International Development Enterprises

Ceramic Water Purifier National Roll-Out Strategy and Quality Assurance Plan

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1 Introduction

1.1 Project Overview

Over the last several years, International Development Enterprises ("IDE") has conducted extensive research and customer-use testing on the product quality and related health benefits of the Ceramic Water Purifier ("CWP"). The CWP is a low-cost household water treatment technology that removes bacteriological water contamination at the point of use. IDE's research has demonstrated substantial health and cost savings benefits of the CWP for rural households and its *potential* for wide-spread adoption in Cambodia where safe drinking water is unavailable to a large portion of society.

To achieve significant and sustainable product proliferation, IDE believes that the best approach is to involve, to the extent possible, private sector firms in the manufacturing, distribution and sale of the product. This "private sector approach" is driven by the desire to build a permanent infrastructure to support the product and maximize customer adoption by reducing the dependency on donor-based funding and support over time.

To test the validity of this belief, IDE has worked to develop several "private sector markets" for the product to understand the issues associated with national distribution based on market demand and private sector value chain participants. While these "pilot" markets are still nascent, the initial findings suggest that the product has the underlying characteristics and economics necessary to attract and support private sector participation in all components of the CWP value chain.

To build on this initial work, IDE has commissioned the development of this *"National Rollout Strategy and Quality Assurance Plan ("NRS")"* for the CWP.[1] The broad objectives of the NRS are to (1) develop a national rollout plan/commercialization strategy in Cambodia for the CWP and (2) develop a strategy for ensuring that all CWPs that enter the marketplace meet appropriate quality and performance standards. To achieve these objectives, the NRS seeks to answer the following questions:

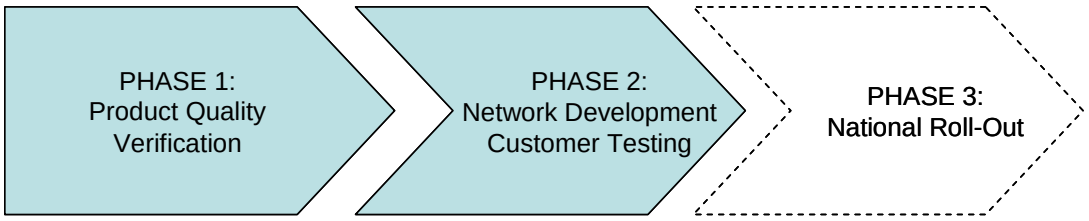
1. How can the current CWP project ensure involvement of the private sector in the expansion of the CWP technology while ensuring that adequate standards in relation to quality control and customer education are maintained?
2. How can IDE ensure that the private sector's involvement is a response of the private sector (pull strategy) and that the business into which prospective firms would enter is a viable one – especially given the challenges of customer's ability / willingness to pay and an unprotected technology?
3. What is the optimal industry structure with respect to the extent of donor/private sector participation and manufacturing centralization?

[1] Funding for the development of this *National Roll-out Strategy and Quality Assurance Plan* was provided by UNICEF (70%) and the American Red Cross (30%).

1.2 Project Foundation

As mentioned above, IDE has already conducted two extensive phases of research and analysis which set the foundation for the CWP NRS in Cambodia. This research, illustrated in **Figure 1**, has validated the benefits of the product and identified some of the key issues associated with market-driven product proliferation.

Figure 1: IDE Research



- Conduct testing to evaluate water purification attributes
- Identify and quantify customer benefits
- Assess product durability and maintenance requirements within rural household use conditions

- Distribute product through subsidized and unsubsidized distribution
- Establish manufacturing sites and pilot distribution and retail networks
- Refine product based on customer use testing
- Refine marketing plan and customer value proposition

The NRS incorporates the key findings of this research as the foundation for developing the specific strategies and actions necessary to support product proliferation through private sector firms.

1.3 Strategy Objectives

To meet the primary objectives of the CWP project, the NRS seeks to provide the foundation for transitioning the manufacturing, distribution and sale of the CWP from a “donor-driven initiative” to a “market-driven industry” that utilizes the support of donor funding/assistance only as required to support national product proliferation. Importantly, the NRS seeks to build the infrastructure necessary to reduce/eliminate donor involvement over time.

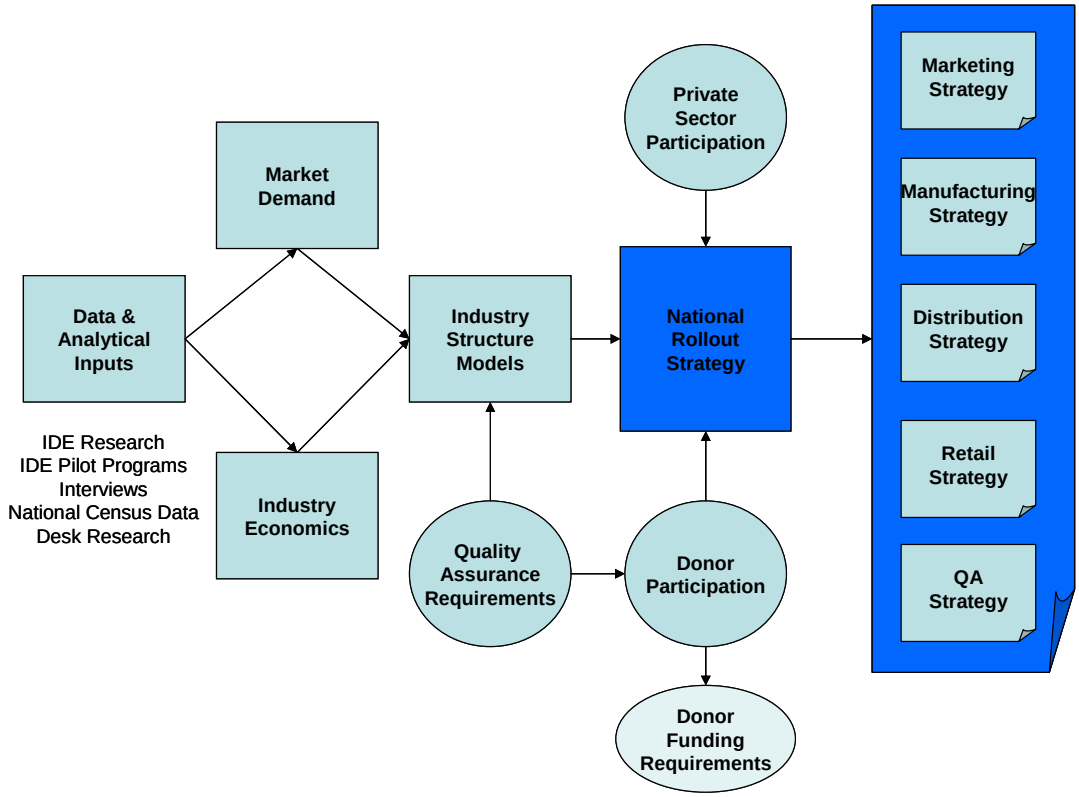
It should be noted that while an important goal of the CWP initiative in Cambodia is to provide safe drinking water to as many households as possible; it is a secondary consideration to the development of a sustainable private sector value chain. As such, the plan seeks to develop a framework which provides adequate financial returns to private sector firms to support long-term industry sustainability. While this objective may limit the number of households that can afford the CWP, it is deemed necessary to develop a sustainable industry that is driven by market demand and not by direct donor price subsidy.

The primary objective of private sector participation; however, presents some issues with respect to ensuring product quality once "centralized donor control" is relinquished. As such, the NRS also seeks to build the mechanisms necessary to discourage proliferation of ineffective *"copy-cat"* products that do not effectively purify water for household consumption. This does not mean; however, that the plan seeks to eliminate competition from other viable, beneficial and cost-effective water purification products.[2]

1.4 NRS Development Framework

The NRS utilizes IDE's preliminary research to (1) evaluate the issues with and potential models for national product rollout based on market demand and (2) calculate expected financial returns to each private sector firm in the value chain to assess the market's attractiveness for these organizations. From this evaluation, the NRS identifies the key responsibilities of both private sector firms and donors with respect to market development and outlines the key strategies required to achieve significant product proliferation. **Figure 2** illustrates the overall framework for development of the NRS.

Figure 2: National Rollout Plan Development



[2] To support private sector firms in the CWP value chain; however, it will likely be necessary to promote the advantages of the CWP over other viable water purification products. Private sector involvement, by definition, creates a competitive environment with respect to competing products serving the same customer need.

2 Current Status & Key Findings

There is a significant amount of information and market experience on the CWP on which to build the NRS. The following sections summarize the current status of the CWP in Cambodia with respect to product characteristics, initial sales & marketing activities, potential market size and product demand, manufacturing capacity, distribution methods, retail network development and trade finance.[3]

2.1 Product Characteristics

2.1.1 Description

The CWP consists of a porous, pot-shaped filter made of kiln-fired clay which is impregnated with colloidal silver. Prior to sale, the clay filter is placed within a large "food grade" plastic receptacle tank that is fitted with a spigot and covered with a plastic lid. When water is poured into the filter, it seeps through the filter and into the plastic receptacle. The water collected in the plastic receptacle after filtration is safe for human consumption.

Pilot tests conducted in Cambodia from May 2002 through June 2003 show that the filter produces water meeting or exceeding WHO low-risk guidelines 99% of the time under conditions of rural household use. The filter produces drinkable water at a rate of 2-3 liters per hour and a total of about 10 liters per filling. Finally, the product remains effective for approximately 2-3 years.

2.1.2 Value Proposition

The benefits of the CWP are significant, yet vary by household. The variation is largely based on the methods of water purification prior to CWP use. Customer research has demonstrated substantial benefits with respect to **cost-savings** over time (reduced firewood and charcoal expenses), **reduced time** spent producing drinkable water (gathering firewood and waiting for water to boil) and **health benefits** (reduced incidents of diarrhea and other water borne illnesses). To date, customer feedback suggests that the most compelling benefits of the CWP include improved health and "clean water." Full realization of CWP benefits requires a properly functioning product and proper cleaning technique. Furthermore, optimizing the health benefits of the CWP requires good hygiene practice.

2.1.3 Product Issues

While the product is viewed favorably in the market by both supporting donors and end-users and provides significant value to its customers, a number of product-related issues have been identified. The primary product issues which may impact demand and growth are outlined in **Table 1**.

[3] These sections do not attempt to provide a comprehensive cataloging of all IDE research and experience to date. Rather, the sections focus on those findings that are most relevant to the development of the NRS.

Table 1: Key CWP Product Issues

Product Issue	Rationale	Comments
Sub-optimal Look and Feel	The plastic receptacle looks like an ordinary trashcan. This appearance does not instill confidence in the buyer that safe water will be produced.	The new receptacle molding will have the brand image molded into the receptacle which should differentiate the water receptacle from other plastic containers.
Filter Durability	As a ceramic product, the filter occasionally breaks during both transport and cleaning. • Breakage during transport is approximately 2%. • Breakage during household use and cleaning is approximately 0.6% per month.	Manufacturing processes should be evaluated to ensure that the filter is being produced to minimize filter breakage. Distribution packaging should be evaluated to optimize protection during transport. Revised cleaning recommendations (from 2x per week to 1x per month) should reduce the household breakage rate. Consumer education should emphasize proper cleaning and handling techniques and safe placement within the home.
Slow Filtration Rate	Consumers believe that it will take too long to produce sufficient water for household consumption needs.	Consumer education and "use guidelines" are required to eliminate this misconception.
Invisible Technology	The key ingredient in the filter (colloidal silver) cannot be seen by the consumer. This makes the product easily replicated without producing the health benefits of the CWP. It also makes the consumer less clear on the value proposition of the product.	Strong quality assurance mechanisms are crucial to reduce the potential for "copy-cat" products. Evaluation of how to physically highlight the key ingredient within the product should be undertaken.

2.2 Sales & Marketing

2.2.1 Sales

IDE has tested a number of methods for distributing CWPs, including various subsidized distribution models (by IDE directly and through partner NGOs) and full-cost distribution through market channels. Over a three-year period (to August 2004), about 18,500 subsidized CWPs were distributed at end-user costs ranging from zero to $5 per unit.[4]

Over a 10-month period (to Aug 2004), approximately 1,700 CWPs have been purchased directly by end users through commercial supply chains at prices ranging from $6 to $13 per unit with the majority selling at $8 (driven, in large part, by the set pricing strategy developed by IDE in Kampong Cham). The unsubsidized market-based sales provide the foundation upon which to evaluate the potential for private sector participation in the market

2.2.2 Marketing

The CWP marketing program to date has been focused on refining the marketing message and initiating basic branding and promotional campaigns. The main programs currently in place include: (1) billboards/displays, (2) brochures, (3) posters, (4) radio broadcasts and (5) mobile billboards and loudspeakers. As no data exists on the customer acquisition cost by marketing program, the effectiveness of each program is unclear. At the same time, current retailers believe that the radio broadcasts and mobile billboards with loudspeakers have been particularly effective.

In addition to direct CWP marketing programs, IDE and other donors have been actively involved in social marketing programs focused on customer behavior change with respect to water consumption. It is believed that these programs have had a solid impact on product recognition and adoption to date.

In total, IDE has spent approximately $11,350 on direct CWP branding and product promotion campaigns nation-wide.[5] In Kampong Cham, the province with the most focused private sector network, IDE has spent $4,140 on direct branding and product promotion activities.

Given the total unsubsidized, dealer-based sales, the average customer acquisition cost from the current direct marketing program is approximately $6.50.[6] While this cost is clearly unsustainable for a product retailing at approximately $8.0, it is not unexpectedly high. In all markets, initial customer acquisition is expensive relative to customer value until the brand becomes established and word of mouth marketing becomes effective and prevalent. This expense does; however, provide a baseline figure upon which to project required short-term marketing spend to achieve required demand.

2.3 Product Demand Indicators

While demand is difficult to assess at this early stage of market development, initial willingness-to-pay studies conducted by IDE suggest that approximately 10% of Cambodian households would be “interested” in the product at a sale price of $8.[7] This demand must be

[4] “Subsidized CWPs” are defined here as CWPs for which the end-user paid less than the full commercial price. Most of the subsidized CWPs were in fact purchased at full cost by NGOs and provided to end users at less than full cost.
[5] This expense does not include the marketing and product promotion conducted by other NGOs distributing the product.
[6] The customer acquisition cost in Kampong Cham is $6.48. The customer acquisition cost nationwide is $6.66.
[7] Data extrapolated from an IDE survey of 100 non-CWP users in Pousat province, August 2003.

viewed with caution; however, as "interest" does not necessarily correlate with the number of household who will actually purchase the product. At the same time, it does provide a data point upon which to test other demand assumptions.

2.4 Manufacturing Capacity & Facilities

By December 2004, the CWP will be manufactured at three separate locations in Kampong Chhnang, Kandal, and Prey Veaeng provinces. The total average monthly output of these three sites is approximately 4,200 units (50,040 units/year.) It is likely, given advances in manufacturing expertise and the acquisition of additional production equipment, that the monthly output of these three sites could exceed 6,000 units. **Table 2** provides a summary of existing manufacturing sites.

Table 2: Current CWP Manufacturing Site Characteristics

Location	Monthly Output Capacity[8]	Operator/Owner	Notes
Prey Veaeng	1,000 units (3,000 units maximum)	Constructed by IDE Owned & Operated by Cambodian Red Cross Funded by American Red Cross and World Bank	Production begins in Nov 2004 Largely manual manufacturing process
Kampong Chhnang	2,000 units (3,000 units maximum)	Constructed by IDE Owned & Operated by IDE Funded by CIDA	Efficient facility driven by limited automation and significant manual labor
Kandal	1,200 units	Constructed, Owned & Operated by RDI	Highly automated Produces "Frog" brand CWP

The current factories are dedicated facilities, producing only the CWP and it is anticipated that these factories will continue to provide production capacity in the future.

As outlined in the table, all sites are currently owned and operated by NGOs. While each of these organizations seek to generate a profit from the sale of the CWP to support other initiatives, they are also driven by non-business objectives and have the ability to secure funding from sources other than their CWP business activities. As such, the continued ownership of these manufacturing facilities by NGOs may present challenges with respect to protecting private sector manufacturers, distributors, and retailers should these organizations sell the CWP below the market price. That being said, all of the current manufacturer-NGOs have expressed their intention to continue producing CWPs on a commercial basis and to cooperate with each other in CWP dissemination.

The cost of manufacturing the CWP varies slightly by facility based on the level of site automation, energy costs, and infrastructure costs. As a baseline for analysis, the current

[8] Actual monthly output varies based on demand.

production cost at the Kampong Chhnang factory has been used and is $5.15/unit.[9] It is anticipated, however, that the cost of production will decrease over the next several years by approximately 10% as manufacturing techniques improve and through consolidated purchasing of raw/semi-finished materials.

IDE is currently in the process of developing a mold for a customized plastic receptacle and will contract with a single source provider to manufacture the product in Cambodia. As such, manufacturers of the CWP will only be responsible for producing the clay filter and assembling the product prior to distribution.

2.5 Distribution Network

To date, most CWPs have been distributed through NGOs to selected provinces across the country. Once an NGO takes "ownership" of the product, they are free to distribute the product wherever they deem appropriate and at whatever price they desire.

The main exception to this distribution structure is the private sector distributor in Kampong Cham province. While the distributor is a "friend of the company," his distribution process likely provides a model for private sector distribution across the country. In this case, the distributor rents a truck once a month to collect the CWPs from the manufacturing site in Kampong Chhnang and stores them at his house in Kampong Cham. He then distributes the product via a flatbed motorbike to the different retail outlets in the province, often going 50km to reach retailers outside of the main population centers. This "Hub and Spoke" model, utilizing vehicles appropriate for the road quality within his market, is likely the correct distribution model and would be employed by any local distributor operating in the country.

2.6 Retail Network

As with distribution, the current retail network for the CWP consists of two primary models. The first model is comprised of NGOs "selling and/or giving" the product to selected households. The second model, used in Kampong Cham, Kampong Chhnang, Poipet and Pursuat, is a private sector-driven retail network. These networks are comprised of a number of different types of retailers ranging from health clinics to pharmacies to all-purpose home furnishing and general goods retail outlets. At present, there are 30 retailers in Kampong Cham, 7 in Kampong Chhnang, 6 in Poipet and 24 in Pursuat.

A brief assessment of the private sector retail networks suggests that health-related retailers are more successful in selling the product and produce a considerably higher product turnover rate than general retailers. This is likely the result of three primary factors: (1) health-related retailers are "respected" by their customers, (2) the customer is driven to the retailer for specific, acute health-related issues and (3) the retailer is motivated to "push" the product given the health benefits that it provides to their customers.

The profit margin of private sector retailers varies considerably across the country and is in the range of 8-25%.[10] In Kampong Cham, given the structured pricing strategy, retailers receive a 10% gross margin.

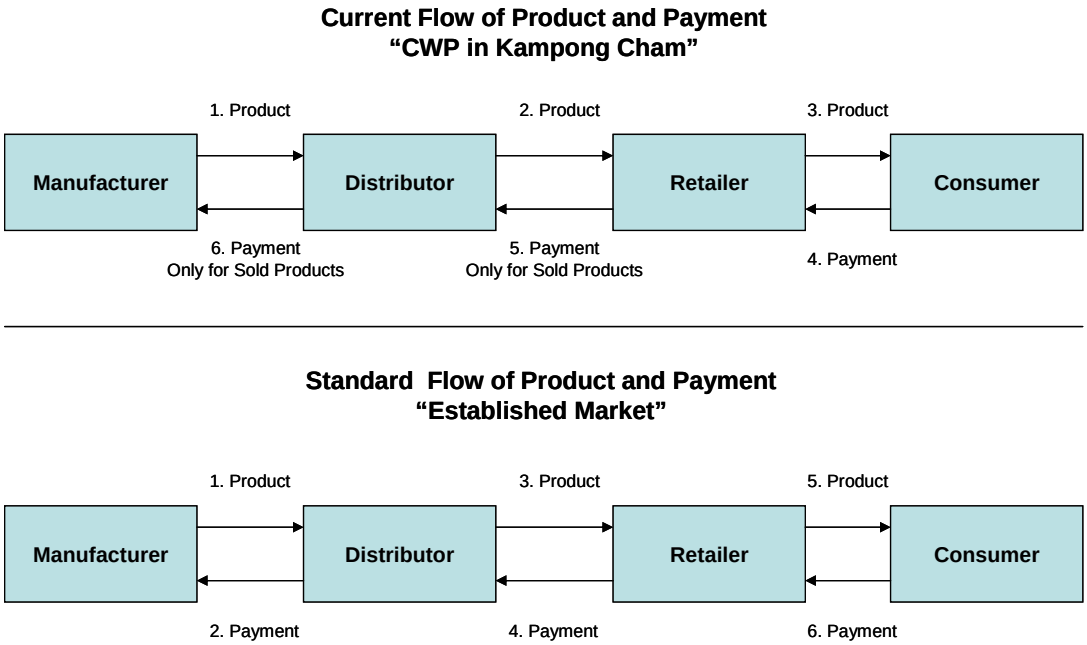
[9] This is the current factory-door production cost for the complete CWP set including ceramic filter element, plastic receptacle bucket, spigot, lid, instruction brochure, and packaging. The cost includes materials, labor, factory rent and utilities, factory management, depreciation on production equipment, and an allowance for filter elements rejected during manufacture or broken during transport. The cost does not include tax, transportation, manufacturer profit, distributor/retail profit, or marketing costs.

[10] It should be noted that to date there has been no refinement of the initial retail networks established in each province. As such, average retailer performance is likely lower than what should be expected once a dedicated effort is made to "filter" underperforming retailers from the network.

2.7 Trade Finance

The current private sector firms in the CWP value chain are of a size that makes pre-purchase of the product difficult. Most of these enterprises have limited access to cash. As such, to develop the market, IDE is currently assuming all product risk and receiving payment only after consumers have purchased the product from the retailer. If the product is not sold, IDE does not cover its production costs. In other words, IDE is providing all "Trade Finance" for the product without receiving interest payments or securing the "working capital loans" with collateral. While this approach was necessary to jump start the market, over time, it provides an unrealistic model on which to base a sustainable private sector-driven market. **Figure 3** provides an illustration of the current product and payment flow against a standard flow for an established product market.

Figure 3: Current Product & Cash Movement



3 Current Private Sector Industry Economics

3.1 Overview

An analysis of the potential private sector economics of each component of the value chain (manufacturers, distributors and retailers) has been conducted to assess the attractiveness of the industry for private sector firms. The assessment is based on the match between expected and required profit margins for each component of the value chain. **Table 3** provides the current margins to each value chain participate based on current manufacturing costs and a retail sale price of $8.0.[11]

[11] All manufacturing cost and profit calculations are based on the current per unit production costs at the Kampong Chhnang facility.

Table 3: Current Profit Margins at $8.00 Sale Price

Value Chain Component	Direct Cost	Sale Price	Gross Margin	Cost of Sale	Net Margin
Manufacturers	$5.15[12]	$6.25	21%	0	21%
Distributors	$6.25	$7.20	15%	$0.80[13]	2.4%
Retailers	$7.20	$8.0	10%	0	10%

3.2 Manufacturers

Approximately 90% of production expense is comprised of variable direct costs. The remaining expense is largely comprised of the depreciation of the fixed assets necessary to produce the CWP. This cost structure is ideal for manufacturers if the net margin is sufficient to cover the limited overhead costs necessary to establish production capacity. In other words, significant demand is not a critical component of the financial attractiveness of the CWP market. Sufficient volume, while important to cover fixed costs, is a secondary driver.

3.2.1 Projected vs. Required Profit Margins

At assumed profit margins of 21%, private sector manufacturers should be attracted to this market. Experience with other water technologies suggests that private sector manufacturers have low margin requirements -- even at relatively low volumes. As an example, manufacturers of the treadle pump are currently selling the product at a margin of 3-8%.

3.2.2 Capital Investment Requirements

The upfront capital investment required to begin manufacturing; however, is not insignificant; particularly for small brick and tile manufacturers without deep capital reserves. For a standard factory producing 1,500 units per month, the estimated capital expenditure is approximately $20,000 for a new production facility.[14] At this volume, and assuming projected margins, the payback period on upfront investment is approximately 10 months. While this payback period is adequate to attract private sector participation, securing the investment capital may prove difficult. The upfront capital investment for existing brick and tile manufacturers is significantly less. Depending on existing infrastructure and capacity, the upfront capital investment for existing manufacturers is approximately $2,000 – $5,000.

3.2.3 Critical Factors

To attract private sector participation, the size of the market for any given manufacturer ("manufacturing coverage area") must be sufficient to cover fixed costs. As such, manufacturing coverage areas must be adequate and protected to ensure required production volumes.

3.2.4 Summary Evaluation

The economics of the industry are attractive to potential private sector manufacturers, even with a substantial reduction in margin. To ensure private sector participation; however, demand for each manufacturer must be adequate to produce sufficient profit to payback capital expenditures and cover fixed costs. To the extent possible, existing brick and tile

[12] This direct cost is total per unit cost including breakage at the Kampong Chhnang factory minus publicity expense.
[13] Transportation cost (vehicle rental/depreciation, fuel, road tax, etc.)
[14] This includes the cost of land rental.

manufacturers with operational facilities and excess capacity should be used to reduce start-up capital requirements.

3.3 Distributors

The attractiveness of the industry for private sector distributors is highly dependent upon the costs associated with transportation; mainly petrol and vehicle rental/depreciation. Given the variability in road access/quality within Cambodia and the vast differences in distribution equipment among existing private sector distributors, the economics for each provincial distributor will vary considerably.

3.3.1 Projected vs. Required Margins

As with manufacturers, the current projected margins should be sufficient to attract private sector participation in CWP distribution. Estimated gross margins of 15% far exceed the current margins of treadle pump distributors and assemblers. These organizations are willing to distribute and assemble the product at gross margins between 2-9%. Required and expected net margin; however, is more difficult to estimate. Based on distribution costs of current distributors in the private sector CWP value chain, the average distribution cost/CWP is $0.80.[15] This cost structure provides distributors with a net profit of $.15 per CWP and a net margin of 2.4%. While low, this margin should be sufficient given the experience of the treadle pump industry.

3.3.2 Critical Factors

As mentioned, the attractiveness of the CWP market to private sector distributors is based on the costs associated with transportation. This expense is driven by the distance and quality of road access between manufacturers and retailers, the depreciation of fixed assets (warehouses and trucks) and the ability of distributors to transport products at "full load" capacity. To maximize distribution profit, therefore, manufacturing facilities should be placed throughout the country and near high-quality roads to reduce petrol expense and vehicle wear and tear. In addition, each distributor should be guaranteed sufficient volumes to ensure that distribution vehicles operate at maximum capacity.

3.3.3 Summary Evaluation

While the economics of distributors are difficult to determine without an understanding of the exact routes and distances between manufacturers and retailers, it would appear that the industry will support private sector participation in this component of the value chain.

Given the relatively low volume of each shipment (driven by monthly demand) and the need for an extensive and geographically dispersed retail network, it is likely that "informal," small-scale distributors will be the preferred providers. Formal, established distributors are less likely to have the vehicles necessary to transport the product over poor quality roads and will likely be unwilling to absorb the additional expense associated with distributing the product outside of provincial capitals.[16]

3.4 Retailers

The importance of the retail network in capitalizing on the potential demand for the CWP requires that retailers in the value chain receive ample margin on the product. Without motivated retailers who are aggressively pushing the product, sales will not produce the volume necessary to support the other components of the value chain.

[15] Current distribution expense varies considerably and is based on a relatively small number of data points.
[16] The assessment of preferred distribution providers is largely based on a discussion with a representative from K-Line Transport, a national distributor operating in Cambodia.

3.4.1 Projected vs. Required Margins

Based on the research conducted on existing private sector retailers in Kampong Cham and Poipet, it would appear that retailers have very modest requirements with respect to margin and product turnover. Most retailers have sufficient space to store the CWP and, thus, have a very low "cost of sale." While retailers will most likely store the product without a significant margin, product margins must be sufficient to "motivate" the retailer to push the product to their customer base.

Projected retailer margins are approximately 10%. Should a retailer sell 15 units/month, the annual profit to the retailer from CWP sales is $144. Given the size of most retailers across the country, this represents a significant contribution to overall firm profitability.

3.4.2 Critical Factors

Retailer economics are driven by product turnover and margin contribution to fixed overhead expenses. Product turnover appears to be directly related to the level of "retailer motivation" to sell the product as well as the retailer's ability to articulate the product's value proposition to consumers. As such, it will be critical to select retailers that have the ability to articulate the value of the CWP and provide them with the training and product knowledge necessary to confidently recommend the product to their customer base.

3.4.3 Summary Evaluation

The expected profit margin, given the size of most retailers in the country, should be sufficient to attract significant private sector interest in the retail component of the CWP value chain.

4 Quality Assurance Requirements

4.1 The Issue

The CWP utilizes impregnated colloidal silver within its clay filter to purify water of harmful contaminants. Without this agent, the product's effectiveness is diminished and high levels of bacteria removal cannot be achieved. The colloidal silver; however, is embedded in the clay and cannot be seen by the consumer. In addition, the flow rate of the filter must be within a certain range: too high and it may not effectively purify water, too low and it will not produce enough water to meet household needs. These product characteristics, particularly in an industry dominated by private sector participation, make the potential threat of ineffective copy-cat products significant.

The risk of significant sales of ineffective copy-cat products is not limited to unethical manufacturers looking to make a profit by cutting corners. The risk can also be found in the form of "authorized" CWP manufacturers who do not possess the proper quality control procedures or production expertise to produce the filter properly and consistently. The risk is further compounded by the relative lack of sophistication and low educational levels of the average CWP consumer.

1. **Unethical Manufacturers**. While the cost of the colloidal silver and the expense associated with the impregnation of the silver into the clay filter represents a relatively small percent of total product cost (approximately 2.3%), elimination of this critical component provides a financial opportunity for the unethical, profit-motivated manufacturer.
2. **Poor Quality CWP Manufacturers**. Even if manufacturers are committed to producing an effective CWP, they may lack the quality control processes and production expertise to effectively produce the filter in a way which renders it effective. In addition, the same

profit motivation that drives unethical manufacturers may convince these firms to seek the same profit advantage.

3. **Uneducated Consumers**. Given the current "look and feel" of the CWP, the uneducated consumer may believe other "clay" products provide the same benefit as the CWP and may, therefore, seek to "gain" the same benefits of the CWP at a lower cost by purchasing a copy-cat product.

It should be noted that this risk is not unique to the Cambodian CWP market. In every country in the world, the risk of significant distribution of ineffective products is prevalent. Ensuring quality in Cambodia; however, is further compounded by the lack of government regulations and infrastructure to protect consumers from these types of valueless products.

To address this potential problem, a key component of the NRS must be to ensure that regardless of private sector participation, the critical elements of the product are always produced and that consumers are purchasing products that produce safe drinking water.

IDE experience in other developing countries for similar products suggests that there is no single "silver bullet" solution with respect to ensuring quality and creating barriers to entry for ineffective products in a market-driven environment. .As such, to ensure quality product distribution, the NRS must incorporate multiple safeguards which, when administered together, create adequate protection against low-quality products entering the market.

4.2 Mechanisms to Support Quality Assurance

The key mechanisms for CWP Quality Assurance after national private sector commercialization include: (1) approved manufacturer certification and inspections, (2) product certification, (3) production assistance with respect to aggregated purchasing of raw and semi-finished materials, (4) aggressive product branding supported by product design modifications, (5) extensive consumer education and (6) use of health-related retailers.

4.2.1 Manufacturer Certification / Inspections

Given the significant "benefits" associated with manufacturing the CWP (i.e., free branding and promotion of produced products, established distribution and retail networks, raw material sourcing and discounted pricing), donor organizations that support the CWP market should require selected manufacturers to undergo routine inspections on manufacturing process and product testing. CWP "certification" should be withdrawn if mistakes are not corrected in a timely and effective manner. These inspections should be conducted by trained staff (IDE or other) familiar with the correct manufacturing processes for the CWP.[17]

4.2.2 Product Certification

While the Cambodian government does not currently have the regulatory framework to independently certify products with respect to quality nor the enforcement infrastructure to remove ineffective products, product certification should still be pursued. Initially, supporting donors should evaluate the potential to receive "product certification" from an independent Environmental Technology Verification (ETV) agency.[18] While this certification alone will not effectively create barriers to entry, it provides the basis for product differentiation and consumer education. To make this certification effective, it must be supported by a branding campaign which highlights the product's unique certification. In addition, the certification must be clearly highlighted in all product packaging.

[17] Existing CWP manufacturers currently use a voluntary self-administered inspection process.
[18] While IDE should continue to work with the RGC to support the development of national product certification of health-related products, the need for short-term protection makes this avenue for product certification inappropriate.

4.2.3 Production Support

To enable authorized CWP manufacturers to maintain a price advantage over potential copy-cat manufacturers, bulk purchasing of raw and semi-finished materials at discounted pricing should be organized.[19] The cost advantages created by this "volume-based purchasing" will reduce the attractiveness of the market to producers who are not receiving this support and must buy materials in smaller volumes at undiscounted rates. Essentially, through aggregated purchasing, the CWP value chain has the ability to create barriers to entry based solely on price.

4.2.4 Branding & Product Design

The most effective approach to ensure quality is to aggressively brand the CWP. Branding should clearly identify the benefits of the product and highlight the critical components ("special sauce") of the product in purifying water. The branding program must be closely tied to the product's design and packaging. If possible, the product itself (plastic receptacle mold) should contain the brand image. This "integrated" branding is difficult to copy and clearly differentiates the product from copy-cat alternatives.

4.2.5 Consumer Education

The consumer must be made aware of the unique benefits of the CWP compared to other similar water filtration technologies.[20] Consumer education programs must focus on the reasons why the CWP is effective and how other products on the market may not have the same health benefits.

4.2.6 Retail Network Selection

The development of a retail network that values the unique benefits of the CWP in promoting good health in their customer base is critical to creating barriers to entry for ineffective products. While the Cambodia health sector does include some practitioners with questionable ethics, it is assumed that most health-related retailers are interested in providing their customers with products that protect them from illness and would not knowingly sell a product that is ineffective. In fact, many health retailers will likely require some level of proof that the product meets its claims. Health-related retailers are typically more knowledgeable than general retailers about the health risks associated with consumption of impure water and thus can act as "spokesmen" for the product and provide the consumer education outlined above.

4.3 QA Summary

The initiatives outlined above address the issue of quality assurance at every link in the product's value chain. While focusing on specific audiences, these initiatives, when implemented as a comprehensive program, provide multiple safeguards against the introduction and sale of ineffective water treatment products. **Table 4** provides a summary assessment of each initiative with respect to its effectiveness against potential avenues for market entry.

[19] Materials that could be purchased in bulk include colloidal silver, plastic receptacle buckets, spigots, packaging, instructional brochures, and promotional material.

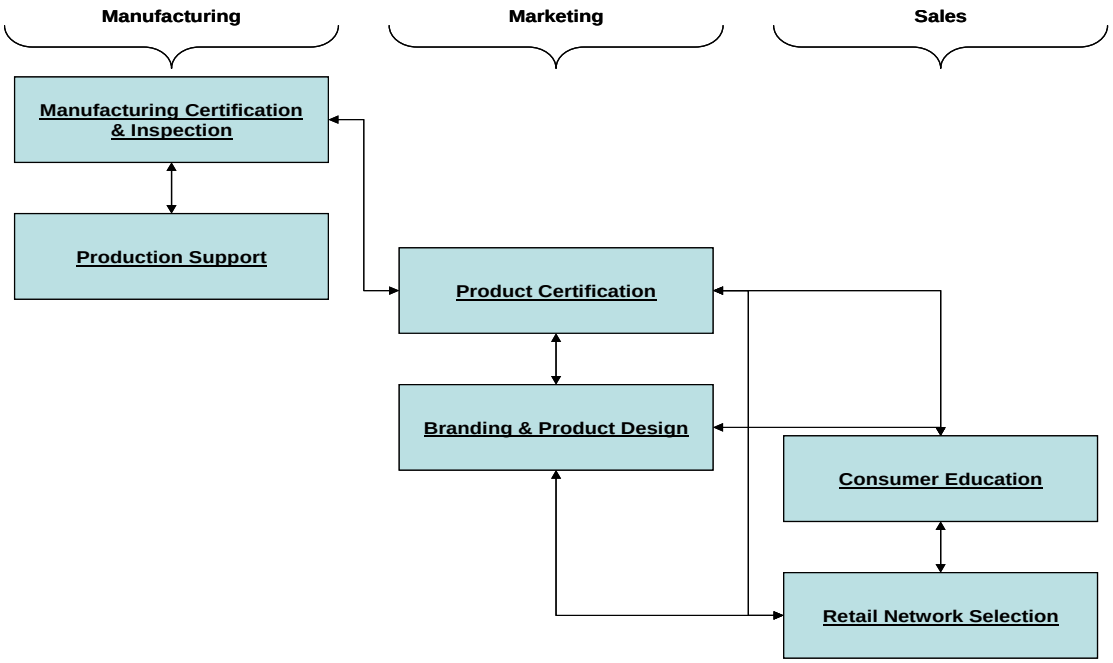
[20] Consumer education in the context of quality assurance focuses solely on educating the consumer about the specific benefits of the CWP and the quality brands (Rabbit and Frog) in particular. This program is not intended to suggest that other consumer education about the benefits of safe drinking water should not also be pursued.

Table 4: Quality Assurance Initiatives

	Unethical Manufacturers	Poor Quality CWP Manufacturers	Uneducated Consumers
Manufacturing Certification	Low	**High**	Low
Product Certification	**High**	**High**	Medium
Production Support	**High**	**High**	**Low**
Branding/ Product Design	Medium	Low	**High**
Consumer Education	Low	Low	**High**
Retail Network	Low	Low	**High**

While each initiative is independent with respect to its scope and focus, the success of each depends heavily on the successful implementation of the other QA initiatives and the level of integration between them. For example, for the consumer education initiative to succeed, the branding and product design initiative must also be implemented to clearly identify the product attributes that make the product effective. As such, the program must be viewed as a whole and should not be selectively pursued. **Figure 4** illustrates the interconnectivity of each program.

Figure 4: QA Program Integration



5 Market Demand Projections

The ability to attract private sector firms to participate in the CWP market is based, in large part, on the expected market demand for the product. As such, demand projections for the CWP will drive other strategies including manufacturing capacity and location, distribution networks and retail coverage.

5.1 Drivers of CWP Market Demand

5.1.1 Primary Drivers of Demand

The primary drivers impacting market demand are not unique to the CWP when compared to other water treatment technologies. The primary drivers of demand will directly impact the size of the target market for the CWP and include the following:

Access to Safe Water

The quality of water varies considerably across provinces within Cambodia. As such, the potential value of the CWP to households across the country varies as well. While households with access to safe water may also value the CWP for its other benefits, their interest in the product will likely be significantly less than that of households without access.

Household Disposal Income

The amount of excess cash each family has for "non-essential" products will significantly impact the demand for the CWP. While the CWP should be viewed as "essential" and the value proposition clearly demonstrates the financial benefits of using the product over other means of water purification, it will likely not be viewed in this manner for the foreseeable future. As such, the CWP will compete with other products for each household's disposable income.

5.1.2 Secondary Drivers of Demand

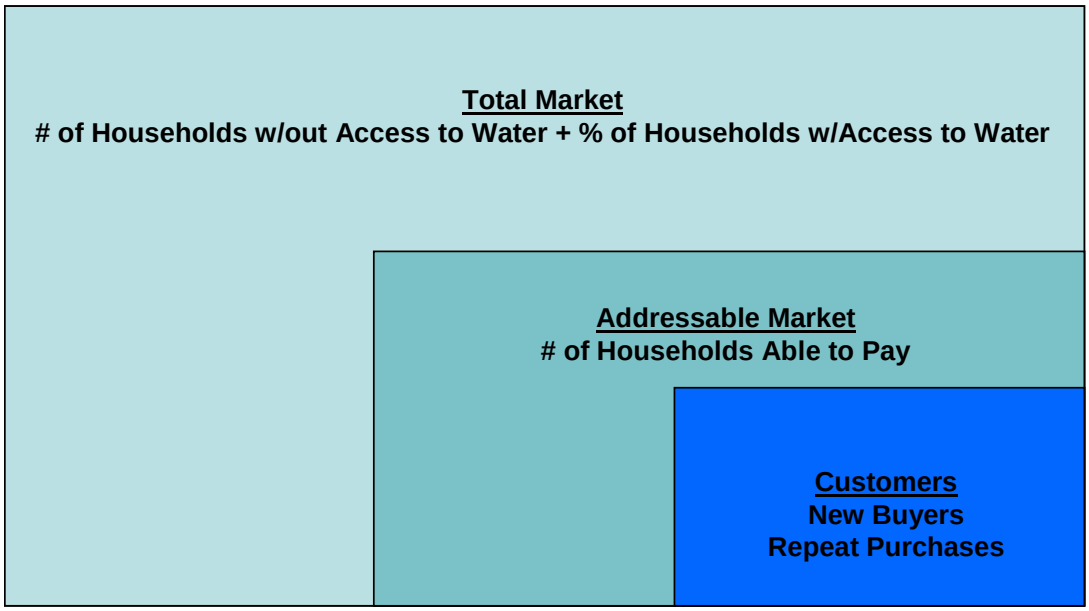
The expected market penetration rate for the CWP in Cambodia will likely be driven by a number of secondary demand drivers. These secondary demand drivers influence how target customers spend their disposable income and include: access to alternative water treatment products (i.e., slow sand filters, chemical treatment, etc.) and the value proposition of the CWP.

In addition, demand for the CWP will experience seasonal variations based on the amount of disposable income at any given time (i.e., rural households typically have more disposable income immediately after harvest season) and periods of increased health problems (i.e., the rainy season).

5.2 Market Demand & Sales Projection Methodology

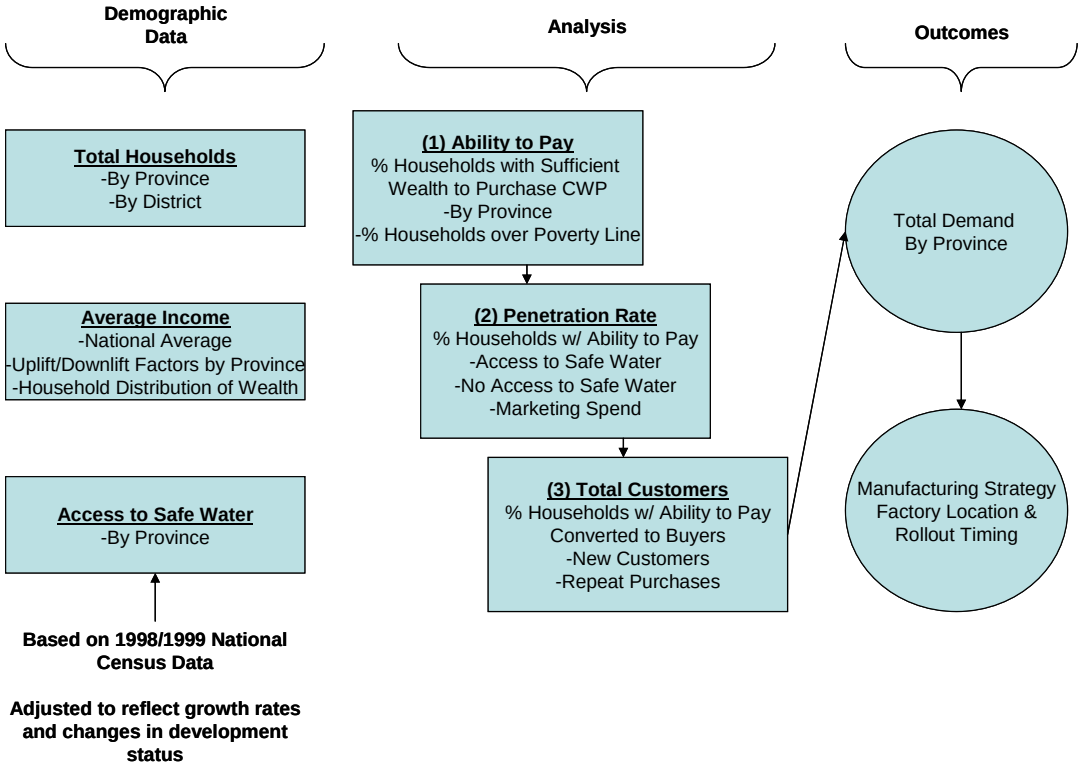
The overall market size and projected sales for the CWP were estimated based on a province-by-province analysis of the key demand drivers. **Figure 5** illustrates the framework used to estimate market demand and total customers.

Figure 5: Market Demand & Sales Framework



Using this framework, market demand and sales projections for the CWP were developed by the data and analysis outlined in **Figure 6**.

Figure 6: Market Demand & Sales Analysis



5.2.1 Total Market

The Total Market for the CWP is driven by the total number of households in Cambodia by province. While households without access to safe water will be the primary market for the product, households with access to safe water may still view the CWP as an attractive alternative means of water purification or as an "extra layer of protection."

5.2.2 Addressable Market

The Addressable Market for the CWP is based on the number of households with the ability to purchase the CWP at a purchase price of $8.0 in any given province.[21] This estimate assesses the overall wealth of each province and the percentage of households with annual income in excess of $70 above the national poverty line of $954/household.[22] The analysis assumes that any household with this level of annual income has the disposable cash necessary to purchase the CWP at an unsubsidized purchase price. In turn, households below this threshold income level are assumed to be unable to purchase the CWP at this price point.[23]

Given the importance of household disposable income in determining the overall size of the addressable market and the variations in wealth and population by province, each province has been grouped into three broad categories: wealthy provinces, average wealth provinces and poor provinces. **Table 5** provides the provincial groupings by wealth category.

Table 5: Provincial Wealth Groupings

Wealth Grouping	Provinces
Wealthy Provinces	Kandal, Krong Preah Sihanouk, Phnom Penh, Siem Reap
Average Wealth Provinces	Bat Dambang, Kampong Cham, Kampong Chhnang, Kampong Spueu, Kampong Thum, Kaoh Kang, Kracheh, Krong Kaeb, Prust, Prey Veaeng, Takaev
Poor Provinces	Banteay Mean Chey, Pailin, Mondol Kiri, Otdar Mean Chey, Preah Vihear, Rotanak Kiri, Stueng Traeng, Svay Rieng

The national average household income level was adjusted either upward or downward for each province based on the provincial wealth groupings to more accurately reflect the actual household income by province. Using these factors, it is estimated that 70% of households in wealthy provinces have the disposable income necessary to purchase the CWP. This percent drops to 50% for average wealth provinces and 20% for poor provinces.

5.2.3 Total New Customers

The number of Total New Customers is based on the ability of the industry to locate and convert potential customers into CWP buyers. This demand is highly contingent upon marketing spend and the retail/distribution networks established in each market.

[21] For the purposes of analysis, the existing retail purchase price in Kampong Cham has been used.
[22] This threshold income level is based on the assumption that households are willing to spend approximately 10-15% of disposable income on health-related product purchases.
[23] It should be noted that the development of a less sophisticated, lower priced CWP would increase the overall size of the addressable market. The NRS; however, assumes that only the current CWP will be manufactured and sold. The viability of additional product lines may be investigated at a later date.

To estimate total customers, the addressable market *penetration rate* must be determined. Given the likely difference in demand between households without access to safe water and those that have access, different penetration rates are used for these two demographic groups.

Given the impact of different penetration rate assumptions on overall product sales, a number of penetration scenarios have been conducted. These scenarios are provided in **Table 6** and are based on total 10-year market penetration of the addressable market for the CWP.

Table 6: Penetration Scenarios

Penetration Scenario	Households without Access	Households with Access
Worst Case	10%	5%
Base Case	25%	12.5%
Best Case	40%	20%

5.2.4 Total Purchases

The Total Purchases incorporates repeat purchases by existing customers and the product adoption cycle outlined below. It is assumed that repeat purchases occur on average every 2.2 years and that 15% of buyers will abandon the product after each purchase.

5.2.5 Customer Adoption Cycle

The rate at which the CWP will penetrate the market, assuming sufficient marketing, will likely follow the standard customer adoption curve for household goods. This "customer adoption cycle" is comprised for four primary stages: product introduction, market growth, market maturity and market decline. Each stage in the cycle is characterized by different buyers, adoption rates and timing. **Table 7** presents the typical characteristics of the different stages of the customer adoption cycle and is used as the foundation for the rate of product penetration for the CWP in Cambodia.[24]

Table 7: Customer Adoption Stages

Adoption Stage	Typical Buyers[25]	% of Addressable Market	Years
Introduction	Early Adopters	16%	1-3
Growth	Early Majority	34%	4-5
Maturity	Late Majority	34%	6-7
Decline	Laggards	16%	8-10

[24] For a more detailed description of the Customer Adoption Cycle, please refer to the CWP Marketing Plan.
[25] For a description of typical buyers in each stage of the Customer Adoption Cycle, please refer to the CWP Marketing Plan.

5.3 Market Demand Projections

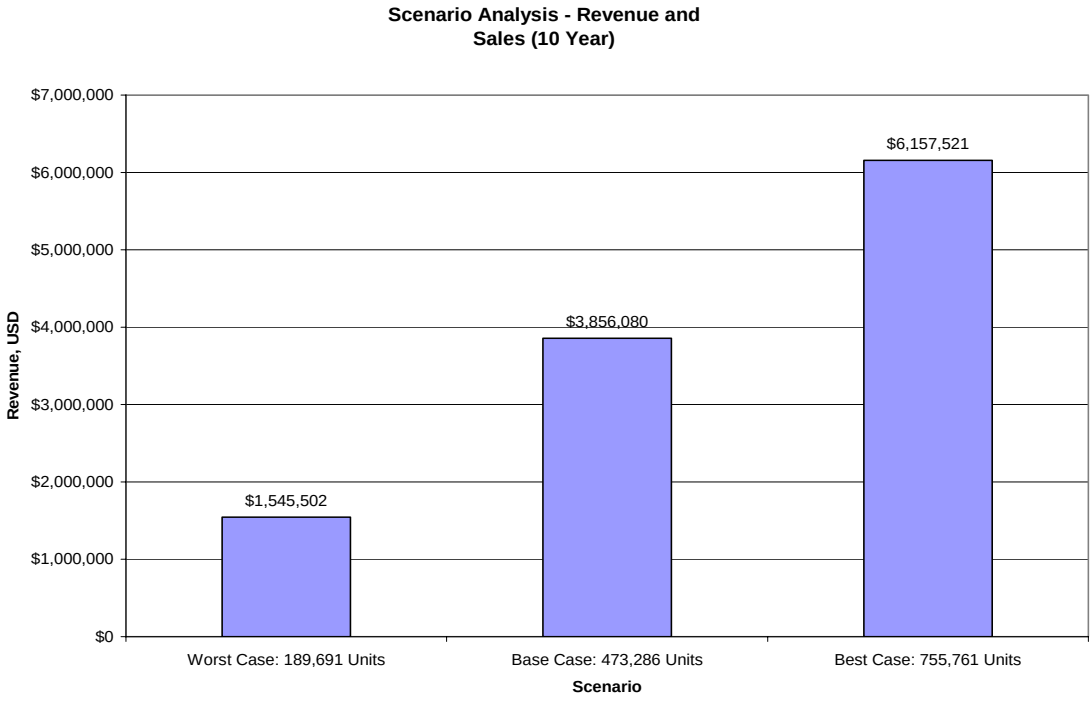
The overall size of the market is substantial. The size of the market is driven, in large part, by the large number of households without access to safe water and the significant number of repeat purchases by existing customers. **Table 8** provides a summary of the addressable CWP market, total new customers, and total product purchases for each 10-Year penetration scenario. [26]

Table 8: Market Demand & Sales Projections

Penetration Scenario	*Addressable Market*	Total New Customers	Total Product Purchases
Worst Case	*1,495,906*	110,570	189,691
Base Case[27]	*1,495,906*	275,882	473,286
Best Case	*1,495,906*	440,548	755,761

Figure 7 provides a summary of overall market size, in US$, by penetration rate scenario.

Figure 7: Project 10-Year Sales by Penetration Scenario

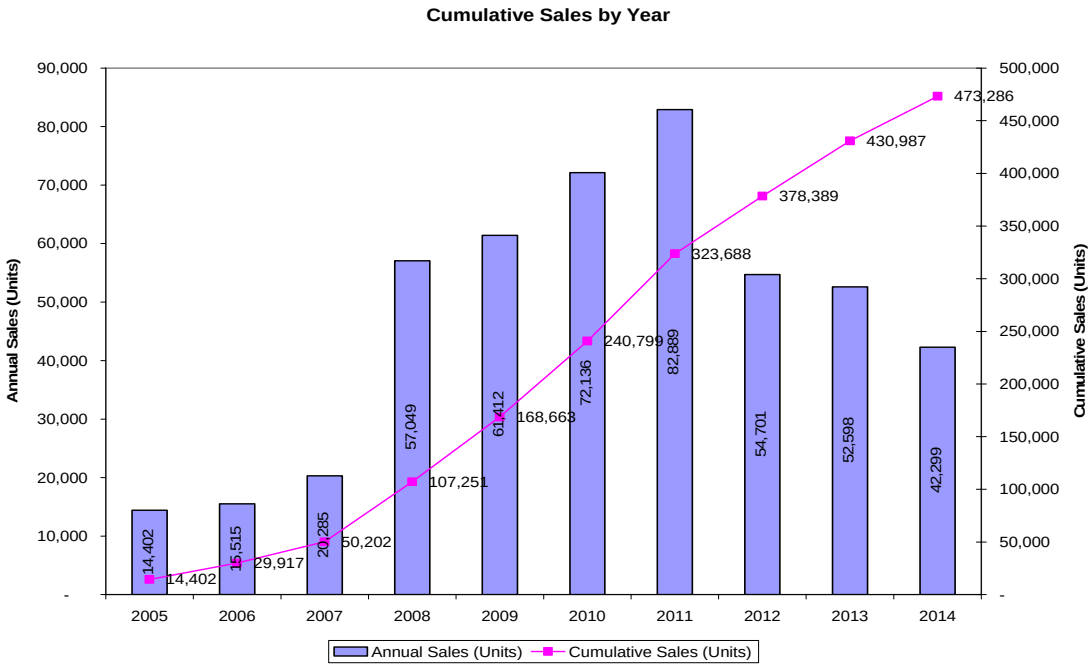


[26] The CWP Marketing Plan and Budget supports the base case assumptions with respect to marketing expenditure and promotional activities.
[27] The Base Case scenario represents a 6% increase over the estimated demand of 10% of total households "interested" in purchasing the CWP at $8.0 as demonstrated in the IDE survey of 100 non-users in Pursat province and 9% of the total households in Cambodia.

5.4 Projected Annual Sales

The customer adoption cycle will drive the estimated annual sales of the CWP. **Figure 8** provide annual and cumulative sales in the Base Case scenario.

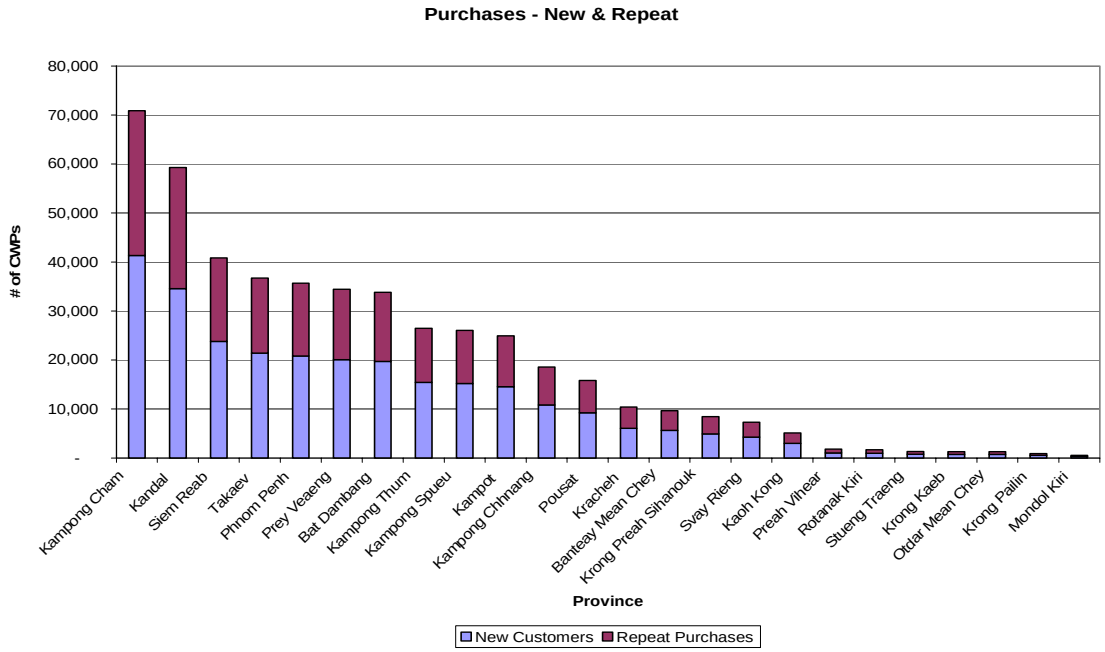
Figure 8: Projected Annual and Cumulative Sales (Units)



5.5 Provincial Demand Projections

The same analysis was conducted for each province in Cambodia to determine the demand by province and to provide an indicator for where manufacturing facilities should be located and where marketing and network development should be focused. **Figure 9** provides a summary of unit sales by province in the Base Case scenario.

Figure 9: Unit Sales by Province - Base Case



The variability in demand and projected sales by province is significant. As such, it provides a clear delineation between primary target markets and markets with insufficient demand to support a private sector network.[28]

6 Industry Structure Evaluation

The evaluation of industry structure models for the CWP market has, as a foundation, the underlying goal of involving the private sector to the extent possible in all elements of the value chain. This objective; however, must be weighed against the realities of the market (industry economics, customer buying power, stage of market development. etc.), the skill sets/expertise and financial capacity of potential private sector participants and the need for quality assurance in all distributed products.

The factors outlined above require that both donors and private sector firms participate in the development of the CWP industry. Neither "group" has the required attributes necessary to develop a sustainable market independently. As such, the selection of a preferred industry structure is focused on determining the optimal "mix" of donor involvement and private sector participation in the industry.

The extent to which private sector firms and donors are involved in the development and operations of the CWP market is driven by the vast functional requirements to establish a viable and sustainable value chain for the CWP and the specific strengths and weakness of each "group."

[28] Refer to the Marketing Section of the NRS for market segmentation criteria and selection.

6.1.1 Private Sector Firms

Strengths

1. Expertise in specific components of the value chain.
    a. Manufacturing
    b. Distribution
    c. Retail
2. Ability to quickly support rapid product proliferation through use of multiple firms within each component of the value chain.
3. Long-term ability to participate in the market (assuming sufficient financial return).

Weaknesses

1. Limited ability to invest in industry-wide development initiatives.
    a. Limited financial capacity
    b. Limited motivation and tolerance for risk
        i. Modest product revenue and margins
        ii. Fragmented and competitive firms operating within the same component of the value chain
2. Limited skill sets/expertise outside of specific "functional" disciplines related to their component of the value chain.
    a. No marketing expertise
    b. Limited product development capability
    c. Limited quality assurance know-how

6.1.2 Donors

Strengths

1. Strong ability to raise the capital required to fund market development and industry infrastructure.
2. Strong skill sets/expertise in key industry development disciplines (marketing, product development, quality assurance, etc.).

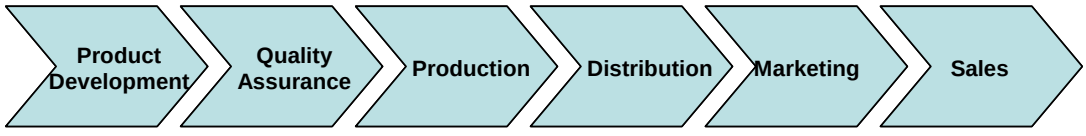
Weaknesses

1. Short-term funding and participation in the CWP industry – donor funding is often transient.
2. Limited experience in manufacturing, distribution and retail – these core value chain functions are outside of the traditional scope and expertise of most donor organizations.

6.2 Recommended Industry Structure, by Value Chain Component

The preferred "mixed" of donor involvement and private sector participation must be determined for each component of the CWP value chain. Each value chain link will require a different mix of participants based on the needs of that element of the market. **Figure 10** illustrates the main components of the CWP value chain which must be considered when conducting this assessment.

Figure 10: Key Components of CWP Value Chain



Given the key requirements to develop the CWP market and the strengths and weaknesses of private sector firms and donors in meeting those requirements, the following roles of each group within the CWP value chain is recommended.

Table 9: Evaluation of Value Chain Components

Value Chain Component	Recommended Private Sector Role	Recommended Donor Role	Rationale
Product Development	**Low** Link with supporting donors to provide market feedback on customer requirements and effectiveness of development initiatives. Improve manufacturing processes to increase profit margin.	**High** Invest in product development to increase product demand and support quality assurance programs. Investigate product diversification options to increase overall size of market and to attract new customer segments.	Cambodian brick and tile manufacturers are unlikely to have the skill set and financial capacity to investment in product development. The size of the market is insufficient to attract private sector manufacturers to invest in this part of the value chain.
Quality Assurance	**Low** Participate in certification programs and retail network educational programs to support donor-developed quality assurance programs.	**High** Develop comprehensive quality assurance program attacking the issue at multiple points along the value chain.	Donor involvement is critical given limited government infrastructure to protect consumers from ineffective products.
Production	**High** Manufacture CWPs for sale to the market.	**Medium** Provide aggregated purchasing for raw/semi-finished materials (plastic receptacle, spigots/taps, packaging, etc.) that are not easily procured by local manufacturing firms.	Private sector firms have the skill set and expertise to produce the CWP. Small scale production facilities will not have the purchasing power to received discounted pricing for raw/semi-finished materials.
Distribution	**High** Distribute the product to take advantage of existing distribution networks and economies of scale.	**Low** Establish the initial distributor network and link manufacturers to approved distributors. Distribute the product to “insufficient” markets where demand does not support the establishment of a private sector network.	The size of the market requires that distributors have defined and protected coverage areas to ensure sufficient volumes to achieve efficient product distribution.

Value Chain Component	Recommended Private Sector Role	Recommended Donor Role	Rationale
Marketing	**Low** Utilize marketing materials provided by supporting donors and provide feedback on marketing program effectiveness.	**High** Develop a comprehensive branding program that supports the quality assurance initiatives and the supporting product promotion campaigns necessary to drive market penetration.	Most private sector firms will not have the expertise or financial capacity to develop a comprehensive marketing campaign for the CWP. The need to develop a consistent brand for the product requires that marketing campaigns be centrally developed.
Sales	**High** Sell the CWP in each market where there is sufficient demand.	**Low** Establish the initial retail network in each market and provide the education necessary to increase the product turnover of each retailer.	Private sector retailers understand their customer base better than anyone else and are already established in the market.

While the level and duration of donor support will vary by value chain component, donor involvement should reduce significantly after Year 5 of market development. At that stage, the CWP market will be mature and should be self-sufficient: word of mouth marketing will be the primary driver of sales; distribution and retail networks will be established, tested and refined; manufactures will have the required expertise to improve operational efficiency; the primary quality assurance programs will be in place and supported by a strong brand; and new product innovations will be established and marketed.

7 National Rollout Strategy

7.1 Overview

The CWP NRS is based on the projected market demand for the CWP in Cambodia, the economics established for each private sector value chain participant, and the employment of both donors and private sector firms in the development of the market. The main elements of the NRS are as follows:

1. Private Sector / Donor Involvement
    a. Employ a “mixed-participation” industry structure model driven by private sector participation and market demand in all elements of the value chain and supported by donor assistance in centralized, market-wide initiatives.
    b. Develop strategies for working collaboratively with other donors to ensure support of and not competition to the private sector value chain.
    c. Seek donor involvement in the development of the underlying programs and marketing infrastructure necessary to support nation-wide product rollout (as outlined above).

2. Manufacturing & Distribution
    a. Establish a network of private sector manufacturers & distributors.
    b. Initially, establish “set pricing” and geographic territories for manufacturers and distributors to ensure sufficient volume to support revenue and margin requirements.
3. Sales & Marketing
    a. Establish a network of private sector retailers in each “served” market.
    b. Focus marketing resources on priority provinces that have the demand necessary to support a private sector network and on supporting the key elements of the quality assurance program.
    c. Ensure market integrity is maintained in any market in which the private sector is participating.
        i. In markets with insufficient demand to support a private sector network, subsidized sale of the product may be acceptable. However, in markets attempting to support private sector sale of the CWP, price subsidization should be discouraged.
4. Quality Assurance
    a. Develop a comprehensive, multi-layer quality assurance program to create barriers to entry for ineffective copy-cat products.

7.2 Marketing Plan

A comprehensive marketing/promotion plan has been developed to support the NRS.[29] The plan is highly integrated with this NRS and works directly to support the key elements of the strategy.

7.2.1 Objectives

The Marketing plan has been developed to support the following objectives:

1. Develop a marketing approach that will "drive" an increased number of purchasers through existing and new retail outlets;
2. Create adequate market demand to meet required production outputs that support a sustainable CWP manufacturing industry;
3. Identify "persuasive" tools and messages best suited to engage and exchange with identified target prospects within selected geographic market segments;
4. Develop a strong branding campaign to create both a desirable product and to endorse product quality and quality assurance; and
5. Use suitable aspects of "social marketing" and health benefit education to implement change behavior among consumers.

7.2.2 Approach

The key elements of the CWP marketing plan are presented in **Table 10** below.

[29] The CWP Marketing Plan is contained in a separate document.

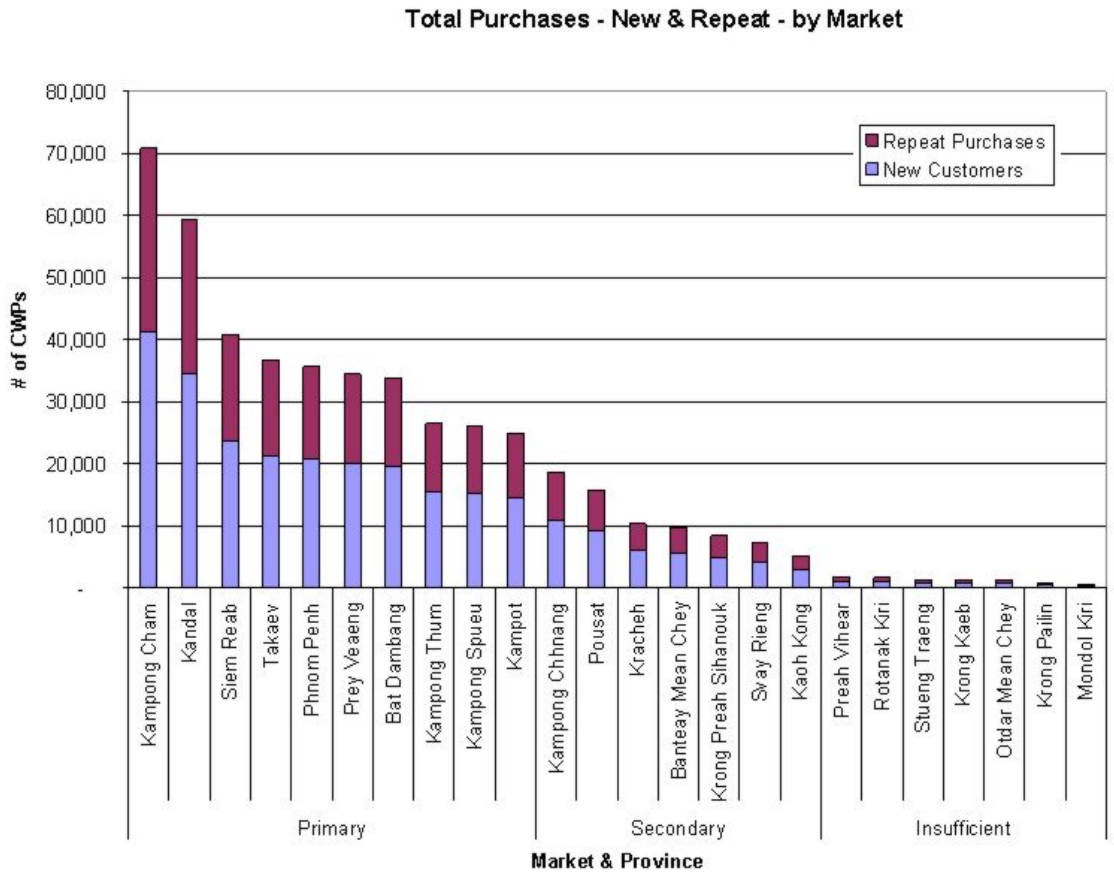
Table 10: CWP Marketing Plan Overview

	PRODUCT	PRICE	CHANNELS	PROMOTIION	TARGETS	MESSAGE	SALES FORCAST
Product Introduction Stage **Year s 1 – 3**	At it's best Refine clay finish	Cost plus sufficient mark up to attract and retain private sector involvement and motivation to "push" the product	Specialist retailers or distributors Health specialist retailers and agents Retailer working capital investment	Awareness/saturation Television – High reach and optimal frequency Face to face presence Demonstrations Trial Visibility In-store POS	Early adopters – female and male, 30 – 40 years, married, with children, average income Leaders in community Innovators Committees Retailers – training and sales skills	Health benefits match consumer needs. Moral responsibility Time and expense savings Guarantee – reliable NGO manufacturer Endorsement Quality assurance Brand	Low initially, slow increase
Growth Stage **Year s 4 – 5**	Introduce product extensions or improvements New packaging New markets	Monitor if competitor enters market Retain if no competition Lower to meet competitor	Health related retailers Expand to house ware retailers New markets	Strong branding campaign Retailer Incentives Consumer Incentives Branding POS	Early majority Referees Retail sales people	Strong brand focus on guarantee, warranty, product assurance Quality control Certification	Increasing to peak
Maturity/ **Decline Stage** **Years 6 – 10**	Small product Modifications	As above	Health related Where ever competitor is	Word-of-mouth becomes primary promotion tool Low-cost and low intensity promotional activities by manufacturer and distributors	Late majority and latecomers – likely to be older people in community	Health Benefits Warranty and guarantee Brand	Declining

7.2.3 Target Provincial Markets

The CWP market is divided into three broad segments: primary, secondary and insufficient markets. This segmentation is primarily based on expected demand by market and the minimum required demand threshold levels for private sector network development. Markets with expected sales of under 2,500 units over ten years are considered insufficient to dedicate resources for market development. **Figure 11** provides a breakdown, by province, for each market based on this criterion.

Figure 11: Demand Based Market Segmentation



All primary and secondary markets should be targeted for initial product rollout. While several secondary markets have limited demand, they have been targeted for market development as demand solely from primary markets is likely insufficient to support private sector manufacturers. Demand in insufficient markets is too low to justify the development of retail networks and marketing expenditure. In addition, most insufficient markets are extremely difficult to access from recommended manufacturing sites.[30]

[30] Should NGOs desire to distribute the CWP in "insufficient markets" and there is excess production capacity, this is acceptable and should be encouraged.

The impact on overall market size and projected sales of removing insufficient markets from the initial product rollout is minimal. In total, insufficient markets represent only 7,650 units (1.5%) over ten years.[31]

7.2.4 Pricing

While a purely market-driven product industry would allow for pricing flexibility at each stage of the value chain, initial pricing should be established and set for the manufacturing and distribution components of the value chain.[32] This "set pricing" strategy will ensure that the economics for each value chain component are sufficient to ensure private sector participation. Overtime, this strategy should transition to a flexible pricing model for all segments of the industry once stable networks are established. At the same time, pricing at the retail level should be flexible and driven by the decision of each retailer. Given their knowledge of their own customer base, retailers need to have the ability to set the price of the CWP at the most appropriate level to maximize profits.

7.3 Manufacturing Strategy

The manufacturing strategy provides the central point for product distribution and market penetration and is built around the projected demand of each target market.

7.3.1 Critical Components

The critical components of the manufacturing strategy are as follows:

1. To the extent possible, utilize small-scale production facilities located in multiple provinces throughout the country and focused in locations with high demand and good road access to neighboring provinces.
    a. High transportation costs and poor road access make centralized production inefficient and costly.
    b. High variable cost structure of the manufacturing process reduces benefit of centralized, large scale production.
2. Utilize existing private sector manufacturers that have multiple product lines to reduce start-up investment and enable flexible demand production.
3. Build each manufacturing facility to match projected demand.
    a. The large CWP factories already established are likely inappropriate as models for future sites. Monthly output of approximately 1,500 units, regardless of location, is significantly higher than expected demand and requires a large coverage area to fill capacity.
4. Tie manufacturing build out to marketing plan to closely match supply with demand.
5. Protect each manufacturer's demand by (1) limiting certification and support to other manufacturers in a given region and (2) dividing the country into manufacturing coverage areas.
6. Require certification and ongoing "quality checks" as a prerequisite for receiving discounted raw/semi-finished materials and other manufacturing support.

[31] Krong Kaeb is classified as an "insufficient market," but its proximity to targets markets suggests that it should be included in market development initiatives. As such, it has been included in target market demand projections.

[32] IDE's involvement in providing centralized support, particularly with respect to aggregated purchasing and marketing, should enable it to set prices initially for the manufacturing and distribution providers.

7.3.2 Complicating Factors

The manufacturing strategy is complicated by the location, capacity and ownership structures of current CWP manufacturers.

Location

The close proximity of current manufacturing sites makes segmentation of the market difficult with respect to manufacturer coverage areas. As such, artificial boundaries, based on provincial lines, will be required, even if the location of some retailers is closer to the manufacturer serving another coverage area.

Capacity

The average capacity of the three existing facilities (approximately 1,500 units/month) is significantly higher than local demand for the CWP. As such, these facilities will be required to "cover" multiple provinces which will increase the distribution expenses associated with product dissemination from these sites.

To address the potential for excess capacity of existing facilities (even with expanded coverage areas), these sites should also produce the CWP for donor-based distribution in insufficient markets where no private sector distribution or retail networks are established. In addition, it would be advisable for these manufacturers to investigate the potential to manufacture other products that utilize the same technology and manufacturing processes as the CWP.

Ownership Structures

While initial indications suggest that the current donor-owned manufacturers support the NRS and are interested in supporting its key principles of private sector participation and market integrity, the current ownership structure of these facilities provides a *potential* barrier to the successful rollout of the CWP through private sector value chain participants. The potential issues associated with this ownership structure include:

1. Sale of the CWP to private sector distributors/retailers at below market prices. This pricing strategy will significantly impact the ability of private sector manufacturers who must make a profit to compete successfully.
2. Sale of the CWP to donor-supported distributors/retailers who will distribute the product at below market prices within markets served by private sector distributors/retailers. It will be extremely difficult for private sector participants to compete in markets where subsidized distribution exists.

In addition, should these organizations not use their capacity to meet private sector demand, additional manufacturing capacity will be required in the regions which they cover.

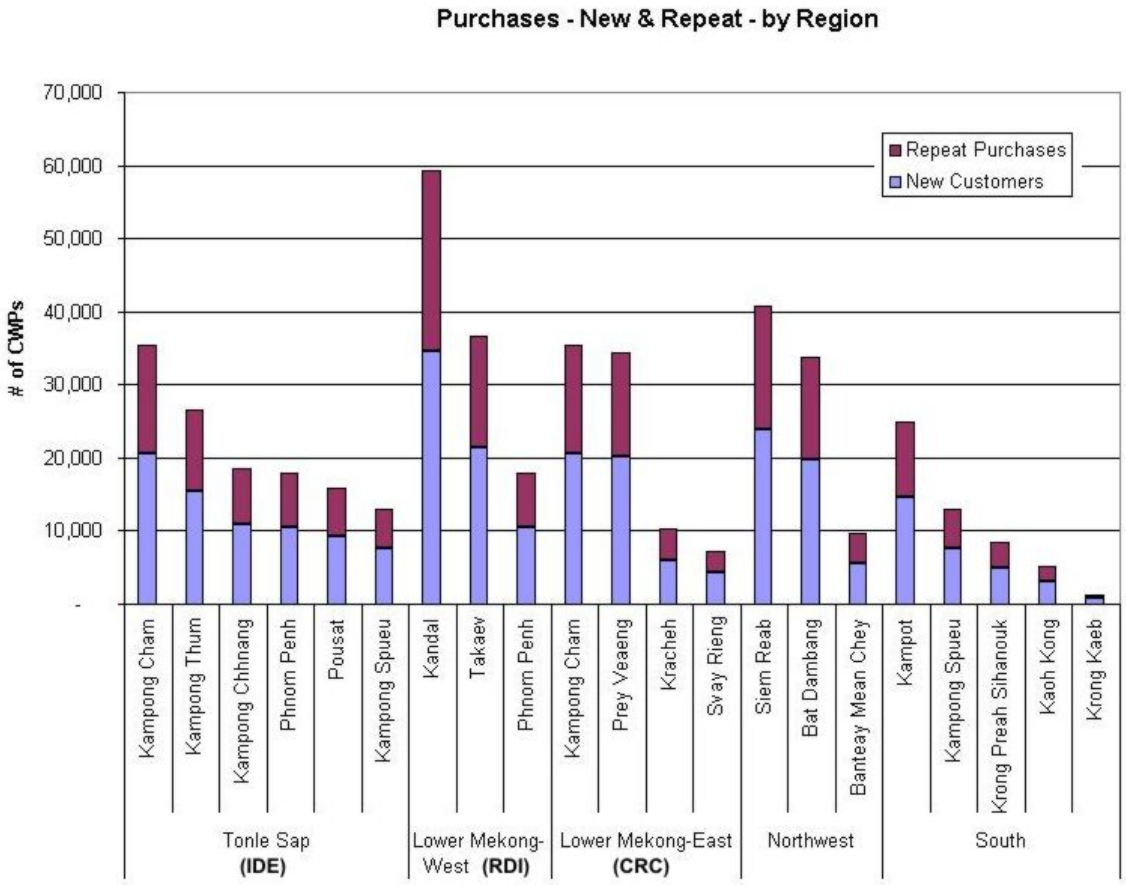
As such, it is imperative that the current donors operating manufacturing sites be integrated into the overall NRS. The benefits to these organizations of full participation in the NRS are significant and include:

1. Established distribution and retail networks for their product.
2. Centralized support provided by other donors (i.e., branding and marketing, product development, quality assurance, etc.).
3. Unfettered access to "insufficient" markets where no private sector network is established.

7.3.3 Site Locations and Implementation Timing

The selection of provincial manufacturing locations is driven by provincial demand, adjacent provincial demand and road/water access between provincial capitals. These criteria are weighed against overall market demand and the "optimal coverage area" per location. Using these factors as a foundation and existing manufacturing sites as a starting point, the following manufacturing coverage areas, identified in **Figure 12**, should be established.

Figure 12: Regional Manufacturing Coverage Areas



The coverage areas have been set in an attempt to provide sufficient volume for each manufacturing facility. **Figure 13** outlines the expected monthly demand, and thus production requirements, for each coverage area.

Figure 13: Monthly Demand Projections by Manufacturing Coverage Area

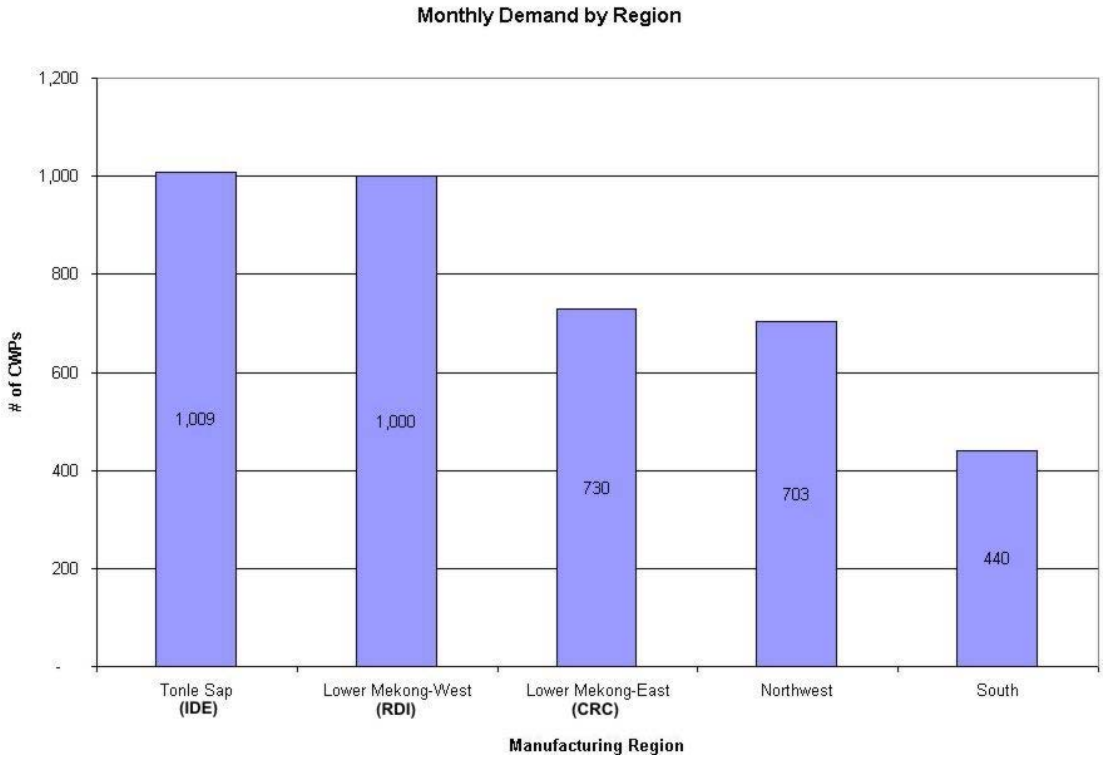


Table 11 identifies the recommended location of each manufacturing facility within each market and the road/water access and distance between each site and the other provinces in its coverage area.

Table 11: Manufacturing Site Location and Coverage Area

Manufacturing Site (New or Existing) (Region)	**Coverage Area**	**Road/Water Access**	**Distance Capital to Capital**
Kampong Chhnang (Existing - IDE) (Tonle Sap)	Kampong Chhnang	N/A	N/A
	Pousat	NR 5	95 km
	Northern Kampong Cham	NR 5, NR 7, Tonle Sap River	119 km
	Northern Kampong Spueu	NR 5	139 km
	Phnom Penh	NR 5	125 km
	Kampong Thum	NR 5, NR 7, NR 6	190 km

Manufacturing Site (New or Existing) (Region)	**Coverage Area**	**Road/Water Access**	**Distance Capital to Capital**
Kandal (Existing - RDI) (Lower Mekong – West)	Kandal	N/A	N/A
	Phnom Penh	NR 2, Tonle Basac River	10 km
	Takaev	NR 2	78 km
Prey Veaeng (Existing - CRC) (Lower Mekong – East)	Prey Veaeng	N/A	N/A
	Svay Rieng R 11	NR 1	92 km
	Southern Kampong Cham	R 11	90 km
	Kracheh	R11, NR 7	215 km
Kampot (New) (South)	Kampot	N/A	N/A
	Krong Preah Sihanouk	NR 3 NR 4	96 km
	Krong Kaeb	NR 3	25 km
	Kaoh Kong	NR 3, NR 4 Ocean	234 km (by road)
	Southern Kampong Spueu	NR 3	196 km
Banteay Mean Chey (New) (Northwest)	Banteay Mean Chey	N/A	N/A
	Bat Dambang	NR 5	68 km
	Siem Reab	NR 6	102 km

The need to locate manufacturing facilities close to demand to reduce transportation expense requires that the coverage areas for existing manufacturers be limited and fall below current capacity levels.

The specific location within each province needs to be developed and should be based on the following criteria:

1. Proximity to provincial center
    a. Close enough to efficiently serve the main markets
    b. Far enough to reduce impacts of noise, smoke, and dust associated with manufacturing facility
2. Proximity to good road/water transportation routes
3. Availability of clay, water, and fuel sources for filter manufacturing
4. Optimal distances to other population centers in its coverage area.
5. Limited flooding during rainy season
6. Ability to secure land title for manufacturing site

7.4 Distribution Strategy

The distribution network will vary by region based on the availability of local/regional distributors and the geographic coverage area of each manufacturing facility. The distribution network should align specific distributors with manufacturers and should be "regulated" to ensure that there is sufficient volume for each distributor to enable efficient distribution from the manufacturer. In addition, it may be appropriate to attempt to partner with established household good producers to utilize excess capacity in their distribution networks.

7.4.1 Network Size

Given the recommended manufacturing coverage areas, each region will likely be comprised of 1-3 distributors. The number of distributors per coverage areas is based on the location of provincial capitals vis-à-vis the regional manufacturing facility. **Table 12** provides a preliminary estimate of the number of distributors per region.

Table 12: Distributors for Each Manufacturing Coverage Area

Region	Distributor 1	Distributor 2	Distributor 3
Lower Mekong-West (RDI)	Southern Route NR 2		
Tonle Sap (IDE)	Northern Route NR 5	Eastern Route NR 5, 6, 7	Southern Route NR 5
Lower Mekong-East (CRC)	Southern Route NR 1	Northeastern Route R 11, NR 7	
Northwest	South Eastern Route NR 6	South Western Route NR 5	
South	Southern Route NR 3, NR 4		

7.4.2 Network Composition

7.4.2.1 Private Sector

Given the expense of national distributors, the estimated size of each distribution load and the need to distribute the product outside of the provincial capitals, it is likely appropriate to develop a network of local/regional distributors that have the "last mile" coverage and vehicles necessary to reach rural retailers. In some instances, it may be appropriate to utilize national distributors to ship products between provincial capitals and have local firms distribute the product to remote provincial retailers.

7.4.2.2 Donors

For provinces in which there is insufficient demand for the establishment of private sector distributors and retailers, it is appropriate to use donor organizations to distribute the product. Donors; however, should not distribute the product below market price in markets served by private sector firms.

7.5 Retail Strategy

The retail strategy is based on the need to provide extensive market coverage while also supporting the key elements of the quality assurance program.

7.5.1 Guiding Principles

To fulfill these needs, the retail strategy is driven by the following guiding principles.

1. Broad coverage enabling access to the majority of households in a given market.
2. Staged expansion starting from provincial centers.
3. Comprised, to the extent possible, of health-related retailers (District Health Clinics, Provincial Referral Hospitals, Village Health Workers, Pharmacies).
4. Strong retailer support through access to working capital loans, product promotion initiatives and product training.
5. Frequent replenishment of inventory to reduce working capital requirements.

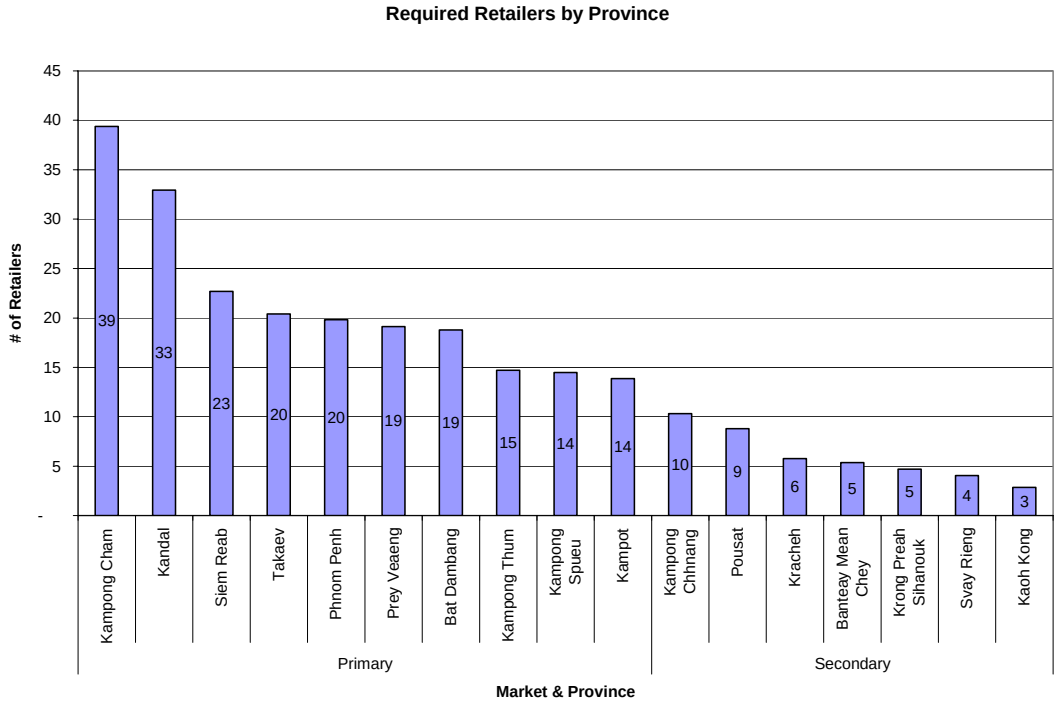
7.5.2 Network Size and Location

To the extent possible, retailers should be placed close to population centers in any given market area, with some retailers providing coverage to remote areas in each "served" province. The goal of broad coverage, however, must be weighed against the distribution costs associated with reaching retailers. For each market, an assessment of road access, distance and demand potential must be conducted to identify the optimal location of retailers.

While each retailer will differ, the experience in Kampong Cham and Poipet suggests that effective retailers can sell approximately 15 units per month.[33] As such, for each market, there should be approximately 1 retailer for 180-240 units/year.

The number of retailers required per target market is shown in **Figure 14**.

Figure 14: Required # of Provincial Retailers



[33] This turnover assumption is dependent on appropriate marketing support and retailer educational programs on product benefits and value proposition.

Given the expected product adoption cycle and the characteristics of "early adopters" of the CWP, it is appropriate to develop a staged rollout of the retail network. While each province will have a different retail network implementation schedule, initial retailers should be based in the provincial capitals where disposable income will tend to be higher and more risk-takers, innovators, and early adopters are likely to be found. Also, marketing first to better-off consumers will help to give the product a sophisticated image as opposed to a "poor-man's technology" image, which might be associated with a product that it targeted first at the poorest population segments. Over time, as the market moves into the "growth" stage, the retail networks within each province should be expanded to cover more remote households and promotional campaigns should be targeted to poorer market segments.

7.5.3 Network Composition

7.5.3.1 Private Sector

To the extent possible, the retail network should be comprised of health-related retailers. Experience in Kampong Cham and Poipet and survey data collected from potential CWP buyers suggests that this type of retailer is the most successful in driving product turnover. This is primarily driven by the following characteristics of health-related retailers:

1. Inspire confidence in the consumer with respect to product recommendations
2. Trusted for selling quality products
3. Customer traffic is comprised largely of individuals seeking health solutions
4. Deeper understanding of product benefits and value to consumer
5. Motivated to sell the product for both profit and social reasons

It is unlikely that any one type of health-related retailer will have the coverage or customer traffic to adequately cover a given market. As such, a combination of Commune Health Centers, Referral Health Centers, Pharmacies and Village Health Workers should be used. Mobile retailers, who travel periodically to remote areas, may also be used (e.g., Cambodia Red Cross volunteers). Should the number of health-related retailers be insufficient to appropriately cover a market, other traditional retailers should be included in the network.

7.5.3.2 Donors

The use of donors to sell the product should be limited, particularly if they sell the product at below market prices. If a donor is willing to sell the product at the standard market price, donor-based sales are not a problem. If, however, donors undercut private sector firms because they do not have the same profit margin requirements, it will significantly impact the ability to sustain a private sector retail network.

At the same time, there are a number of markets that are insufficient to support a private sector network. As such, donors should be allowed and encouraged to sell the CWP in any market, at any price, where there are no private sector retailers.

7.5.4 Support Requirements

Given the small size and financial capacity of most retailers in the country, it is unlikely that they will have the ability to independently market the product. At the same time, retailers (even if health-related) will require product training and education on the inherent benefits of the CWP. As such, to be successful at penetrating the market, retailers will require the full compliment of product promotion support and product training. Without this support, as was the case with several retailers in Kampong Cham, product turnover will be minimal.

7.6 Centralized Donor-Based Support

As discussed above, while the key participants in the value chain are private sector firms, the expected revenue and profit to each firm is relatively small and insufficient to expect the private sector to invest in industry-wide initiatives. As such, the development of the CWP market requires that donors provide initial support to the industry in several "centralized" functions. These functions differ significantly from direct price subsidies by donors in that they build the infrastructure necessary to enable the industry to become self-sufficient over time without distorting the market. The required centralized functions are outlined below in **Table 13**.[34]

[34] Further elaboration on the complementary roles of private sector and donor organizations is given in Section 6, Industry Structure Evaluation.

Table 13: Centralized Industry Support Functions

Centralized Function	Description	Rationale	Timeframe and Donor Phase-out
Network Development	Establish production-distribution-retail network Identify, screen, and select private firms, establish linkages, product training, and business development services	Private sector firms lack skills, financial capacity, and incentive to independently build these networks	Establish and strengthen network over 5 year project period Transfer retailer management to distributors as their capacity increases Transfer distributor management to manufacturers as their capacity increases Develop manufacturers association as their capacity increases
Marketing/ Branding	Develop and implement promotional campaigns for the CWP to support market penetration, customer education, and quality assurance program	Initial marketing "blitz" required to create awareness and demand for a new and unfamiliar product Small enterprises lack marketing skills and resources to mount large-scale campaigns	Donor funded marketing continues for 5 years. Gradual decrease in the last 2 years as word of mouth increases. In year 6 onward, manufacturers and distributors carry on with lower cost, lower intensity marketing activities paid for out of their own revenue.
Product Development and Diversification	Basic improvements to product and process: CWP cost reduction, product appearance, product line diversification, kiln fuel efficiency, packaging and transport, etc.	Small enterprises lack technical skills and resources to conduct PD&D Cannot recoup PD&D costs for low-tech, easily copied innovations. Private sector can provide valuable customer feedback and suggestions for improvements	Estimate two years to resolve major PD&D issues Manufacturers linked to international CWP networks to drive future product and process developments
Aggregated Purchasing	Identify suppliers and negotiate price discounts for bulk orders of raw and semi-finished materials (colloidal silver, receptacles, spigots, instruction brochure, packaging, and promo materials)	Individual manufacturers will lack volume to obtain discounted prices May not be required if manufacturing sites becomes consolidated under a single firm	Donor organized initially and handed over to manufacturers association over time

Centralized Function	Description	Rationale	Timeframe and Donor Phase-out
Trade Finance	The method, agents, and terms of trade finance to be determined by the availability of formal finance in each market. Where possible, link value chain participants with MFIs or banks. Provide trade finance (with interest) to value-chain participants that cannot access MFI or bank loans See Section 7.6.1 and Table 14 for more details	Required initially to "jump-start" the industry. For larger, established firms, MFIs and local banks may be able to provide working capital loans. For smaller firms (primarily retailers), it may be difficult to secure working capital loans from established institutions.	Gradual withdrawal of donor-based trade financing by the end of the 5-year project. Ongoing financing needs met by MFIs and local banks At least initially, until the demand for the product is significant,
Quality Assurance Program	Initiate and manage QA initiatives as listed below:	QA requires multiple and coordinated activities across several parts of the value chain.	
	- Manufacturer certification and inspection	Initially, manufacturers may not be familiar with or see value of QA Potential conflict of interest for manufacturers to conduct individually	Implemented by donors initially and handed over to manufacturers association as their understanding and commitment increase Consider role of government as practical and appropriate
	- Product endorsement	Donor organizations are better positioned seek product endorsement	One-time activity required at start up only
	- Aggregated purchases	As described in "Aggregated purchases" above	As described in "Aggregated purchases" above
	- Branding product design	As described in "Marketing/branding" above	As described in "Marketing/branding" above
	- Consumer education	As described in "Marketing/branding" above	As described in "Marketing/branding" above
	- Retailer selection	As described in "Network development" above	As described in "Network development" above

7.6.1 Trade Finance

As described in Table 13 above, trade finance may be required for the CWP value chain participants. **Table 14** outlines the likely trade finance requirements for manufacturers, distributors, and retailers. Financing may come from several potential sources:

- From the value chain participants themselves (their own capital investment and/or revenue from other products/activities)
- From established finance institutions (MFIs, donor programs, banks) [35]
- From the CWP National Roll-out program

Table 14: Trade Finance Requirements

Firm	Purpose	Frequency	Loan Size	Comments
Manufacturer	Asset Purchase	One-time at start-up	From $2,000-$20,000	Predominately for new firms without existing infrastructure
	Working Capital	Quarterly	$4,635	Assumes 900 sales to distributors on credit per quarter (first year). Production cost of $5.15
Distributor	Working Capital	Quarterly	$3,172	Assumes 450 sales on credit to retailers per quarter (first year). Purchase and transport cost of $7.05
Retailer	Working Capital	Monthly	$108	Assumes stock purchase of 15 units per month at a cost of $7.20

[35] The MPDF is currently in discussions with a local financial institution to provide working capital loans at reduced interest rates for Grassroots Business Organizations (GBOs). While the private sector firms requiring trade finance for the CWP market are not necessarily GBOs, this facility should be explored as a potential vehicle for providing trade finance to this market.

7.7 NRS Estimated Financial Returns

The CWP NRS provides for a positive financial return for all private sector participants in the CWP value chain. This return; however, is contingent upon donor funding to support the centralized functions necessary to develop market demand for the CWP and to develop the industry infrastructure required to create a sustainable private sector market.

7.7.1 Private Sector Estimated Financial Returns

Table 15 summarizes the expected financial returns for each private sector component of the CWP value chain and individual firm under the parameters of the NRS.[36]

Table 15: Estimated Private Sector Participant Economics

Economic Indicator	Manufacturing	Distribution	Retail
Revenue			
Revenue/Unit	$6.25	$7.20	$8.00
10-Year Industry-Wide Revenue	$2,958,000	$3,408,000	$3,786,000
Average 10-Year Revenue/Firm	$592,000	$379,000	$14,000
Net Profit			
Net Profit/Unit	$1.10	$.15	$.80
10-Year Industry-Wide Net Profit	$520,000	$71,000	$379,000
Average 10-Year Net Profit/Firm	$104,000	$8,000	$1,440

[36] The Net Margin projections do not include the costs associated with the centralized functions executed by supporting donors.

8 Appendix

8.1 Market Demand Assumptions

Estimates of market demand for the CWP are based in large part on several nation-wide studies focusing on population by district, access to safe drinking water and household wealth levels. Given that many of these studies were conducted several years ago, several assumptions are required to ensure that they still represent the current situation in the country.

Table 16: Key Assumptions

Variable	Baseline Data Source	Assumption	Notes/Comments
Demographic Data			
# of Households	1998 Cambodian National Census	Used growth rates as estimated in census study 1.8% annual growth	Average household size held constant Does not address population shifts across provinces
Average Income	1998 Cambodian National Census	Used growth rates as estimated in census study. 1.9% real income growth	
% of Households with Access to Safe Water	1998 Cambodian National Census	5% increase in % of households with access to safe water from 1998 to 2005, then 2% every year thereafter. Assumes households that drink dug well water and river water do not have access to safe drinking water.	Assumes overall increase in access due to continued efforts by RGC and donors to provide safe drinking water

Calculation	Assumptions	Notes/Comments
Addressable Market (Ability to Pay)		
Household Income by Province	Uplift and Down lift Factors to reflect wealth differences by province Three major groupings 1) Wealthy Provinces: Uplift Factor of 1.25 2) Average Provinces: No adjustment to National Average 3) Poor Provinces: Down lift Factor of 1.25	No provincial income distribution is available. Uplift and down lift factors are based solely on perceived wealth status by province. There is no data source to accurately reflect these variations.
Wealth Distribution by Province	Used national average income distribution as a proxy for provincial income distribution	
National Poverty Line	$.5/day/person Average individuals/household of 5.23 Household Poverty Line of $954	
Households w/ Ability to Pay	% of Households in each province $70 above the National Poverty Line	
Total Customers		
Penetration Rate of Addressable Market	Different rates for households w/out access to safe water and households with access to safe water Assumes slow initial penetration, followed by aggressive penetration, ending with slow penetration of remaining market	
	Replace After 1 Year= 7.5% Replace After 2 Years= 32.5% Replace After 3 Years= 32.5% Replace After 4 Years= 12.5% Abandon Rate = 15%	