1 and confirmed to be important in Phase 2. Given the recent rise of HWTS products in developing countries with water and sanitation issues, building awareness is a starting point for HWTS organizations. The market has to be educated on current water quality levels, their consequences, and of corresponding HWTS solutions. Monitoring and evaluation metrics and methods around educational programs and initiatives to educate target customers are vital to build and expand the market for HWTS solutions. This is the first step in building a sustainable business in the HWTS space.

Additionally, in Phase 2, the need to build credibility in the market place complemented the need to build awareness through social marketing. The nascence nature of HWTS products in many markets requires confidence building in the target customers. Endorsements and partnerships with trusted organizations and groups are keys to building credibility.

Most manufacturers of HWTS struggle to understand and find the infrastructure necessary to enter a developing market. For this reason the importance of partnerships with local organizations came out as a key theme in all discussions in Phase 1. Especially when HWTS organizations are not local, there is a strong dependency on local sellers and distributors. Hence, it is very important to have metrics and methods around partnerships to ensure HWTS products reach customers. Phase 2 further highlighted the importance of partnerships with government and aid agencies, especially during emergency relief efforts, as they are important partnerships both for credibility building and awareness generating efforts.

In Phase 2, managing supply chain perceptions was another interesting discovery. Both in awareness building and market generation efforts, the distributors and retailers need to be inline with the value of the HWTS product, in addition to the goals of the implementing organization in order to stock and advocate sales of HTWS products. Marketing and operational efforts need to consider this in their metrics and methods used to ensure that they are building a sustainable and viable business.

Affordability was another recurring theme in Phase 1. The difference between affordability, the ability to pay for an HWTS product, and the willingness-to-pay (WTP) for the product was an important and interesting discovery from the research phase of this initiative. However, through the field interviews in Phase 2 it was found that in order to be a sustainable business targeting customers in developing countries, WTP is more commonly used when determining prices and managing costs.

Phase 1 demonstrated that a focus on post-sales efforts enables all implementing organizations to understand customer acceptance of HWTS products. Additionally, customer complaints can be better managed once metrics and methods around post-sales issues are instituted. Post-sales are also important particularly to groups selling products that require replacement of consumable parts.

Best Practices

This section provides a detailed report of the best practices identified and validated through Phases 1 and 2, as well as those hypothesized practices that were not validated.

- Original best practices validated
    1. Develop strategic relationships with knowledgeable and respectable partners and distributors in local markets.
    2. Visit potential markets and analyze key market components prior to entering new markets.
    3. Understand customers' willingness to pay to determine optimal pricing and to assess feasibility of existing cost structure.
    4. Provide expiration dates or replacement indicators on products.
    5. Educate customer on the product at the time of sale or before the sale.
    6. Track customer complaints in the household at the point of use to understand customer acceptance.
- New best practices identified
    7. Utilize endorsements from government accredited universities and organizations as marketing tools
    8. Forge public/private partnerships to leverage advantages
    9. Plan exit strategies for emergency distribution situations
    10. Enforce limited stocking based on moving sales averages to allow intermediaries to experience "fast-moving" sales
    11. Balance distribution channels to capture both Equity and Efficiency
    12. Focus marketing efforts to reach both the end consumer as well as organizations within the supply chain
- Best practices not validated:
    13. Monitor the number of replacement consumables produced versus those that are sold
    14. Monitor break even point of production facility

Original Best Practice Methods Validated

1) Develop strategic relationships with knowledgeable and respectable partners and distributors in local markets

Original Hypothesis: Local partnerships serve as credible avenues to understand local markets and opportunities. Understanding the perceptions, willingness to pay, affordability and needs of the customer is a major challenge particularly in developing nations. This is further compounded by difficulties related to distribution, marketing and simply reaching the rural areas where a majority of the customers are located. Organizations such as Medentech,

Unilever and Eureka Forbes are all dependent on key strategic partnerships to overcome these challenges and to deliver their products to the customers. For example, Hindustan Lever and Eureka Forbes partner with local self help groups who are more knowledgeable of practices and customs in rural villages in India and are hence more effective in leading product awareness campaigns.

Validation: A number of organizations that are implementing HWTS solutions rely on strategic partners to manage various aspects of their supply chain ranging from manufacturing to distribution. For example, Medentech has exclusively partnered with EtMedix, a pharmaceutical drug distributor, to distribute Aquatabs across Ethiopia. While Medentech manufactures and exports the tablets, EtMedix exclusively markets, distributes and sells the tablets across Ethiopia. EtMedix plans to utilize its extensive local network of pharmaceutical distributors as a key distribution channel for Aquatabs. In addition, relationships in local regions of Ethiopia have helped EtMedix to setup a newly created retail distribution channel. All of these would have been major challenges had Medentech chosen to enter the Ethiopian market on their own.

Securing buy-in from local community influencers or village chiefs, a critical requirement to commercially enter a new village, can prove challenging in the absence of local relationships. One salesperson at Pure Home Water (PHW), had helped secure community projects and partners for the Peace Corp over many years before working at PHW. He leveraged his connections with local Peace Corp volunteers in the villages to endorse the Kosim filters in new villages. Through his contacts, he was not only successful in securing buy-in from local village chiefs, but also in developing relationships with key influencers who served as community liaisons for PHW. These local relationships were deciding factors in the large sales that he generated which exceeded those of all other salespeople.

WaterHealth International and Enterprise Works were other organizations that all partnered with local companies. Appendix H.1 provides a tool that organizations can use to help evaluate which organizations/agencies to partner with.

2) Visit potential markets and analyze key market components prior to expanding into or entering new markets

Original Hypothesis: Visiting a potential market to enter and analyzing key market attributes is critical to assess the sustainability of operations in a new market. Organizations such as HaloSource and Vestergaard Frandsen S.A. have formal new market entry processes, where they dedicate significant amounts of time to analyze countries that they plan to begin operations in. Their approach includes significant on-the-ground diligence and meeting with potential customers, existing HWTS organizations and potential partners.

Validation Rationale: This hypothesis was validated by organizations such as PSI, WaterHealth, Medentech and New Energy during the field visit phase of this project. PSI, for example, conducts Willingness-to-Pay and Affordability surveys on varying demographic samples prior to entering new markets. These surveys are created by an expert in Washington D.C. and are implemented both by consultants and regional staff members. Focus groups composed of a sample size of 19 are targeted using a rapid assessment survey in order to gain a relatively inexpensive idea of the target markets.

Medentech, the producer of Aquatabs, on the other hand, ties up with an exclusive distributor in its target market after soliciting marketing proposals from various local distributors, which allow them to have a preliminary assessment of the market. Under this methodology, Medentech selected EtMedix in Ethiopia and Precision in Ghana as their exclusive distributors. Prior to soliciting bids, however, Medentech made an active effort to meet with local aid organizations and governments in order to gain a general understanding of the marketplace as a first screening to determine selection.

Tried and tested approaches such as listed above allow organizations to understand the potential market size upfront and develop a strategy to target a specific demographic within the market. This will allow firms to be able to evaluate their expected cash flows upfront and determine an estimate on profitability that will provide a baseline to their business sustainability.

Attributes to consider when entering a new market include: existing competitors in the same market space, technologies prevalent in the market, market response, unmet consumer needs, HWTS household market size, prevailing price points, profile of target customer segments, regulatory constraints, availability of key partners and trusted distribution channels.

Appendix H.2 provides a tool that organizations can use to determine which market-related characteristics they should assess when they are planning to enter a new market.

3) Understand customers' willingness to pay to determine optimal pricing and to assess feasibility of existing cost structure

Original Hypothesis: Customers' willingness to pay (WTP) is an effective measure to determine pricing of a product. Once the product's market price is determined, the business can work backward through the supply chain and assess the feasibility of the existing cost structure.

Validation Rationale: Surveys, focus groups and auctions are useful tools to assess customer WTP. Understanding this metric allows organizations to set a retail price that will ensure demand in the market. Once the retail price is set, organizations can work backwards through the supply chain and set intermediate

prices.   This ensures appropriate margins to distributors, wholesalers and retailers.

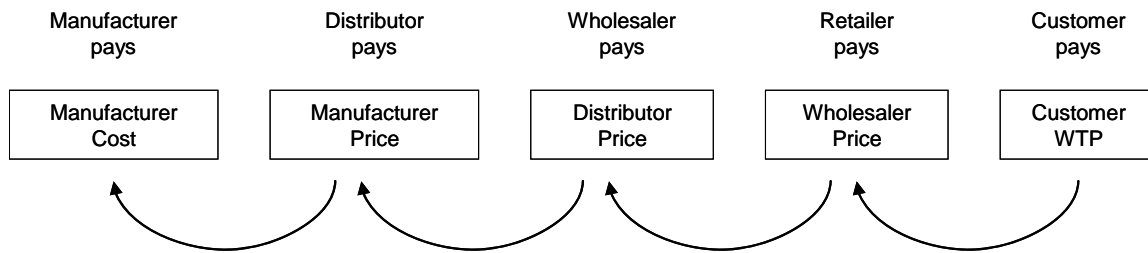| Manufacturer pays	Distributor pays	Wholesaler pays	Retailer pays	Customer pays
Manufacturer Cost	Manufacturer Price	Distributor Price	Wholesaler Price	Customer WTP

Figure 2: Profit Margin of Value Chain from Customer WTP

Knowledge of customers' WTP can not only help organizations to determine how to price the product at each stage of the supply chain, but also to determine whether the existing cost structure will be sufficient to support the appropriate margins through the supply chain.

Organizations that validated this best practice include Water Health Care, The International Rescue Commission, Precision, Pure Home Water and EtMedix. Precision used sophisticated surveys across several regions to determine the customer WTP. These surveys asked auction-type questions and recorded the WTP as the highest price at which the respondent would still purchase the product.

To work backwards, Precision needed to understand the appropriate margin for each intermediary. One way to do this was to consider the margin intermediaries make on other fast-moving consumables, such as a loaf of bread, milk, or a package of biscuits. After subtraction of each intermediary's trade margin, Precision could determine if the manufacturing cost of Aquatabs was feasible. Feasible manufacturing costs for a sustainable business should also ensure a 'sustainable' profit margin for the manufacturer.

The team also observed rapid assessments used to determine the WTP. This was used by Water Health Care where the municipality would decide on the price of safe water for its community.

Appendix H.3 provides a basic tool that organizations can use to determine appropriate intermediary margins once they have determined customers' WTP.

Pertinent Indicators (Refer to Appendix H.3):
- Profit margin across all parts of the supply chain
- Customer's willingness to pay per unit

4) **Provide expiration dates or replacement indicators on products**

Original Hypothesis: Educating the customer on product expiration dates or including replacement indicator features on consumable products informs customers when they need to renew their products. The benefit of such education and of including such features is three-fold. First, customers replace their products on time and therefore have healthy drinking water at all times. Second, product replacements generate revenues for manufacturers and retailers. Third, product replacement provides usability and adoption related indicators to manufacturers and retailers.

Validation Rationale: A consumable product, PSI's Waterguard has batch numbers, expiration dates, and a recall program that they have mastered over time. Batch numbers and expiration dates are printed on every bottle of Waterguard. These are then tracked by PSI's 11 key distributors, to ensure that sales of these products occur on a timely basis. PSI also has a recall program to ensure that when products are found to be defective there is a tested and fast system in place to recall the products with the use of batch numbers.

PSI also has put a Product Age and Monitoring Program in place which the CDC reviews to determine the lifetime duration of the product. While internal PSI tests indicate that the product will expire after 28 months, the CDC has recently extended their approval of the efficacy of the Water Guard product from 12 months to 18 months.

Visiting the only pharmacy to serve the 18,000 population of the historic town of Lalibela in Ethiopia, the team discovered that the owner who stocks Waterguard disposes of the products when they expire, even if he takes a loss on the unsold stock.

Failure to ensure that customers follow proper replacement timelines can result in lost sales and customer dissatisfaction, both of which can affect the sustainability of the business in the long term.

Pertinent Indicators (Refer to Appendix H.4):
- Number of replacement consumables produced versus those that are sold:
  # of units produced
  # of units sold

- Compliance rate of timely replacement of consumables: # of customers replacing consumable components on time

5) Educate customer on the product at the time of sale or before sale

Original Hypothesis: Educating the customer on how to use the product either at the point of sale or before sale can help to ensure that customers are using the

products correctly and also to minimize post-sale complaints from customers. Given the diversity of the customer base in most developing nations, the educational programs should be customized for various audiences. This includes utilizing pictorial manuals for illiterate customers, conducting live demos in the local dialect and providing posters, brochures and manuals in the local language.

Validation Rationale: Education was seen to be the first step in building the market for all of the organizations interviewed. Most had educational programs or partners to work on such efforts. Specifically, PSI and Precision had local language and culture-adapted educational materials created. For example, PSI had pictorial educational posters created in two versions, one depicting a Christian family and the other depicting an Islamic family, to ensure applicability to the rural markets covered. UNICEF, EtMedix, and Kale Heywet Church all referred to the importance of the behavioral and educational marketing requirements in the space. Kale Heywet referred to this as the "software package" that accompanies their concrete biosand filters and indicated that their software package costs significantly more than the actual product costs such as manufacturing, distribution and labor.

Some organizations, such as Pure Home Water (PHW), took educational efforts to the next level by employing an in-community model. PHW representatives coordinate water and sanitation volunteers for each community/village being served and have the volunteer be the contact person to help with education, maintenance, and usage questions. These community liaisons took orders, payment, and delivered the products to people within their communities. The liaisons were paid a US$2 commission for every sale.

Along with Pure Home Water, International Rescue Committee, New Energy, and Kale Heywet Church all advocated and used some version of this model. For example, New Energy had local water boards to ensure decision making was taken at a local level, increasing the likelihood of awareness and adoption of products.

Pertinent Indicators (Refer to Appendix H.5):
- Conversion:

No. of people from targeted population that purchases the HWTS solution

Total target population that receives education

Figure 3: Educational materials for a Muslim household (left) and a Christian household (right). (PSI)

Potential tools to facilitate effective education and to create awareness around the importance of clean drinking water could include: pictorial guides showing a step-by-step process on the use of the product, printed posters to aid in small group discussion around effects of unclean water, demonstrations in public areas such as the village centers to educate a large audience and demonstrations in schools as well as hospitals.

6) Track customer complaints from within households at the point of use to understand customer acceptance

Original Hypothesis: Tracking customer complaints at the point of use is an effective approach to ensure customer acceptance and competitive design of the product.

Validation Rationale: This best practice was validated by UNICEF, Precision and Vestergaard. All of these organizations emphasized the importance of customer acceptance in order to achieve the sustainability of any HWTS product. Precision and Vestergaard demonstrated the collection of customer complaints to track customer acceptance.

One effective method to track complaints is to group complaints into categories such as "high", "medium" and "low". This can help to understand the trends in customer complaints, manage the complaint mitigation process and identify remedial or product improvement procedures.

During a field visit to a rural area that is currently testing Vestergaard's LifeStraw, the team observed the importance of customer acceptance. Surveys were used to understand users' perceptions and acceptance levels of the product. Many users had initial complaints pertaining to the design of the LifeStraw saying that it was laborious and tedious to use and it gave them a sore throat. Gathering this data at the point of use will be vital to Vestergaard in evaluating its product design, acceptance and marketing strategies.

Appendix H.6 provides a tool that organizations can use to organize and track mitigation of customer complaints.

Pertinent Metrics (Refer to Appendix H.6):
- Average number of complaints per customer/intermediary

New Best Practice Methods Identified

7) Utilize endorsements from government accredited universities and organizations as marketing tools

Hypothesis: Endorsements from government, accredited universities, and other high profile organizations can benefit market entry efforts by building credibility and brand recognition. When entering the HWTS market, acknowledgement by a recognized and credible organization or institution helps build brand and generate awareness.

Example: Many of the organizations had endorsements they sought out to build credibility within the market. These included logo endorsements on marketing materials, certificates displayed in sales offices, and studies commissioned with prestigious and known institutions.

Ceramica Tamakloe had many distinctions visible in their sales office, which were also used in marketing materials. They had won a World Bank Development Marketplace Ghana prize, worked with the University of Ghana, and conducted water quality tests through government-certified agencies.

International Aid found that there was little awareness of their patented plastic biosand filters in their target Ghana markets, so they are commissioning a health impact study with University of North Carolina to prove product efficacy to potential partners and distributors. Dow Chemical is funding the study, which provides an additional credible partner in the effort. They also plan to use the results of the study in their marketing and educational programs.

PSI and United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) also employed such strategies in their efforts.

One possible way of gaining recognition and developing branding awareness is through partnerships. International organizations are held in high regard amongst the rural populations, therefore organizations can improve their brand by advertising their partnerships (through campaigns in the media or print on product packaging) with international agencies.

8) Forge public/private partnerships to leverage advantages

Hypothesis: Through discussions with for-profit organization, non-profit organizations and international organizations, it is apparent that in the regions of

focus, governments are proactive advocates in expanding the HWTS market and have been catalysts for the growing market size of HWTS products. Especially in Ghana, it is clear that the government welcomes private sector investments in these areas. Some ministries within Ethiopia, however, believe that advocating private sector investment in HWTS detract from their own credibility and pose a conflict of interest, as currently its citizens have immense faith that the government is providing reliable drinking water. The points below mention best practice measures that private organizations have implemented to forge a productive relationship with the public sector in expanding the HWTS network.

Example: While some public/private partnerships existed between most of the organizations that we interviewed and have been actively encouraged by inter-governmental organizations such as UNICEF and UNOCHA, Medentech seemed to be able to extract the most gains from such a partnership.

Prior to granting exclusive distribution rights to Precision, Medentech visited Ghana and met with non-governmental organizations as well as government representatives. Kevin O'Callaghan from MedenTech was able to forge a relationship with the non-government organization AED (Academy for Educational Development) and its Hygiene Improvement Project (HIP). AED essentially performs social marketing initiatives to raise awareness on HWTS issues and has been mandated by the Ghanaian government to educate 600 government volunteers on these issues. Through its partnership with AED, Medentech was able to effectively train these volunteers on the benefits and use of Aquatabs and enhance its awareness. This involvement with AED also helped Precision win a general endorsement, as well as a speedy food and drug board endorsement. Its indirect association with the government through this study also helped Precision to meet with the military, a potential client for Precision.

A strong relationship between a private enterprise, a public sector organization, and a non-government organization can be fruitful by allowing all stakeholders to participate in solving the same goal together by leveraging each others competitive advantages that would contribute to the branding, awareness and sustainability of the private enterprise. There are challenges in achieving such partnerships due to the inherent differences in incentives. However these challenges can be overcome with upfront agreements on goals of the partnerships, clear description of roles and responsibilities and communication of detailed operating procedures.

Pertinent Indicator:
- Number of people reached by government/NGO efforts

9) Plan exit strategies for emergency distribution situations

Hypothesis: Since many HWTS products are sold to aid agencies for distribution in emergency situations, organizations sometimes face the problem of their

products being recognized as emergency products rather than lifestyle products. This often hampers post-emergency commercial sales of products within communities coming out of emergency situations where products were distributed for free. Despite this struggle between a lifestyle and emergency brand, emergency situations also provide an opportunity for HWTS implementers. When emergency relief aid is provided, some communities see the benefit of HWTS products and oftentimes ask for such products after the free distribution ceases. An exit strategy from emergency situations would help mitigate both of these.

Example: Many organizations discussed the challenges with transitioning from an emergency product to a lifestyle product in the eyes of customers who have received HWTS products from aid agencies during emergency situations. International Rescue Committee and UNOCHA verified the situation as a real problem for organizations, with UNOCHA planning a marketing program on lifestyle and preventative use of HWTS products to address just this issue. PSI launched a pilot marketing effort in September 2007 to change perceptions of their product to be a lifestyle product. Based on initial results, they saw an increase in sales, but feel they have a long way to go to change customer perception.

Upon discussion, the MIT team suggested two brands or packaging types for the product. There would be an emergency package or brand and a lifestyle product. This suggestion was well received by PSI. Not only would this help with changing perceptions, but it would also help mitigate against cannibalization of commercial sales from government and aid products, which were bought at lower prices than commercial prices, that are resold to commercial organizations at a lower price. Pure Home Water confirmed that this is a problem for them as well.

Another way to guard against this challenging transition between emergency to lifestyle product is to build a commercial brand before selling to aid agencies for emergency relief. Medentech distributors EtMedix and Precision both follow this model and find that having a brand and product awareness built before a product is used in emergency relief prevents association with an emergency product alone. Furthermore, they also hope to limit their sales to government and aid agencies to primarily those that will be distributed to small and isolated communities, as a way to prevent the perception issues from spreading to larger markets. Of course, this approach may be difficult in the face of a large epidemic or emergency.

UNICEF presented emergency situations as opportunities for HWTS organizations, as those in the affected areas have little to no access to such products after free distribution ceases. People in the affected communities ask agencies like UNICEF to help connect them to such products, but there are often no groups selling into those regions. Hence, an exit strategy would benefit both the local communities and organizations that are missing these potential sales.

UNICEF's recommendation was for aligned and consistent communication with private sector HWTS implementers throughout the cycle of emergency situations. If education takes place before, during, and after, transition to use of an HWTS product, sales will become easier than if there were no coordination at all. Underscoring the importance of the previous best practice # 6, there is value in having coordination with governments, so that alignment with aid efforts becomes even smoother.

10) Enforce limited stocking based on moving sales averages to allow intermediaries to experience "fast-moving" sales

Hypothesis: Supply chain intermediaries value fast-moving products more than high margin products. Limited stock will lead intermediaries to believe the consumable is fast moving and therefore intermediaries will continue to stock the product.

Example: PSI championed this approach by enforcing a 1.5x stocking rule at each retailer. Waterguard salespeople were responsible for tracking retailer weekly sales and using a moving average over the last four weeks to forecast next week's sales. The salesperson was then not allowed to sell the retailer inventory that would make the retailer's Waterguard stock more than 1.5x the subsequent week's forecasted sales.

PSI indicated the importance of this practice in order for the retailer to believe the product is fast-moving, regardless of whether the product is fast-moving or not. This method minimizes expired product at the retailer or wholesaler.

In order to implement this best practice, it is essential to accurately measure sales over a consistent and regular period of time. Precision indicated that they understand the importance of this practice by committing to make monthly visits to wholesalers. Sustainable businesses should select wholesalers who track retailer sales and are willing to pass this information along to the manufacturer, allowing all members of the supply chain to understand weekly sales.

Appendix H.7 provides a tool that can be used to track inventory stocked and to implement the 1.5x stocking rule.

Pertinent Indicator (Refer to Appendix H.7):
- Regularly recorded retail sales over consistent periods of time

11) Balance distribution channels to capture both Equity and Efficiency

Hypothesis: Most of the businesses that were interviewed stated that they had a dual-purpose goal. They essentially wanted to make a social impact as well as make money. Yet, in creating such a business, they saw a trade-off between making that extra dollar of profit and distributing their product to those who really

needed it at a price at which they could afford it. Profitability could be enhanced by transporting goods to retailers that stocked a wide array of products that were on major roads, yet those who needed the product were typically in rural regions and had less of a willingness- and/or ability-to-pay. From the interviews, it was obvious that a large portion of the cost went to transport, whether it was sourcing the raw materials or distributing the goods to the end user. This made it even more costly to distribute it to those in rural regions and less profitable as well.

Example: While many firms were unable to provide a clear answer as to how to alleviate this problem, PSI provided the team with an interesting solution to this problem. Their distribution methodology is based on the Pareto Principle or the 80/20 rule, where out of 114,000 outlets in Ethiopia, 80% of the value (profit/distribution capability) comes from only 20% of the outlets. By being able to determine which of these outlets were more efficient, PSI is able to save costs through distribution. The identification of the efficiency of retail outlets were deemed possible either by the Every Dealer Service (EDS) method or the Free Run. The former is an expensive method of going to every single outlet and conducting an extensive survey, while the latter option, which was chosen, allowed PSI to kill two birds with one stone by going to each outlet, stocking them with the product and assessing the sales efficiency of the outlet after the expected inventory cycle, while gaining revenues through the sales of stock.

However, this Pareto Principle only assesses efficiency, and thus PSI has split their distribution into Pareto Outlets and Equity Outlets, the former is based on the aforementioned efficiency identification methodology, while the latter is based purely on the social impact objective of distributing their product to those who need it most. PSI, however, believes that a reconciliation of the profit versus social impact trade-off can be made by investing enough into the Equity Outlets, conveying best practices through their sales people, to transform these Equity Outlets into Pareto Outlets that generate cash flows and profitability that is on par, if not greater than, the initially selected 'best' retail outlets.

As mentioned in the beginning of the paper, this team's definition of a sustainable business not only encompasses the financial and commercial sustainability of a business, but more importantly, the scalability of its social impact. The above mentioned Pareto Principle only allows for the identification of value-maximizing outlets, but does not provide room for scalability. Investing in Equity outlets to become Pareto outlets, however sheds light on a possible methodology for becoming a truly sustainable business.

12) Utilize marketing channels to effectively reach both the end consumer as well as organizations within the supply chain

Hypothesis: The target consumers for a large number of HWTS solutions live in rural areas. These consumers are usually unaware of the need to have clean

drinking water and of diseases that can be caused from consuming untreated water. Marketing thus plays a critical role in creating awareness, as well as in building demand within the target consumer population. However, in addition to targeting the end consumer, using appropriate channels to reach traders in the supply chain can also help to build demand as these traders are responsible for selling and stocking the product.

Example: PSI Ethiopia is an organization that effectively utilizes this marketing approach. PSI's customers are villagers that live in rural parts of Ethiopia. A majority of villagers own or have access to radios, however, only a few have access to televisions. Yet PSI uses both radio and television for their marketing campaigns. While the messaging for both campaigns targets the end consumer, the rationale for using television as a channel is to create brand and product awareness amongst distributors and wholesalers who eventually take the product to the end consumer. This marketing approach has helped PSI to partner with key organizations that have shown interest in the product. To evaluate the effectiveness of their marketing channels, PSI uses channel planning criteria such as the number of people that can be reached though that channel, the effectiveness of the message to induce a change in behavior, cost effectiveness and budget availability.

It is important to note that the best practices 10 to 12, while demonstrated only by PSI, were found to be very innovative and highly effective. Given the impact of steady sales at the retail level, of effectively reaching both customers and suppliers as well as of balancing efficiency and equity, the project team strongly believed that best practices 10 to 12 would serve as excellent examples for other organizations.

Best Practices Not Validated Through Interviews

13) Monitor the number of replacement parts produced versus those that are sold

Rationale: The number of consumables produced over the number sold measures the alignment of the manufacturer's perception of replacement part practices versus consumers' actual replacement part practices. The metric was not considered as a best practice since consumables were not used in any of the HWTS products that were prevalent in Ethiopia and Ghana.

The team, however, believes that this is still an important metric to monitor for organizations that manufacture, sell or distribute HWTS products that contain replacement parts such as a resin based cartridge. If the metric is far greater than one, it will indicate that either the manufacturer is incorrectly forecasting the replacement parts rate , or that customers are not replacing parts when necessary. The first conclusion will lead to the necessity for better forecasting, the second will lead to the necessity for re-education of consumers. Hence,

monitoring the metric can aid in better forecasting decisions as well as evaluation of educational programs. If the number is above one, then not enough production is taking place to meet the demand for replacement parts. Production levels will need to be increased as a result.

14) Monitor break even point of the business or production facility

Determining and monitoring break even point of a production facility is a useful tool to prevent losses due to over or under production. While several organizations such as Pure Home Water and Ceramica Tamakloe did consider break even points, they found the metric not very useful. This is because given the frequency of disasters and emergency relief requirements in the HWTS business, forecasting demand and production needs are extremely challenging. Hence, using a break even point to determine production requirements can be very risky given the high uncertainty in the demand projections.

In more mature markets, however, where demand is more predictable calculating a break even point upfront can help to determine optimal levels. In addition, break even points can also be used to assess whether it is feasible for an organization to enter a potential new market.

Conclusion

Throughout the project it became clear that there are a limited but growing number of commercially focused organizations in the HWTS space. Today, few of these organizations are sustainable and can go to scale. Yet, in order to meet the aim of providing safe drinking water where it is currently not available, business sustainability and scalability are of the utmost importance. Traditionally dominated by government and NGO players, there are now a number of new entrants to the space looking to business sustainability as a key goal, but without clear guidelines, methods and indicators.

In order to achieve the business sustainability and scalability necessary to make a lasting impact, the team's findings indicate organizations entering the space must focus on the three things: building the market, focusing on partnerships, and bringing down costs.

Build the Market: Not only does the market need to be educated and made aware of the consequences of drinking unsafe water, but they must be able to recognize the technology and how to use the HWTS solution before they will willingly pay for a product. Educational programs with in-person demos and seminars, marketing campaigns adapted to local markets with pictorial representation of cultures and ideas, and providing trials as proof points are all best practice activities to build the market.

 Partnerships: . For education, awareness and credibility building, manufacturing, and distribution, partnerships with locally knowledgeable and credible groups are vital. For example, partnering with aid agencies and government efforts before, during, and after an emergency aid situation provides a mutually beneficial relationship. The implementing organization gets the opportunity to educate, build awareness, provide trials of their product, and then sell into a captive market post the emergency. On the flip side, the aid agencies and governments get access to aid products, education efforts, and expertise.

 Bring Down the Costs: costs must come down in order to make the currently implemented solutions sustainable. While some existing organizations are making good progress on building the market and partnerships, they still struggle with their cost structures. Distribution and manufacturing costs are the most significant, especially as products are delivered to more and more remote areas. Utilizing existing distribution channels, investigating local manufacturing, and innovating on the technology are all avenues to reduce distribution and manufacturing costs.

The opportunity to affect change and make a significant impact is boundless at this point in the HWTS market. The team has full faith that there are many new innovations to come in HWTS technologies, business models, and market approaches.

Reflections

Insatiably curious, the team approached G-Lab looking for opportunities to have a global social impact, work in new business environments, and match the team's skill sets to the project's needs. This project presented a unique opportunity for the team to make a scalable global impact towards social development. Indeed, our field study not only satisfied our desire to further our understanding of how for-profit sustainable businesses can operate profitably as well as make a social impact, but also emancipated our minds from the standard business school curriculum.

We not only learned that we can survive without having high-speed internet access for weeks at a time, but in fact we could be productive and add value with just our collective minds, a pad of paper and a pen. The contacts we made during our travels not only enhanced our understanding of how business is executed in the varying parts of Africa, but befriended us, provided us with tips and advice, loaned us their lead sales representative to take us out for a tour of their city amidst their busy schedule, and let us play with their baby when the schedules only allowed for us to meet with them at their home. We found that the same person can be Pure Home Water's top sales representative during the day and carry out his duties as the tribal chief's son by leading his village through the Fire Festival during the night. The memories of our travels have been trapped in our minds forever, while what we have learned during this trip has sharpened our business acumen and reshaped our perspective of the world.

From a team perspective, this project provided us the opportunity to stretch ourselves and enhance our skills. It was important for us to understand our team members to learn the most effective way of communicating with each member throughout the length of this trip, cold call organizations who had never heard of MIT and arrange meetings on one hand, while using the MIT / WHO brand name on the other hand to connect with people in areas of the world where we otherwise would not have come to nor met. We expect the friendships forged as part of this whole process to last for a life time and the experiences to help shape who we are by being more cognizant of the needs of many more people in the world.