Enhancing the Quality of WASH Products in Cambodia – Guidelines and Capacity Building

NOURISH Project

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Led by Save the Children, NOURISH is implemented in Cambodia in partnership with five local and international partners: SNV Netherlands Development Organisation, Operations Enfants du Cambodge, Partners in Compassion, The Manoff Group, and Wathnakpheap.

Executive Summary

The NOURISH project aims to significantly reduce the proportion of children in Cambodia who are stunted, through a multi-sector approach and including water, sanitation, and hygiene (WASH) interventions. WASH activities include the market-based promotion of latrines and water filters. However, issues associated with the quality of latrine and filter products in the marketplace were reported to SNV, and an assignment to address these concerns at institutional and programme levels was initiated. Quality issues were first researched and characterised in Phase 1 of the assignment, followed by training and monitoring activities in Phase 2.

The design and work plan for Phase 2 of the assignment was prepared in agreement with SNV, local authorities, and SMEs – including the latrine parameters that would be addressed through the quality improvement initiatives. For Ceramic Water Filters (CWFs), it was decided that the focus in Phase 2 would be placed on strengthening supply chains to broaden the availability of replacement filters and spare parts within the marketplace. National-level accreditation and standardisation concepts were discussed with the relevant government authorities, and agreed to be a low priority at the current stage.

The activities in Phase 2 were grouped into three components: consultation and inception; training and mentoring; and, reporting and dissemination. The results of the consultation phase were prepared and submitted to SNV in the form of an Inception Report. A series of latrine quality criteria were agreed and shared at training and mentoring activities.

A latrine construction manual was developed in consultation with NOURISH programme partners and SMEs, covering correct design, production, installation, and usage in response to the quality issues identified in Phase 1. It was subsequently reviewed, revised, and finalized, before being utilized in a latrine construction training workshop which combined both classroom and field demonstrations and learning components. Supply chain and marketing approaches for water filter products were also presented and discussed based on past experiences by other organizations.

SMEs were visited individually for mentoring and monitoring meetings, to further explore their response to the latrine quality trainings, what quality enhancements they were able to make, and whether they had interest or had trialled any approaches to water filter marketing. Most were able to implement some quality improvements – mainly related to installation and production of latrine components. Some limitations were encountered, specifically regarding SMEs that had moulds for small diameter pit rings, and those that did not use rebar in their cement fixtures, or at intervals wider than the specifications. Additionally, some SMEs continued to produce simpler and lower quality latrines for ID Poor households, citing that they did so in order to conform to agreed unit prices.

For NOURISH, ongoing monitoring by SNV and local authorities may be need to ensure that the SMEs continue to address quality issues through the implementation of the guidelines in the latrine construction manual – through to the end of the NOURISH programme and beyond. Efforts should be made to ensure that comparable latrine quality standards are provided to poor and non-poor households alike, and that latrines function to a minimum level of satisfaction for all customers to ensure equality.

Development partners and NGOs should acknowledge the issue of quality, raise it with producers that are engaged in their projects, establish clear quality standards in their contracts with producers (using the tools from this assignment and those available to the sector), and subsequently monitor quality in a reasonable way. The standards and protocols established through this initiative under NOURISH, and through a very consultative process with project stakeholders, should serve to support such efforts in the NGO community, and also inform the development or revision of future national latrine construction guidelines.

Some SMEs are promoting tulip water filters (an imported water filter) which are preferred due to being lightweight, easily transported and aesthetic appeal. Several SMEs had become retailers of the Super Tunsai water filter but have since stopped selling filters after an initial trial due to weak sales. Water filter subsidies should be applied strategically so-as not to distort the marketplace. There is significant evidence for the effectiveness of household water treatment products to improve water quality and reduce illness among families that use them – and further efforts are needed to raise demand for and understanding of their importance.

Results and lessons learned from the assignment will be disseminated to national-level stakeholders, where discussion towards WASH product quality will focus on next steps and implications for the sector.

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List of Abbreviations

CWF	Ceramic Water Filter
MRD	Ministry of Rural Development
NGO	Non-Governmental Organization
PDRD	Provincial Department of Rural Development
SME	Small-Medium Enterprise
SNV	SNV Netherlands Development Organisation
WASH	Water and Sanitation and Hygiene
WATSAN WG	Water and Sanitation Working Group

1 Introduction and objectives

The NOURISH project aims to significantly reduce the proportion of children in Cambodia who are stunted through a collaboration between multiple organisations, Ministries, and entities. The project has taken a multi-sector approach to address needs in health, nutrition, water, sanitation, and hygiene (WASH), and agriculture. NOURISH is led by Save the Children International and operates in three provinces in the north-west of Cambodia – covering 555 of the poorest rural villages in the region. WASH is a significant component of the project and SNV Netherlands Development Organisation (SNV) leads the WASH activities. Activities aim to improve drinking water quality at the point-of-use, increase access to toilets, and promote hand washing with soap. These outcomes are designed to be achieved through capacity building and market-based approaches to stimulate demand for and investments in WASH products and services.

Within the NOURISH programme area, technical and quality issues associated with WASH products – namely pour-flush latrines and ceramic water filters (CWFs) – were previously reported. Such quality issues can have various negative effects. For example, potential customers may refuse to invest if the product has a bad reputation – either due to actual or perceived problems with its functionality, performance, and/or lifespan. There may also be serious safety concerns associated with health-related products that do not function to protect the user and environment as intended. Therefore, to maintain customer satisfaction, reputation, and safety, it is important for producers of WASH products to consider and address the issue of product quality during all stages - including design, production, and installation. Additionally, the customer/user must be familiar with correct usage and maintenance instructions. Spare parts or repair and maintenance services may also be relevant towards ensuring the continued performance and function of WASH products. If spare parts or local maintenance service providers are not available, the product may not last for the duration of its design life.

In the case of CWFs, a poorly performing filter may not have been properly produced, and as a result, may not adequately remove potentially harmful pathogens according to specifications. A dysfunctional filter may have a broken clay filter element, cracked water receptacle, or a broken spigot. In the case of latrines, poorly constructed latrines may not be safe to use or may contaminate the nearby environment with faecal waste. The super or sub-structure may not last for the marketed design-life or poor installation may result in wastewaters not adequately flowing from the chamber box to the pit latrine.

From a business perspective, producers of WASH products must consider carefully their profitability, but also need to be mindful of product quality and reputation in the marketplace. Therefore, there should be a balance between reducing costs to make a product affordable (particularly in resource-poor settings like rural Cambodia) and ensuring a reasonable level of product quality and sufficient lifespan. Each producer may take their own approach – as some may cut corners or rush production or installation to cut costs, while others may take more pride in delivering a high-quality product to their customers, and maintaining a strong reputation.

The issue of latrine quality in Cambodia has been considered by the Department of Rural Health Care[1] and development partners and non-governmental organisations (NGOs). In response, a Household Latrine Construction Manual was developed by the Ministry of Rural Development in 2010 to provide technical support to sanitation project implementors and practitioners. The manual presents construction details, instructions, and bills of quantities associated with various toilet facility types and their individual components. Despite the existence of this manual, its dissemination to latrine producers and subnational government staff responsible for sanitation has not been fully implemented. There have not been any programmes, implemented to scale, to build the capacities of local latrine producers and improve or ensure sufficient levels of latrine production and installation quality. Such efforts to address quality that have occurred, have largely been project-driven, and led by NGOs and development partners in focused geographic areas.

MRD has also acknowledged the issue of water filter production quality and user/consumer protection. With support from the World Bank in 2010, the feasibility of a performance verification programme for water filter products was explored. However, no viable mechanisms to implement the proposed program were found and pursued. CWFs continue to be produced in-country – at several different factories – and their quality is only controlled internally.

Standardisation and accreditation are concepts used around the world to ensure the consistency and quality of services and durable products in the marketplace. Standardisation aims to ensure that a product is consistently produced to a given specification. Accreditation or certification are mechanisms to monitor or enforce standards and protocols in the marketplace. Guidelines may also be used as a tool to passively support quality improvements – particularly in situations where regulatory controls and enforcement are not viable or relevant.

[1] The department within the Ministry of Rural Development (MRD) responsible for sanitation in rural areas

In 2017, SNV initiated an assignment within the NOURISH project called "Developing Quality Standards and Accreditation of WASH Products" to explore and address these issues of WASH product quality in the project area and the Cambodian WATSAN sector. The objectives of Phase 1 of the assignment (May to September 2017) were to assess the quality of existing latrines and water filters promoted under NOURISH, identify quality issues, agree with project stakeholders and producers which quality issues could be mitigated, explore the viability of accreditation initiatives, and initiate dialogue on WASH product quality among WATSAN sector stakeholders and development partners at national level. The rationale and design of the assignment were based on several assumptions, namely: 1) that latrine and CWF producers would be willing to engage in the identification and mitigation of quality issues – leveraged by their ongoing contracts with SNV; and 2) that national-level stakeholders including the Government of Cambodia (under the authority of the Ministry of Rural Development) viewed WASH product quality as a priority worthy of attention and resourcing for standardisation and accreditation programmes.

The objective of Phase 2 of the assignment (February to August 2018) was to take the findings and agreements from Phase 1, and work with producers and retailers to actually improve WASH product quality in the NOURISH target areas. This initiative included the development of a latrine production and installation training manual to specifically address the quality issues that were discovered in Phase 1 – followed by training partner SMEs and subsequent mentoring and monitoring of quality improvements. The initiative also intended to ensure consultation and feedback from partners and stakeholders at each step. Relating to CWFs promoted under NOURISH, spare parts supply chains were to be examined and SMEs and local retailers were to be engaged to explore and address gaps.

This document represents the final report for Phase 2 of the assignment. It comprises of a summary of the findings and results from Phase 1, a description of the activities and results from Phase 2, and an analysis of what the results mean for the NOURISH programme and the Cambodia WATSAN sector.

1.1 Summary of Phase 1

This section summarises the results from Phase 1 of the initiative. Complete details can be referenced from the Phase 1 Final Report dated September 2017. Initially, a desk study of international and national experiences on standardisation and accreditation of WASH products was conducted. A national-level stakeholder meeting was also convened to consolidate perspectives and explore the viability of standardisation and accreditation concepts in the WATSAN sector. A primary data

collection methodology and accompanying questionnaires were developed to explore and identify WASH product quality issues in the NOURISH programme area. Key informant interviews and focus group discussions were subsequently administered with provincial authorities, SMEs, and latrine and water filter users.

Globally, standardisation and accreditation initiatives for WASH products were found to be uncommon in the developing world, but have been implemented in some developed countries. Institutional mechanisms were found to exist in Cambodia for the potential standardisation of relevant consumer products. Limited laboratory facilities also exist for potential verification and performance testing. However, leadership and financing towards such efforts are likely to be lacking. MRD's Household Latrine Construction Manual was found to be the only tool endorsed by the government to support WASH product quality in the sector.

Global CWF production parameters were also investigated based on publicly available manuals and research studies. CWF factories in Cambodia operate independently and have their own protocols for production and quality control – established based on international guidance and research. Information about the production and performance of other water filter products imported into Cambodia from abroad is less well understood.

The study found that latrines in the NOURISH programme area were not always designed or selected based on geographical or hydrological contexts. Designs need to account for areas of flooding, high water tables, or low permeability soils. Accessibility conditions for children, the elderly, and the disabled were reported to be challenging. Cement mixes (the proportions of cement, sand, water, and gravel) were observed to be incorrect among some producers. Additionally, some latrine components were not always adequately reinforced with metal rebar according to MRD's guidelines. Drying times for cement components were occasionally observed to be too short. The diameters of some cement ring moulds were found to be too small to meet household preferences and some latrine pans required significant and suboptimal quantities of water for flushing. Latrine installations by local masons were observed to be rushed in many instances – driven by the fact that they were being paid on a per unit basis with minimal supervision. However, despite these issues, disuse of existing latrines was reportedly low. Overall satisfaction with the quality and performance of latrines typical of rural Cambodia was found to be high – but not without areas for improvement. One of the primary reasons for a disused latrine was reportedly due to the pit becoming full and not being emptied.

Design and production parameters critical to the quality of latrines in the NOURISH target area were considered at each stage of the production and installation process

– inclusive of design/selection, production, delivery, installation, and use. These criteria were also examined through the guidelines in MRD's manual – and subsequently through the interviews with SMEs and consumers. After consultation with NOURISH project stakeholders and SMEs themselves, the following criteria were selected for standardisation and training to be carried forward to Phase 2:

- Latrine design alterations for households in flood zones (elevated superstructures and pits);
- Latrine pan selection for low water usage;
- Latrine accessibility conditions (such as access ramps/steps, handrails, and sizing) for the young, old, and disabled;
- Minimum diameter standard of cement rings for latrine pits;
- Concrete mix ratio and specifications for raw materials (water, gravel, and sand);
- Metal rebar size and interval (for rings, slab, and chamber box);
- Installation guidelines (in particular the digging of the pit, joining of the rings, elevations of the piping, and preparation of the slab and chamber box)
- Recommendations for supervision of installation masons;
- Latrine operation and maintenance - including emptying and contact details for local sanitation services.

The study from Phase 1 also found that CWF flow rates were too slow for some households and the volume of the treated water storage was sometimes reported to be too small – particularly among larger families. The clay CWF pot (filter element) and the plastic water spigot were reportedly most susceptible to breakage over time. Technical support, spare parts, and replacement filters were very difficult (if not impossible) to source in the local marketplace (SMEs).

Through discussions with MRD, it was agreed that formal standards and accreditation of latrine and CWF producers would not be pursued, and that SMEs engaged in the NOURISH programme would be encouraged to participate in the quality improvement activities and adapt their protocols voluntarily – and that these efforts would be supported in Phase 2.

2 Summary of Phase 2 activities and results

The objective of Phase 2 of the assignment was to support SNV with the implementation of training, mentoring, and monitoring related to quality improvements associated with WASH products - within the geographic scope of the NOURISH project. The results, conclusions, and agreements of Phase 1 of the

assignment were first shared with NOURISH stakeholders and a consultative plan were established for the Phase 2 activities. A supplementary training manual for latrine production and construction under the NOURISH programme were established and used to support capacity building, mentoring, and field monitoring with the SMEs. Additionally, the issue of supply chains for CWF spare parts were further explored and addressed in the 2nd phase. Lessons learned would continue to be raised to the broader WATSAN sector at national level towards policy considerations and strategic thinking on the role of standardisation and the issue of product quality in the sector.

This chapter describes the activities conducted under Phase 2 and their respective outputs and implications. Firstly, Table 1 presents the actual implementation schedule of activities for Phase 2 of the assignment.

Table 1 - Phase 2 implementation schedule

Component	Activities	Feb	Mar	Apr	May	Jun	Jul	Aug
Inception	Consultation, agreement, and planning meeting among provincial stakeholders	X						
	Drafting of inception report		X					
	Phase 1 findings and Phase 2 inception report presented to relevant national sector working groups for feedback		X					
	Finalisation of inception report		X					
Training	Drafting of latrine construction/installation manual and training package			X	X			
	Consultation of training package with sub-national government and SMEs				X			
	Consulting with the SMEs and sub-national government on CWF				X			
	Finalisation of training package					X		
	Delivery of trainings to SMEs					X		
Monitoring	Mentoring, follow-up, and monitoring of SMEs						X	
	Strengthening of CWF supply chains					X		

Component	Activities	Feb	Mar	Apr	May	Jun	Jul	Aug
Dissemination	Meetings with key national stakeholders to gain insights and perspectives on results							X
	Drafting of final report							X
	Final report							X
	Dissemination of key results, findings and recommendations to national stakeholders							X

2.1 Inception phase on latrine and water filter quality improvements

The objective of the inception phase was to transition the assignment into Phase 2 through a reflection on the findings from Phase 1, development of a consultative plan to achieve the objectives for Phase 2, and to document plans and agreements in an Inception Report. These preliminary activities are described further in this sub-chapter.

2.1.1 NOURISH consultative workshop on latrines and water filters

A consultation workshop was held in Battambang Province on 13 February, 2018 with representatives from all three NOURISH provinces – including PDRDs, local authorities, and SMEs. The objective of the half-day workshop was to share the status and progress of the assignment with provincial-level stakeholders including the results of Phase 1 and to develop a clear and consultative plan for Phase 2. Additionally, a consultative group discussion was held to assess the feasibility of the recommendations from Phase 1 as well as the guidelines issued in MRD's household latrine construction manual.

Stakeholders at all levels recognized that latrine designs must consider the geographical setting – particularly as it relates to areas prone to flooding. Latrine positioning and height of installation should also be implemented into the design. Ventilation pipes were agreed to be included in the guidelines, to reduce smells. It was agreed that dry-pit latrines would be excluded from the guidelines because they were not sufficiently relevant to the rural Cambodia context as demand for them was reportedly very low compared to that for flush toilets. Pit designs and configurations (in series, parallel, alternating) were also agreed to be included among future product options for the customer. SMEs were found to require sensitization on faecal sludge management and related pit configurations that facilitate safe handling and end-use – such as alternating twin-pits. SMEs appeared to be generally willing to accept minimum pit diameters – although for some it was reportedly not feasible or cost-

effective to develop or purchase new moulds in the short-term. Specifications for cement composition and rebar reinforcement were also agreed to be included in the guidelines. Installation parameters including distance to/from the nearest water source would also be specified. The quality of latrine pans would also be highlighted.

Participants of the workshop were given the opportunity to voice their opinions and ideas on the design of Phase 2 of the assignment – and this was intended to motivate their interest and participation in the upcoming activities. No major feasibility, commitment, or participation concerns were raised among the SMEs – although some SME representatives were more active in the discussions than others.

It was also agreed that a framework and checklists for the monitoring of SMEs active in the NOURISH areas would be developed and utilised. The proposed training materials were agreed to comprise of a background of the NOURISH programme, the findings from Phase 1 (outlining the rationale for quality enhancements), and the actual technical guidelines for latrine design, production, installation, use, and maintenance – with supportive technical drawings where appropriate.

Regarding water filter products, the importance and benefits associated with their use (particularly the Super Tunsai brand) were discussed. Local authorities and SMEs were informed about community-level demand for water filter products that have resulted from the NOURISH promotional activities, and the concept of meeting this demand through the establishment of small-scale retailers. The discussion also focused on the quality and performance of the Super Tunsai filters. The potential economic return from the use of water-filters was also a part of the discussion. The participants calculated the costs associated with water-related diseases and their treatment and impacts on physical child development (and potential stunting). The participants concluded that the costs associated with consuming unclean water outweighed the cost of purchasing a water filter.

2.1.2 National WATSAN consultation

The findings from Phase 1 of the assignment were presented to the WATSAN Working Group on 7 November 2017. The majority of the participants accepted the findings and the plans proposed for Phase 2. Regarding dry-pit latrines, it was proposed and agreed that they would be excluded from the scope of the forthcoming capacity development programme – as their prevalence in rural Cambodia was reportedly extremely low and most households that still had them were likely to soon abandon them for pour-flush latrines in the coming years. The strengthening of local businesses to support supply chains for CWFs was also discussed.

2.1.3 National consultation with Hydrologic Social Enterprise (HSE) on the supply of Super Tunsai water filters and their spare parts

Consultation and discussion was also conducted with the Hydraulic Social Enterprise (HSE) to study their approaches for water-filter promotion into rural communities – specifically the Super Tunsai and their associated spare parts – and with a particular focus on the NOURISH provinces. To reach rural communities, HSE sold its water filters and spare parts through the following channels:

- Online promotion and sale;
- Direct sale into water scarce communities in the NOURISH project;
- Engaging with NGOs and their subsidy programs;
- Engaging retailers (local shops) for supply into the communities;

These approaches were considered towards their relevancy and appropriateness for integration in Phase II of the assignment.

2.1.4 Inception Report

An Inception Report for Phase 2 was finalised in March 2018 and reiterated the objectives for Phase 2, proposed the methodology and work plan to meet the objectives, and presented results from the preceding inception phase activities (2.1.1 and 2.1.2).

2.2 Training phase on latrine and water filter quality improvements

The objective of the training phase of the assignment was to develop the latrine construction manual and conduct training and mentoring with NOURISH-partnering SMEs on both latrine quality and water filters (including the filters themselves and their associated spare parts).

2.2.1 Latrine construction manual

The aim of the development of the latrine quality manual was to describe the correct design, production, installation, and usage protocols and standards to address the quality deficiencies discovered from Phase 1. The intention was to produce the manual through a consultative process with participation and agreement from the SMEs. The manual was designed to be a NOURISH-specific document and a supplement to MRD's household latrine construction manual.

The manual was drafted in March 2018 and finalised in June 2018 in both English and Khmer. It covers the rationale and background for latrine quality improvements, a summary of the quality issues that were identified, followed by specific technical

specifications and protocols to address each issue. The technical specifications detail the instructions and equipment used for each step of the construction process (including cement mixtures, components, and siting the construction location on the customer's property), different types of latrines, various latrine features and options, pit configurations, and installation details such as brick-laying, chamber box alignment, and pipe connections. Finally, use and maintenance procedures for the latrine were also discussed.

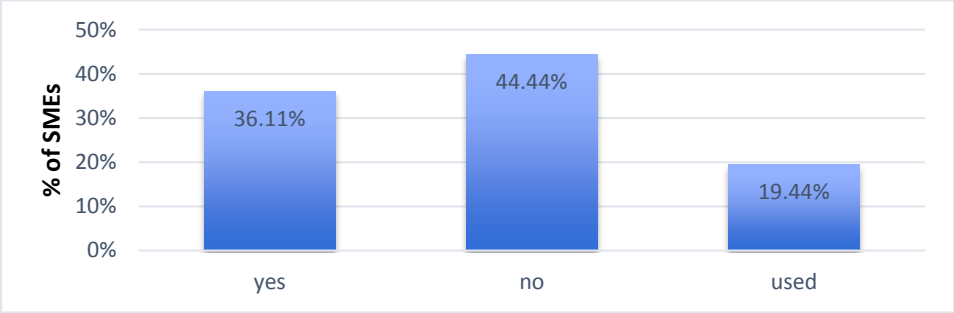
2.2.2 Consultation workshop on the latrine construction manual and water filter supply chain strengthening

A consultation workshop was convened in Pursat Province on 7 May, 2018 where NOURISH stakeholders and SMEs reviewed the first draft of the latrine construction manual and provided feedback for subsequent revisions. A secondary objective was also to consult the SMEs on the plans for the upcoming training, mentoring, and monitoring activities. Participants were also sensitised to the concept of standards and the issue of finding balance between product quality and profitability. Overall, only several points emerged from the discussions that resulted in revisions to the draft training manual, including revised rebar configurations and some minor adjustments to spelling and phrasing of the text to improve clarity. Some feelings emerged from among the SMEs that, at present, the focus of the sanitation sector should be on getting latrines installed so that all households are served – including ensuring accessibility to the poor by providing the cheapest possible product. However, they acknowledged that the quality of their work also affected the sustainability of their businesses. Concerns were also raised regarding cost implications for conforming to the new standards – particularly as their unit costs were already fixed in their contracts with SNV. For the 26 SMEs with contracts with SNV, it was decided and agreed that their current standards and unit costs would be accepted by SNV into the future. The SMEs would not have any formal obligations to follow the standards and protocols in the manual, within the bounds of the NOURISH project and their pre-existing contracts. Any changes to their operations and protocols would be voluntary. The latrine construction manual was subsequently revised with additional inputs received from an internal review conducted by SNV.

The importance of water filters in the NOURISH project areas was also discussed with the participants – including the Super Tunsai brand, other brands of ceramic water filters produced in Cambodia, and Tulip and bio-sand filters. The function and processes employed by the water filters to trap pathogens were discussed, as well as the associated impacts relating to the prevention of diarrhoea and the reduction of the child stunting.

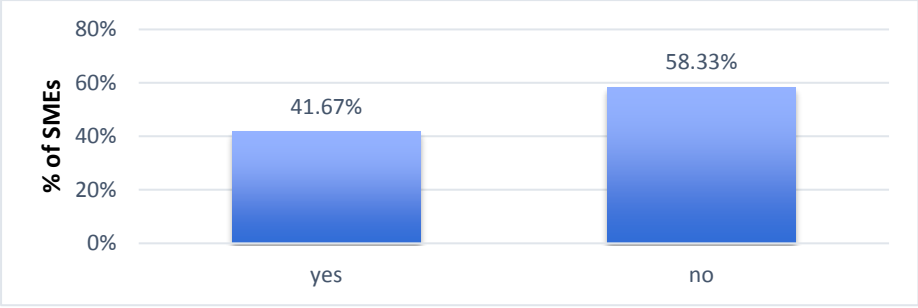
SMEs were also provided with a questionnaire to assess their perceptions towards CWFs and willingness to become a supplier of both the filters themselves and their spare parts. Over 40 participants completed the questionnaire. The analysis of the results was presented at the Siem Reap provincial training workshop. From this survey, it was found that 36% of SMEs were in the process of selling water filter products, while 44% did not, and 19% used to, but stopped (Fig. 1).

Figure 1: Have you ever supplied water filters to communities?



Around 41% out of 44% who did not want to supply water filters SMEs had thought about becoming a distributor for water filters (Fig. 2). Some stopped supplying spare parts because of low profit margins. SMEs are now aware of the issue of replacement parts for CWFs and depending on their perceptions and priorities, can engage in their resale through their customer networks. However, interest in the resale of spare parts appears to remain low due to a perceived low demand and low profit margins.

Figure 2: Have you ever thought about supplying water filters?



Opportunities to enhance water filter supply chains were subsequently discussed amongst the workshop participants – the results of which are presented in Table 2.

Table 2 - Identification of areas for water filter strengthening with SMEs and local authorities

Strengths	Weaknesses
- SMEs operate close to the communities and villagers, potentially making it convenient for customers to access products; - SMEs and business centres are already known by the villagers including their existing products and services; - SMEs operating in the communities have received training and improved skills in the sale and marketing of water filters;	- SMEs with new operations have limited skills in the sale and marketing of water filter products; - SMEs with few operating staff have limited capacities for services expansion;
Opportunities	**Threats**
- Some villagers do not already own a water filter, representing high potential demand; - Sales and technical support opportunities provided by SNV; - Local authorities can support communication and demand creation down to the direct purchasers/villagers; - Water filters (i.e. Super Tunsai) and their spare parts are produced in country and supply chains already exist; - Some communities have scarce water resources;	- Villagers are waiting for subsidies of the water filters and may not invest their own resources at full-cost; - Villagers still lack an understanding and knowledge on consuming clean water – and this may limit demand; - Water filters have small storage capacities and potentially are not suitable for large families or number of users; - Subsidies have distorted the perceptions of price in the marketplace, including the spare parts; - Low market and demand for spare parts and little incentive to carry them in their inventory - Water filters are not fancy enough compared to those that are imported;

Source: information extracted from the questionnaire

2.2.3 Latrine construction and water filters training workshop

A 2-day training workshop was administered in Siem Reap Province from May 27-28, 2018 where NOURISH stakeholders and 38 SMEs had another opportunity to review the latrine protocols and standards in greater detail (0.5 day), and then participate in several field practical sessions covering various quality-related topics and core components of the manual (1.5 days). The first 0.5-day practical session comprised of the observation of a new type of brick for higher-quality superstructure construction, and several local examples of low-cost latrines (typically used by ID Poor households) that had experienced quality issues (notably a termite infestation, a hill-side construction, and installation within a close proximity to a pond). The importance of proper siting was highlighted to the trainees, and common siting issues were discussed. Proximities between the latrine and sensitive sites such as wells and ponds were also discussed.

On the 2nd day of the training, the participants visited a local production facility to discuss the production of the latrine components, and were split into two groups, with each group constructing a latrine according to the step-by-step protocols in the manual. Due to time constraints, some components were pre-assembled at the local production facility and delivered to the training sites. At each stage, the participants discussed what aspects from the manual worked, and which needed clarifications or revisions. The construction of some of the pre-fabricated components followed the SMEs past construction habits, but any deviations with the latrine manual were discussed. One latrine was successfully constructed while the 2nd group was unsuccessful do to high-water tables at the selected site.

Participants at the training workshop in Siem Reap province were also introduced to the concept of supply chain strengthening for water filter products. These concepts included information about strategies to sell spare parts, as derived from the previous experiences of PATH (an organisation in Cambodia previously working on water filter issues) and HSE. The concepts provided a model for spare part distribution in the NOURISH provinces, and included: 1) door to door sales, 2) retail sales models, 3) connecting to micro-finance, 4) piloting design and operation of the new WASH product Participants were keen to embrace these concepts and integrate them into their businesses when possible.

2.3 Mentoring and monitoring phase

The objective of the mentoring and monitoring phase of the assignment was to provide follow-up support to the latrine producers and to monitor their individual practices against that prescribed in the latrine construction manual. Additionally, CWF

supply chains would be strengthened through the exploration and implementation of marketing approaches and potential solutions with SMEs and retailers.

2.3.1 SME mentoring and monitoring

After the training workshop in Siem Reap was completed, the manual was finalised in Khmer, translated into English, and accepted by SNV. Subsequently, mentoring and monitoring activities commenced. A total of 16 SMEs were visited and their activities were monitored including construction processes, the production of latrine components, and installations. Monitoring observations were recorded using an inspection worksheet (Annex III). Table 2 presents the compliance figures from the inspections.

Table 2 – SME Inspection Results

Parameter	% of SMEs demonstrating compliance with the training manual	Comments
Cement mix	100%	Most SMEs applied the correct cement mix ratios although they used different tools for measurement
Ring diameter (>1m)	90%	Most villagers preferred rings of >1m; but some still received ring diameters even smaller than 1m
Rebar reinforcement	44%	Inclusion was influenced by the local price of rebar. Most SMEs used 4cm intervals.
Drying of cement components	0%	Some SMEs removed rings from the mould earlier than they should
Correct pit cover	100%	Diameter based on size of rings and of sufficient thickness
Correct slab foundation	50%	Correct based on physical requirements, but sometimes too small based on customer preference (0.8m diameter in Siem Reap)
Correct latrine slab construction	100%	After training, masons produced slabs more accurately
Correct installation of chamber box	100%	After training, masons installed slabs more accurate

Correct ring/pit installation	100%	After training, masons installed rings/pits more accurately
Correct connection between chamber box and pit	100%	Elevations were observed to be correct to ensure flow into the pit
Informed choice provided to potential customers and appropriate for context	100%	Although informed choices provide to potential consumers and latrine suppliers, high water table designs incur a higher cost, and the unit prices that the SMEs are contracted to cannot be followed in such cases.

Generally, SMEs demonstrated that they were able to conform to most of the quality elements prescribed in the manual. Particularly, SMEs improved their cement strength (ratios and mixing of components), their production (slab, ring, and chamber boxes, and pit cover) and installation processes (ring/pit installation and elevation of piped connection). However, those SMEs with small diameter moulds were unable to conform, rebar reinforcement improvements were found to be too expensive, and designs could not adapt to flood-prone areas due to increased costs associated with high water table configurations. Additionally, cost-cutting measures associated with latrines produced for ID Poor households and subsidies (to make the unit prices as low as possible) were found to be common – including the absence of rebar reinforced cement components and smaller diameter pits.

Improved quality of the latrine products can result in increased costs. SMEs used correct cement mixes by correcting the cement component ratios. SMEs were required to add larger rebar intervals for strengthening the ring, slab, ring size, and cover slab. These additional raw materials added more cost to the latrine production. Complying to the correct cement drying times did not affect cost; however, SMEs did not apply this guidance well because of high demand from the communities. They removed latrine from mould earlier than the recommendation in the training manual.

Some methods were found for SMEs to improve technical installations without increasing costs. Installation processes including correct positioning of pit covers, ring/pit chamber boxes and piped connections did not add cost to the latrine production. Masons installed slabs, rings, and pits more accurately after the trainings. These did not require additional costs to the SMEs. The elevations of the connection between chamber box and pit were correct, enabling correct water flow into the pit. Such technical improvements did not added cost to the production. Continuing these quality improvements will require on-going monitoring from the related implementers — including stakeholders and local authorities, most importantly, villagers themselves.

Under their current contract with SNV, SMEs were not able to change latrine pit diameters. Once the SMEs were contracted to supply the latrine in the NOURISH areas, the latrine configuration was accepted, therefore, it was difficult for the suppliers to change some elements of the latrines to conform to the training manual. However, some technical aspects associated with installation could be adapted to follow the guidelines in the training manual.

Latrine production for high water tables were introduced in the training manual but were not observed to be implemented over the short monitoring time. Since the introduction of the training manual in June 2018, the SMEs did not have any latrine installations in high water table areas yet. As the latrines in the high water tables require additional costs, villagers may find it difficult to afford such latrines.

Latrine production and installation is the most common business practice implemented by the SMEs under the NOURISH project contact. 26 SMEs supply of latrines products with different specifications into the local communities. Annex 4 presents detailed information about the SMEs operation and locations in the NOURISH project.

SNV also worked with SMEs to encourage them to establish supply chains for water filters and their spare parts. Additionally, SMEs were engaged on the issue of spare part supply chains during the various workshops previously described. The importance of spare parts availability and the potential demand for such products were discussed.

Through the review of approaches to water filter promotion, assessment of spare part supply chains, and the trainings conducted through this assignment - some of the SMEs have become retailers for Tulip water filters. These particular filters are seen to be more aesthetically pleasant to customers, demand is perceived to be higher, and SMEs believe such products will yield greater returns. Furthermore, Hydrologic Social Enterprise (HSE) has also engaged in direct resale and distribution of Super Tunsai filters and their spare parts among the subsidised communities of the NOURISH project.

Most SMEs however are not motivated to supply water filter products (including the Super Tunsai brand) to the communities due to perceived weak demand. Demand may have been higher among the “1000 day” subsidy villages/communes due to the promotional activities, but is perceived to be less so in the non-target areas.

Only five SMEs partnering with NOURISH project became retailers to supply the Super Tunsai water filters. None of these SMEs are currently engaged in the resale of their spare parts. However, they have since stopped their resale activities after piloting. The SMEs are of course profit-oriented and reportedly have generated little income from their resale compared to other aesthetically advanced water filters (such as the Tulip design) and latrines. Furthermore, the Super Tunsai filter has been subsidised to the communities targeted for the pro-poor program. Beyond this target group, there are few users of the Super Tunsai filter and therefore demand for spare parts is low.

Some SMEs have adopted the Tulip water filter into their businesses due to its reasonable price and higher demand in the communities that they service. Currently, 10 NOURISH partnering SMEs supply the Tulip water filters and approximately 100 units have been sold in NOURISH project areas to-date.

HSE continues to supply the Super Tonsai product through its mobile sales team and retailers in the local communities in the NOURISH project area. These two approaches (HSE's existing sales network and approaches to the resale of the Super Tonsai and the SME resale of Tulip filters) are providing some diversification of water filter products available in the marketplaces of the local communities in the NOURISH project provinces.

The resale of water filters presents a challenge to the SMEs under the NOURISH project due to low levels of demand. Locally produced water filters do not provide sufficient profit margins in most cases, as experienced by some of the SMEs who had supplied them – and/or their spare parts - in the past. Some SMEs started to supply the spare parts and locally produced water filters after the trainings but later discontinued.

Imported waters have greater aesthetic appeal, are more easily transported and offer potential higher profitability for SMEs. The filters provide more convenience and are more trusted in their ability to trap diseases. With the profit-orientated and potential of increasing demand, 10 SMEs have started to pilot the supply of water filters in local communities.

2.4 Dissemination phase

The final report will be disseminated to the Cambodian WASH sector at national level to inform the sector of the results and lessons learned from the latrine and water filter product quality enhancement assignment. This dissemination will allow national stakeholders to understand the challenges, successes, and lessons learned from

NOURISH program's efforts to increase latrine and water filter spare parts quality during project implementation. Such efforts will demonstrate to national level authorities how to improve efforts to provide consistent and good quality products to communities.

3 Key findings and recommendations

The Provincial Departments of Rural Development (PDRDs), local authorities, and latrine producers (SMEs) in the NOURISH target areas have demonstrated a high level of willingness to engage in the WASH product quality initiative. After their engagement in the initiative, it is clear that they recognise the importance of quality products to ensure the safety and satisfaction of customers and standardisation to ensure consistency. However, it was also recognised that the increase in costs associated with following standards can be significant, and any resulting difference in costs would have to be passed on to the customer. Such cost increases would make latrine products less affordable. Due to ongoing contracts, increases to the unit costs of the latrines were not immediately implementable, and therefore the practical improvements to latrine quality were limited.

SMEs were largely unable to implement quality modifications that required significant investments or increases in costs (i.e. moulds for larger pit diameters and rebar reinforcement). However, some were able to make changes to their protocols such as improvements to production and installation methods. Overall, their recognition of product quality and knowledge of improved protocols and standards should give them a stronger foundation for future improvements to the technical aspects of their business, compared to other SMEs that have not received similar support. ***Recommendation 1 – Ongoing monitoring by SNV and local authorities may be needed to ensure that the SMEs continue to address quality issues through the implementation of the guidelines in the latrine construction manual – through to the end of the NOURISH programme and beyond.*** However, among provincial and local governments, while in theory there could be a role for monitoring product quality – particularly latrines – in practice this is likely to be challenging due to limited capacities and resources, and the lack of such a mandate directed from national authorities.

Additionally, some signs were observed that the efforts to reduce the unit costs of latrines for the poor may result in some negative implications – particularly in regard to small pit sizes and the lack of rebar reinforcement of cement components. These issues will need to be monitored carefully in the future to ensure that negative risks are mitigated. ***Recommendation 2 - Efforts should be made to ensure that comparable latrine quality standards are provided to poor and non-poor households***

alike, and that latrines function to a minimum level of satisfaction for all customers to ensure equality.

While national priorities and those of the SMEs themselves remain focused on eliminating open defecation through low-cost sanitation solutions, the quality of products is another step to enhance the sector. As latrine quality issues appear to be minor, the focus on low unit costs will likely continue until sanitation coverage improves – after which demand for higher levels of quality may strengthen as ability to purchase higher quality products increases. ***Recommendation 3 - Development partners and NGOs should acknowledge the issue of WASH product quality, raise it with producers that are engaged in their projects and establish clear quality standards in their contracts with producers.*** The quality standards tool established through this initiative under NOURISH, and through a very consultative process with project stakeholders, should serve to support such efforts in the NGO community, and also inform the development or revision of future national latrine construction guidelines. Subsequent monitoring of quality is also important.

Demand creation for water filter products is an important pre-requisite for the emergence of a healthy marketplace, and sufficient demand for spare parts and replacements. It is clear from this assignment, as well as others previously conducted in Cambodia, that demand for water filter products is more attributable to social status and aesthetic appearance than the reduction of health risks. The Super Tunsai filter design has strived to improve the attractiveness of locally produced water filter products. However, consumer preference for the Tulip filter design appears to be stronger and SMEs have therefore gravitated towards this product, particularly in the open marketplace in the absence of subsidies. As the overall prevalence of household water filters remains low, the demand for spare parts is also extremely low – resulting in little interest from SMEs to stock and promote them. However, HSE's existing supply chains and sales models may support ongoing resale of the Super Tunsai product in the NOURISH programme areas – although to a limited geographical extent.

Research from Cambodia suggests that some tulip filters may be able to achieve sufficiently high bacteriological removal efficiencies, and their preference in the marketplace should be acknowledged in future programmes to promote safe drinking water. ***Recommendation 4 – Development projects should work to increase demand for household water treatment with proven water filter technologies, and only provide subsidies strategically so-as not to distort the marketplace.*** Water filter technologies can become "proven" through internal and/or external verification programmes, for which guidelines have been published by the World Health Organisation[2]. Efforts to promote spare parts in the marketplace to sustain use

2 http://apps.who.int/iris/bitstream/handle/10665/44693/9789241548229_eng.pdf;jsessionid=74DE67

beyond the product's lifespan will only be effective once sufficient demand exists – and this will remain a challenge until the use of filter products increases significantly, as boiling remains the norm.

4 Conclusions

Phase 2 of the WASH product quality assignment has provided the opportunity for SMEs, PDRDs, local authorities, academics, and NGOs - as well as key decision makers at the national level, to engage, consider and address quality issues in the NOURISH provinces. These engagements have been achieved through meetings, interviews, trainings and consultation workshops. Efforts have been made to produce a practical latrine construction training manual/guideline which has been designed to address the issues of variations of the quality of latrines in order to meet the satisfaction and preferences of local communities. The agreed and accepted standards in the latrine construction training manual/guidelines can be deployed now and in the future to support minimum quality levels. Applying these standards would enable increased latrine uptake and more sustainable businesses for the SMEs in the local communities. Furthermore, water filter promotion has been explored with the SMEs to identify potential mechanisms for supply chain strengthening and marketing, while challenges and limitations encountered have been documented.

C9DF53A213BCE29BCC67DF5017?sequence=1 - Evaluating Household Water Treatment Options: Health-based targets and microbiological performance specifications -

Annex I. Questionnaire for water-filter supply

1. **Question related to experiences**
   - **1.1** Where are you from.....?
   - **1.2** Have you ever supplied water-filter to the communities?
     .....

1.2.1 If yes, what are those types of water-filters..... ..... 1.2.1.1 What is the cost of each type? .... 1.2.1.2 How many days/months/years have you supplied these water-filter products?	1.2.2 If no, why?..... .... 1.2.2.1 Have you never thought of starting to provide water-filters supply to communities? .... 1.2.2.2If yes, why? .... 1.2.2.3 If no, why?..... .....

2. Question related to opinions

2.1Does the supply of water-filter have any potential growth for SMEs in the community? Why?

.....
.....
.....

2.2 Phase I assessment findings show that communities had difficulty to purchase water-filter spare parts once they were broken, as current MSEs do you have any strategies to supply those spare parts to the communities?

.....
.....
.....
.....

2.3 What are your strengths for providing water-filter supply to the communities?

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.....

2.4 What are your weaknesses for providing water-filter supply to the communities?

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.....

2.5 What are your threats for providing water-filter supply to the communities?

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.....

2.6 What are your opportunities for providing water-filter supply to the communities?

.....

.....

2.7 What types of technical difficulties you may need for providing water-filters supply to the communities

Annex II. Checklist latrine development for mentoring and monitoring

No	Implication in Phase I including (design/selection, production, delivery, installation, and use)	Areas for improved quality in Phase II	Others
1	Latrine design according to geographical areas (flooding, high water table and low permeability soil)	Required methods of strengthening the standards of latrine in the developed training manual	
2	Latrine size vary 0.8 m, 1.0m and 1.2 m	Required 1.0m	
3	Small cement mixed and more sand added	Required ratio as explained in the MRD's manual	
4	Slab may poor designed resulting in crack and breakage overtime because of small size metal rebar (4cm generally found)	Required methods of strengthening the standards of latrine in the developed training manual	
5	Metal rebar reinforcement vary	Required 6 cm	
6	Pit/ring without metal rebar reinforcement	Required metal rebar reinforcement	
7	Drying time for the latrine components is not sufficient	Required to apply with the MRD's manual standard time	
8	Some pans required large quantity of water for flushing	Required to adhere to the technique of the developed training manual	
9	Inappropriate installation of latrine	Required methods of strengthening the standards of latrine installation in the developed training manual	
10	Protocols for pit digging, joining of rings, elevations of piping, and placement of the slab and chamber box were not always consistent or clear	Required methods of strengthening the standards of latrine in the developed training manual	
11	Accessibility of the latrines for children, elderly, and the disabled are likely to be challenging	Required methods of strengthening the standards of latrine in the developed training manual	
12	Latrine maintenance procedures is not fully understood	Required methods of strengthening the standards of latrine in the developed training manual	
13	Low quality materials may result in breakage of doors, walls, and roofs	Required methods of strengthening the standards of latrine in the developed training manual	
14	Distance of delivery resulting in breakage and late delivery of latrines	Replacement of breakage and improved quality of service delivery	
15	Intermediary latrine installation masons sometimes request for upfront or illegal deposit	Inform to the SME if they have intermediary to ask for deposit shall consider of any repercussion	

Annex III. Monitoring Visit form

			A. Correct cement mix		B. Correct pit lining diameter		C. Correct rebar reinforcement of cement products		D. Correct drying of cement products		E. Correct pit cover features/construction		F. Correct slab foundation construction		G. Correct latrine slab construction		H. Correct installation of chamber box	
Group	SME Name	Number	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation	Correct implementation	Reasons why not / experiences with implementation
SNV contracted		1	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		2	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		3	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		4	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		5	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		6	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		7	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		8	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		9	☐		☐		☐		☐		☐		☐		☐		☐	
SNV contracted		10	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		11	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		12	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		13	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		14	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		15	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		16	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		17	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		18	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		19	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		20	☐		☐		☐		☐		☐		☐		☐		☐	
Independent		21	☐		☐		☐		☐		☐		☐		☐		☐	

Annex IV List of latrine and water filter suppliers

No	Province	District	Commune	Village	Concrete Producer	Products
01	Pursat	Kandieng	Srei Sdok	Banteay Kraok	Name withheld	Sell only toilet
02	Pursat	Pursat city	Banteay Kdey	Banteay Kdey	Name withheld	Sell toilet and imported Water Filter
03	Pursat	Pursat city	Teak Prey		Name withheld	Sell only toilet
04	Pursat	Kandieng	Kanchhor	Samroung	Name withheld	Sell only toilet
05	Pursat	Kandieng	Sya	Boeung Chak	Name withheld	Sell toilet and imported water filter
06	Pursat	Bakan	Talou	Talou	Name withheld	Sell toilet and imported water filter
07	Battambang	Ratnak Mondol	Traeng	Chi Sang	Name withheld	Sell only toilet
08	Battambang	Rukhakiri	Prekchik	Prek Chik	Name withheld	Sell only toilet
09	Battambang	Sangke	Raing Kesey	Raing Kesey	Name withheld	Sell only toilet
10	Battambang	Sangke	Kompong Preah	Prey Chaek	Name withheld	Sell only toilet
11	Battambang	Bavel	Ampil Pram Doeum	Ampil	Name withheld	Sell only toilet
12	Battambang	Ratnak Mondul	Sdao	Banon	Name withheld	Sell only toilet
13	Battambang	Ratnak Mondul	Anderk Heb	Svay Chour	Name withheld	Sell toilet and imported water filter
14	Battambang	Ratanak Mondul	Sdao	Sdao	Name withheld	Sell only toilet
15	Battambang	Thmar Koul	Tamoeun	Thmar Koul	Name withheld	Sell only toilet
16	Battambang	Thmar Koul	Kien Kes	Kouk Khmum	Name withheld	Sell only toilet
17	Battambang	Bovil	Bovil	Samaki	Name withheld	Sell only toilet
18	Battambang	Moung Russei	Moung	Moung	Name withheld	Sell only toilet
19	Battambang	Kom Rieng	Ta Krie	Srah Toek Thmei	Name withheld	Sell only toilet
20	Battambang	Sangke	Slor Kram	Wat Ta Moem	Name withheld	Sell only toilet
21	Siem Reap	Puok	Doun Keo	Cham Bak Hae	Name withheld	Sell both toilet and imported water filter
22	Siem Reap	Pouk	Pnov	Sar Sar Sdom	Name withheld	Sell both toilet and imported water filter

23	Siem Reap	Banteay Srey	Khnar Sanday	Banteay Srey	Name withheld	Sell both toilet and tulip water filter
24	Siem Reap	Srey Snom	Chruoy Neang Nguon	Trum	Name withheld	Sell both toilet and imported water filter
25	Siem Reap	Varen	Lvea Krang	Uh Tei	Name withheld	Sell toilet, imported water filter and experience selling local water in the past
26	Siem Reap	Varen	Svay Sor	Russei Thom	Name withheld	Sell both toilet and imported water filter