Project SWAN

-Safe Water and Nutrition-
A community-based participatory approach in Vietnam

ILSI
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Collaborative research between ILSI Japan CHP and
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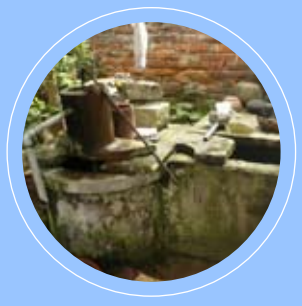


I. EXECUTIVE SUMMARY

1. English

<Background>

WHO has reported that 1.1 billion people do not have access to safe drinking water, in many developing countries the intake of unsafe water and unhygienic environments cause diarrhea and infectious diseases among children. This interferes with the intake of necessary nutrients, resulting in malnutrition. In Vietnam, access to safe water is still a high priority public health issue. Only about 3% of rural households in Vietnam are supplied with water that meets the national Drinking Water Hygiene Standard (Ministry of Health, Vietnam, 2002).

<Framework and objectives>

Under these circumstances, in order to secure safe water in rural areas where there will be no public water works available in the foreseeable future, Project SWAN aimed to establish sustainable water supplies and health communication models in rural and suburban areas. The goal was to accomplish this through a participatory approach with the inhabitants by 1) enhancing the knowledge of drinking water, food safety and nutrition at the household level, 2) optimizing the operation of water treatment facilities and supplies of safe water, and 3) establishing effective management systems to enable the sustainability of community based participatory approaches.

The project was composed from two programs; the IEC (Information, Education and Communication) Program working for sharing information with inhabitants to improve water management in households, food safety and nutrition, and the Technical Program working for improving water quality at water treatment facilities (WTFs) through their renovation and by providing technical training about the operation of WTF.

In November 2005, the project was started in three communities (Tam Hiep-Hanoi, Dai Mo-Hanoi, Quang Trung-Nam Dinh Province) in the Red River Delta Region of Vietnam.

<IEC Program>

In the first half of the project, the program aimed to increase awareness and knowledge of inhabitants about the water treatment process, clean water, water management by the Water Management Union (WMU*), food safety and nutrition in the context of a participatory approach. The project SWAN issued newsletters, organized workshops, a drawing contest for school children and a poem contest for adults. In the second half of the project, the program tried to promote the self-reliance of the community. We conducted training

of instructors to improve communication skills of WMU members and developed a sustainable IEC providing system.
In order to examine the effectiveness of the program over 3 years, a study was designed as an intervention study. We developed a questionnaire based on a literature review and focus group discussions and carried out surveys with around 200 mothers and their children from 6 months to under 5 years old.

**WMU: Consist of the leader of the village and commune, the vice-leader of the village and commune, operators, village health workers, and health staff*

<Technical Program>

To achieve sustainable water supplies by optimizing the operation of WTF, we conducted the following technical activities.
1) problem identification of the WTF and personnel capacity, 2) planning renovation based on the needs of the locality and modification of WTF, 3) develop operational and maintenance manuals, and guidance for the WMU, 4) technical training for WMU members, 5) periodical monitoring and instruction concerning operation records, 6) detection methods for water loss and countermeasures.

<Outcomes>

As results of above activities, the knowledge of the inhabitants about safe water, food safety and nutrition has significantly improved and the incidences of childhood diarrhea and underweight have decreased. We have confirmed that the water quality improved and now meets the national standards except occasional fluctuations following the WTF renovation. Furthermore, the number of households who receive treated water as well as water volume (L/capita/ day) increased. The satisfaction of inhabitants in clean water and water management has increased.
The project was implemented through a participatory approach and we utilized existing personnel and equipment in local areas. Therefore the water treatment practices, water management skills and IEC activities have been cultivated in the local populations during the project.
In the first half of the project, a project team (ILSI and NIN) led the activity, but from the second half of the project, the project team remained as a supporter and together with the efforts of the inhabitants, WMU led the activities in local areas. This approach has ensured the sustainability of WMU. We also established a reasonable water fee collection system and carried out measures for minimizing water loss. This led to an increase in revenue for WMU and the increased revenue was able to be allocated to the maintenance of the WTF, salaries of WMU members, the purchase of chemicals, and even personnel costs of IEC activities, therefore enabling financial independence. Furthermore, the WMU members of the project site became the local consultants for other villages and started promoting the expertise leaned from Project SWAN.

For tackling safe water supply issues in developing countries, improvement of water quality alone would not be a complete solution for local communities. Through the appropriate operations of WTF and safe water supplies, inhabitants are able to drink safe water and to use it for cooking at home. Ensuring food safety in the home links with prevention of diarrhea and under nutrition of family members. All of the above have always been closely related with the health of people, thus Project SWAN was able to combine IEC activities and water quality improvements in the minds of the inhabitants although they are totally different areas of expertise. The two activities were seen as two wheels of the same cart. We believe this led the great success of the project.
These experiences of Project SWAN will serve as good practice for other similar projects.

2. Japanese

＜背景＞
現在、安全な水を利用できない人は、全世界で11億人にのぼるといわれています。途上国における不衛生な水の摂取や保健衛生環境の不備は、とりわけ子供の下痢や感染症の引き金となります。また、下痢によって栄養吸収を妨げることから栄養不良の原因ともなります。
ベトナムにおいても安全な水へのアクセスはいまだ重要な課題であり、政府の水質基準を満たす水が供給されているのは、農村地域の約3%とされています。

＜概要と目的＞
このような状況下、公共水道水の供給が今後も見込まれていない農村地域において安全な水を確保するため、住民参加による安全な水の供給・ヘルスコミュニケーションのモデルを確立することをプロジェクト目標とし、ベトナム国立栄養研究所（NIN）と共に2005年11月、ベトナム北部にある3ヶ所のコミューン(ハノイのタンヒエップ村・ダイモ村、ナンディン省クワンチュン村)を対象として活動を開始しました。
具体的には、啓発活動及び技術支援活動の両側面から事業を進め、最終的には以下の3点を達成することを目指しました。
1)住民が、安全な水、食品安全、栄養、保健衛生に関する知識を得て、各家庭で実践する。
2)水処理施設の適切な改造を行い、最適な運転を継続して住民に安全な水を供給する。
3)上記の啓発活動と水管理活動を、水管理組合*が継続して行う。
*水管理組合：村長、副村長、オペレーター、普及員、医療スタッフ

＜啓発活動＞
プロジェクト前半は、安全な水、食品安全、栄養、保健衛生に関する住民への啓発活動として、ニュースレターの発行、ワークショップ、小学生による絵画コンテスト、住民による川柳大会等を実施しました。その後はコミュニティーの自助努力を引き出すため、村の水管理組合を対象としたコミュニケーションスキル向上のための研修や住民への継続的な情報提供のための仕組み作りを行いました。
また、啓発活動の効果を評価するため、介入研究のデザインに則ってプロジェクトの介入効果を調査しました。具体的には、フォーカスグループディスカッション及び文献調査を基に作成されたアンケートを用い、６ヶ月から５歳未満の子供を持つ母親約200人を対象に調査を行いました。

＜技術活動＞
水処理施設の適切な改造と安全な水の安定供給を目的とし、以下の技術支援活動を行いました。①現場施設及び人材の問題点把握、②現場のニーズに合わせた改造計画立案と改造の実施、③水処理施設の運転/機器維持管理のマニュアルの作成及び水管理組合の活動基本の紹介、④水処理施設現場での技術研修と実践指導、⑤定期モニタリングと管理運営方法、記録の習慣化指導、⑥処理水給水配管に関わる漏水等の水損失の発見方法と対策

＜成果＞
これらの活動の結果、安全な水、食品安全、栄養に関する住民の知識が向上し、子供の栄養不良・下痢発生率が減少しました。また、水処理施設の改造工事及び運転指導により、ベトナム政府の水質基準を満たす水質が確保され、さらに配水についても受水可能世帯数及び、一人当たりの受水量の両方が増加しました。住民と協同で作業を行い、既存の人材・資機材を活かすアプローチを取った結果、活動中に培われた知識・技術、組織運営能力及び啓発活動がコミュニティーの中に定着しました。
また、１年目はプロジェクトチーム（ILSI,NIN）が活動を率先しましたが、2年目からはプロジェクトチームはサポートとアドバイスのみに留め、現場の水管理組合が主体となった結果、水管理組合が自立して活動できるようになりました。また、水料金の適正な徴収システムを確立し、漏水対策も行ったことにより、水管理組合の収入が増加し、水処理施設の維持管理費、関係者への給与、水処理薬品費、啓発活動に係る人件費を継続的に確保できるようになり、経済的にも自立しました。さらに、プロジェクトの対象となった水管理組合のメンバーは、現在では近隣の村からの要請に応じ、コンサルタントとしてプロジェクトで培った専門的知識を他の村へ普及できるまでになりました。

途上国における安全な水の供給の課題に対し、地域の水質を改善するだけでは根本的な解決にはなりえません。水処理施設を適切に運営し、安全な水を供給することにより、家庭において安全な水を飲み、調理に使用することができます。また食品安全の確保は、下痢や栄養不良の予防にもつながり、住民が健康でいられることと密接な関わり合いがあります。本プロジェクトでは「住民への啓発」と「水質改善」という、専門的には全く異なる分野を住民の視点で有機的に結びつけ、それぞれを両輪として活動したことが大きな成果に繋がったと言えます。この経験は、今後類似した事業に取り組む上での良い実践例になることを期待します。

3. Vietnamese

<Tình hình chung>

Theo báo cáo của Tổ chức Y tế Thế giới, có khoảng 1,1 tỷ người không được sử dụng nước sạch. Tại nhiều nước đang phát triển, việc dùng nước không sạch và môi trường mất vệ sinh gây ra bệnh ỉa chảy và các bệnh nhiễm trùng khác ở trẻ em. Điều này ảnh hưởng tới việc hấp thụ các chất dinh dưỡng cần thiết cho sự phát triển của trẻ nhỏ, gây ra bệnh suy dinh dưỡng ở trẻ. Ở Việt Nam, sử dụng nước sạch vẫn là một vấn đề sức khỏe cộng đồng được ưu tiên hàng đầu. Chỉ có khoảng 3% trên tổng số các hộ gia đình ở nông thôn Việt Nam được sử dụng nước sạch đạt tiêu chuẩn vệ sinh quốc gia (Tiêu chuẩn của Bộ y tế Việt Nam ban hành năm 2002).

<Khuôn khổ thực hiện và các mục tiêu của Dự án>

Trong bối cảnh đã nêu, để đảm bảo việc cung cấp nước sạch ở những vùng nông thôn hiện chưa có nhà máy nước tập trung, Dự án SWAN đặt mục tiêu thiết lập và duy trì bền vững mô hình quản lý và cung cấp nước sạch cho nhân dân ở các vùng nông thôn và ngoại thành thông qua chương trình tham gia cộng đồng của các hộ gia đình bằng cách 1) nâng cao kiến thức về nước sạch, vệ sinh an toàn thực phẩm và dinh dưỡng cho các hộ gia đình, 2) tối ưu hóa sự vận hành trạm cấp nước và cung cấp nước sạch và 3) thiết lập nên một hệ thống quản lý có hiệu quả có thể duy trì bền vững sự cung cấp nước sạch cho nhân dân - thông qua sự tham gia của cộng đồng.

Dự án bao gồm hai chương trình; Chương trình truyền thông cung cấp thông tin cho người dân nhằm cải thiện vấn đề dinh dưỡng, vệ sinh an toàn thực phẩm và tình hình quản lý nước tại hộ gia đình và Chương trình kỹ thuật nhằm cải thiện chất lượng nước tại trạm bơm thông qua cải tạo và hỗ trợ kỹ thuật vận hành.

Tháng 11 năm 2005, Dự án đã được triển khai tại ba xã thuộc khu vực đồng bằng sông Hồng (xã Tam Hiệp - Hà Nội, xã Đại Mỗ - Hà Nội, xã Quang Trung - Nam Định).

<Chương trình truyền thông>

Chương trình này được chúng tôi tiến hành trực tiếp trong nửa thời gian đầu thực hiện Dự án với sự tham gia của người dân nhằm nâng cao nhận thức và hiểu biết cho người dân về nước sạch, quy trình xử lý nước sạch, cơ cấu và cách thức hoạt động của Ban quản lý nước, dinh dưỡng và vệ sinh an toàn thực phẩm. Chúng tôi đã phát hành các tờ tin, tổ chức các buổi hội thảo với các bà mẹ, các chủ hộ gia đình, tổ chức thi vẽ tranh cho các em nhỏ học sinh và thi thơ cho toàn bộ nhân dân địa phương. Nửa cuối thời gian thực hiện Dự án, với mong muốn thúc đẩy khả năng làm việc độc lập của các cán bộ và cộng đồng địa phương, chúng tôi đã tổ chức các lớp tập huấn nhằm nâng cao kỹ năng truyền thông cho các thành viên Ban quản lý nước và xây dựng hệ thống cung cấp thông tin bền vững.

Để kiểm tra tính hiệu quả của chương trình sau 3 năm thực hiện, chúng tôi đã triển khai 1 nghiên cứu cắt ngang với bộ câu hỏi điều tra được thiết kế dựa trên đầu ra của các buổi thảo luận nhóm. Đối tượng tham gia là khoảng 200 cặp bà mẹ và con trong độ tuổi từ 6 tháng đến dưới 5 tuổi.

**Ban quản lý nước: Bao gồm lãnh đạo UBND xã, cán bộ Trạm y tế xã, trưởng thôn, phó trưởng thôn, cán bộ vận hành trạm cấp nước và các nhân viên y tế của thôn.*

<Chương trình kỹ thuật>

Để duy trì bền vững sự cung cấp nước sạch cho nhân dân thông qua việc tối ưu hóa hoạt động vận hành của trạm bơm, chúng tôi đã tiến hành các hoạt động kỹ thuật như sau:

1) Xác định các vấn đề của trạm cấp nước và các khó khăn về nguồn nhân lực, 2) Lên kế hoạch cải tạo trạm cấp nước trên cơ sở nhu cầu của người dân địa phương, 3) Cải tạo trạm cấp nước, 4) Tập huấn kỹ thuật cho các thành viên Ban quản lý nước, 5) Xây dựng sách hướng dẫn vận hành và biểu mẫu ghi chép vận hành, 6) Nghiên cứu biện pháp kiểm soát sự thất thoát nước.

<Kết quả>

Với các hoạt động nói trên của Dự án, kiến thức của người dân về nước sạch, vệ sinh an toàn thực phẩm và dinh dưỡng đã dần được nâng cao, tỷ lệ trẻ bị ỉa chảy và suy dinh dưỡng theo đó cũng đã giảm xuống. Các kết quả phân tích nước của Dự án cho thấy chất lượng nước tại trạm bơm sau khi cải tạo đã đạt tiêu chuẩn của Bộ y tế. Không những thế, số hộ gia đình sử dụng nước của trạm bơm cũng như thể tích nước nhận được trong ngày (Lít/người/ngày) đã tăng lên thấy rõ. Người dân cũng hài lòng hơn về chất lượng nước của trạm bơm và công việc của Ban quản lý nước.

Dự án được thực hiện thông qua cách thức tiếp cận cộng đồng và tận dụng nguồn nhân lực và thiết bị sẵn có tại địa phương. Do đó, trong quá trình thực hiện Dự án, chúng tôi chú trọng trau dồi kỹ năng quản lý, vận hành trạm cấp nước và kỹ năng truyền thông cho các cán bộ địa phương. Trong nửa thời gian đầu thực hiện Dự án, nhóm cán bộ Dự án (ILSI và Viện Dinh dưỡng) đã trực tiếp tổ chức mọi hoạt động. Tuy nhiên, thời gian cuối của Dự án, nhóm Dự án chỉ đóng vai trò hỗ trợ và để cho Ban quản lý nước tự tiến hành các hoạt động của Dự án tại địa phương mình. Cách thức tiếp cận này giúp đảm bảo tính bền vững trong hoạt động của Ban quản lý nước. Chúng tôi cũng giúp thiết lập nên một hệ thống thu phí nước có hiệu quả và tiến hành các biện pháp chống thất thoát nước. Điều này đã giúp nâng cao doanh thu cho trạm cấp nước qua đó tăng tính độc lập về tài chính cho Ban quản lý nước. Số tiền thu được ngoài để tích lũy cho bảo dưỡng trạm cấp nước còn được dùng để chi trả các khoản khác như: chi phí sửa chữa đường ống, mua hóa chất, lương cho Ban quản lý nước, phụ cấp cho cán bộ đi truyền thông…

Ngoài ra, các thành viên Ban quản lý nước trong khu vực triển khai Dự án đã dần trở thành những chuyên gia kỹ thuật địa phương để giúp đỡ các xã bạn và truyền đạt những kinh nghiệm đã học được từ Dự án SWAN.

Giải quyết vấn đề cung cấp nước sạch ở các nước đang phát triển là kết hợp cải thiện chất lượng nước với vận hành và cung cấp nước đúng theo quy trình sẽ giúp người dân được sử dụng nước an toàn cho ăn uống. Đảm bảo cung cấp nước an toàn cho ăn uống gắn với thực hành vệ sinh thực phẩm hộ gia đình cho phòng chống tiêu chảy & suy dinh dưỡng trẻ em góp phần nâng cao sức khỏe của từng thành viên trong gia đình và cộng đồng. Dự án SWAN đã thực hiện song song cả hai hoạt động: truyền thông và cải tạo chất lượng nước với vận hành và cung cấp nước đúng theo quy trình ở 3 mô hình cung cấp nước hoàn toàn khác nhau. Bằng cách đó Dự án đã đạt được những thành công nhất định.

Những kinh nghiệm của Dự án SWAN sẽ là bài học tốt cho các Dự án tương tự khác.

II. BACKGROUND OF PROJECT SWAN

1. International recognition

Safe water

A safe water supply and adequate sanitation to protect health are considered by many to be fundamental human rights. Sufficient and adequate quality drinking water and basic sanitation can reduce preventable communicable diseases (1, 2). In developing countries, 90% of all deaths among children under 5 years old have been attributed to diarrhea (3). UNICEF and WHO estimate that 1.1 billion people lack access to improved water supplies in the world (3, 4). One of the targets of the Millennium Development Goals is to halve the number of people without access to safe drinking water and basic sanitation by 2015 (5).

To increase the access to safe drinking water, many approaches have been undertaken in reference to WHO Guidelines for drinking-water quality in developing countries (6).

Food safety situation

Foodborne diseases are one of main causes of diarrhea among children under 5 years old in developing countries. The results from an Indian study showed that since many foodborne illnesses arise from home kitchens and mothers' food handling practices (7). Other studies in the U.S.A. have focused on the five major control factors for pathogens are personal hygiene, adequate cooking, avoiding cross-contamination, keeping food at safe temperatures and avoiding foods from unsafe sources. Food safety education is most effective when messages are targeted toward changing behaviors most likely to result in foodborne illness (8).

WHO issued Five Keys to Safer Food Manual in 2006 (9). It provides food safety messages with five key steps and suggests ways to communicate the message and includes an evaluation form for participants.

Five Keys to Safer Food

- Keep clean
- Separate raw and cooked food
- Cook thoroughly
- Keep food at safe temperatures
- Use safe water and raw materials

Nutrition situation

In developing countries, children aged 4-24 months are at the greatest risk of developing diarrhea from contaminated drinking water and food (10). According to WHO, in 2001, 50-70% of the burden of diarrhoeal diseases, measles,

malaria and lower respiratory infections was attributable to malnutrition (11).
Complementary Feeding Family foods for breastfed children (WHO, 2000) (12) is a practical guide for introducing complementary foods to breastfed children aged 6 to 24 months. It emphasizes preparation of foods based on the local staples that are clean, safe, and nutritionally adequate for healthy growth and development. The messages in this guide are clear and simple and suitable for health workers to use in communities.

According to the "Codex Alimentarius: Food safety - The basic texts 2003" and "Five keys to safer food manual, WHO 2006", "food hygiene is all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food-chain" and "food safety is all measures to ensure that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use". In this report, we use the term "food safety".

2. Situation in Vietnam

Safe water

In Vietnam, access to safe water is still a high priority public health issue. The Vietnamese government has been operating the Rural Water Supply and Sanitation (RWSS) program since 1982 with funding from UNICEF. The program has constructed over one hundred thousand wells with hand pumps and latrines. At the same time, local people have also constructed two or three times this number of RWSS facilities (13, 14). The Ministry of Construction and the Ministry of Agriculture and Rural Development prepared the Vietnam National Rural Water Supply and Sanitary Strategy which commenced in 2000 and runs up to 2020. The strategy states that 1) all rural people should have access to clean water meeting national quality standards in amounts of at least 60 liters/capita/day and also have access to approved hygienic latrines through the active promotion of community participation and a demand responsive approach, and 2) universal good personal hygiene practice among rural people and good environmental sanitation in communes and villages should be promoted through focused IEC (information, education and communication). As the government began to give priority to rural water supplies and sanitation development, Vietnam has made rapid progress in improving its water supply and sanitation (13).
The Ministry of Health in Vietnam set up the Drinking Water Hygiene Standard in accordance with WHO Guidelines for drinking-water quality (2002). However in terms of water quality, only about 30% of households have water supply systems that meet their relative basic domestic quality requirements, and among these only 10% (3% of rural households in Vietnam) are supplied with water that meets national standards for drinking water (13). In 2005, Ministry of Health of Vietnam established the Clean Water Standards which apply to water for people's daily activities and not to drinking water.

Comparison of Drinking Water Hygienic Standards and Clean Water Standard in Vietnam

	Drinking Water Hygienic Standards, MoH, 2002*	Clean Water Standards, MoH, 2005
Water supply system supplying for	Over 500 people (about 100HHs)	Less than 500 people (about 100HHs)
Application	Drinking & Cooking	Washing & Bathing
No. of Parameters	112 parameters	22 parameters
Parameters in concern in Project SWAN		
Turbidity	2 NTU	5 NTU
Ammoniac (NH4+)	1.5 mg /L	3.0 mg /L
Iron	0.5 mg /L	0.5 mg /L
Arsenic	0.01 mg/L	0.05 mg /L
Chlorine residue	0 / 100ml	50 / 100ml
E-coli or thermotolerant coliform	0 / 100ml	0 / 100ml

**The selection of indicators and the criteria for the Vietnamese standards are basically the same as WHO standards. The difference is only turbidity. While the criteria of WHO is 5NTU, the Vietnamese standard is 2 NTU.*

Food safety situation

According to the Food Administration of Ministry of Health, Vietnam, there were 248 cases of food poisoning affecting 7,329 people and 55 deaths in 2007 (15). The microbiological contamination in food remains a major cause of food poisoning in Vietnam (72.8% of food poisonings are from microbiological contamination in food) (16). Most of these cases occurred in the kitchen of canteens and households. In Vietnam, food poisoning is related with personal hygiene, inadequate cooking, cross-contamination, keeping food at room temperatures for long periods time and foods from unsafe sources. The National Plans of Action for Nutrition from 2010 to 2020 focuses on reducing diarrhoeal diseases through public education about food and water hygiene (17).

Nutrition situation

Over the past two decades, Vietnam has made remarkable progress in reducing child undernutrition. The prevalence of underweight has fallen from 51.5% in 1985 to 24.6% in 2006 and the prevalence of stunting has also substantially decreased from 59.7% in 1985 to 27.9% in 2006 (18). However, the current prevalence of child malnutrition, in terms of both underweight and stunting in Vietnam remains high based on the classifications of the World Health Organization (19).

An important risk factor underlying malnutrition is the availability and use of safe water and sanitation, and personal hygiene. Recent studies in Vietnam have indicated that water and sanitation are key factors influencing child stunting (18). There are also strong correlations between malnutrition and limited mothers' knowledge about selecting and processing food and feeding patterns (20, 21).
One of the strategies in the "Implementation plan of Child Malnutrition Control Program 2006-2010" is 1) to disseminate menus and to guidance for the use of menus to children in day-care centers and kindergartens and 2) to improve hygienic practices at the household level, personal hygiene, environmental hygiene and food safety.

3. Preliminary Investigations during 2001-2004

1) Monitoring of quality of drinking water at selected sites

Prior to this study, we monitored water quality for one year to determine the quality of drinking water by identifying contaminants which pose health-risks and seasonal changes in selected drinking water sources in the Red River Delta Region (22). We found ammonium, arsenic and iron contaminants in several ground water samples, and total coliforms, E.coli, Cl.perfringens in most of the surface water and ground water samples. The levels of contamination were higher than the Vietnamese Drinking Water Hygiene Standard (MOH 2002). Although all the selected water treatment facilities had aeration and sand filtration systems, in some cases the chemical contamination was reduced by water treatment facilities (WTF) while others did not show any effect following the treatment. We did not find pesticide residues or heavy metals contamination in the selected water sources (22).

2) Focus Group Discussions

The community-needs survey also showed that sometimes WTFs were not properly operated and that inhabitants were concerned about the water quality resulting from WTFs (23). Due to a lack of communication materials, information about clean water, food safety and nutrition were not properly distributed. However we confirmed that inhabitants and Commune People's Committees had strong willingnesses to participate in the activities.

III. FRAME WORK OF PROJECT SWAN

1. Objective

Project SWAN aims to establish sustainable water supplies and health communication models in rural and suburban areas through a participatory approach with inhabitants by
1) enhancing the knowledge of drinking water, food safety and nutrition at the household level,
2) optimizing the operation of water treatment facilities and supplies of safe water, and
3) establishing effective management systems to enable the sustainability of community based participatory approaches.

It was expected that the models could be applied and expanded to other rural and suburban areas in Vietnam.

What needs to be done in order to secure safe water in rural areas where there will be no public water works available in the foreseeable future?

To establish a sustainable water supplies and health communication model in rural areas through a participatory approach with inhabitants

- enhancing the knowledge of drinking water, food safety and nutrition at the household level
- optimizing the operation of water treatment facilities and supplies of safe water
- establishing effective management systems to enable the sustainability of community based participatory approaches

2. Project sites

Selection criteria of Project sites

- Existing water treatment facility supplies water for more than 500 households
- Chemical and microbiological contaminations are observed by previous investigations
- Concern on limitation of safe drinking water and of food safety information
- Willingness to participate in the activities

We selected 2 villages and 1 commune in the Red River Delta Region of Vietnam. As a control, we conducted situation analyses in the neighboring villages and communes to select control sites where the situation is similar to the project sites.

	Project sites	Control sites
Model 1	Huynh Cung Village, Tam Hiep Commune, Hanoi	
Model 2	Ngang Village, Dai Mo Commune, Hanoi	Ngoc Truc Village, Dai Mo Commune, Hanoi
Model 3	Quang Trung Commune, Nam Dinh Province	Trung Thanh Commune, Nam Dinh Province

3. Process

The project was composed from two programs;

- IEC (Information, Education and Communication) Program working for sharing information with inhabitants to improve water management in households, food safety and nutrition practices.
- Technical program working for improving water quality at water treatment facilities (WTFs) through renovation and for providing technical training for the operation of WTFs.

We expected to generate a synergistic effect by combining both IEC and water supply technical activities to improve safe water supplies and health communication systems through the participation of inhabitants in communities.

IV. ACTIVITY OF PROJECT SWAN

1. IEC program

1) IEC activity

We used the following approaches which are commonly used in the health promotion field to collect quantitative and qualitative data from communities.

1) Team formation and objective sharing
   - Discussions with local people to form teams
   - Explanations to make sure local people were clear about the objectives
2) Focus Group Discussion (FGD) to identify gaps, problems, solutions and priorities
   - FGD with WMU members and village health workers regarding drinking water, food safety and nutrition
   - FGD with 10~12 mothers having children under 5 years old regarding child care practices
   - Visits to households to investigate the actual situation
3) Baseline survey to investigate drinking water, food safety and nutrition situation
   - Based on the FGD, we developed the KAP (Knowledge, Attitude and Practice) questionnaire
   - Administration of a baseline survey and collection of quantitative data from inhabitants
4) Development of IEC activities based on the baseline results
5) Implementation of activities
6) Evaluation of activities

In the first half of the project, the IEC program aimed to increase the awareness and knowledge of inhabitants about the water treatment process, clean water, water management by the Water Management Union (WMU), food safety and nutrition in the context of a participatory approach. We conducted five FGDs in each project site with WMU, health staff members, village health workers and the inhabitants to identify gaps, problems, solutions, and priorities were determined based on an importance and changeability matrix.

Topics covered in IEC program

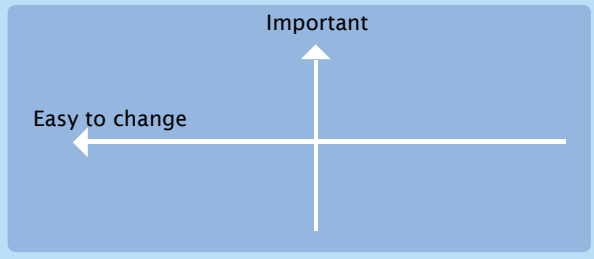
- Introduction of Project SWAN
- Treatment process and water quality situation
- Food safety & Child care during diarrhea
- The role of WMU & inhabitants for controlling water loss
- Clean water and hygiene environment
- Nutritional guideline for young children

Four series of workshops were organized to communicate directly with the inhabitants. Four newsletters were developed by describing related educational information and summarizing the current activities in the village. We distributed the newsletters to all the households. Also WMU organized a drawing contest for school children and a poem contest for adults in order to increase the awareness of related topics.

In the second half of the project, the program aimed to promote self-reliance in the community. We developed 4 flip charts composed of 6 pages (picture-story style) for explaining the "Water Treatment Process", "Food Safety and Care for Children with Diarrhea", "Clean Water and Environmental Hygiene" and "Nutrition Practice for Young Children". We intended the flip charts to be a practical guides for village health workers and WMU members. We conducted training of instructors to improve the communication skills of WMU members and village health workers as to how to use flip charts to provide educational information to inhabitants. During the training, participants experienced the examination of household drinking water using test kits and participated in role-play using flip charts. After that, a system we developed for WMU and village health workers to visit households to provide relative educational information was implemented. During village gatherings, WMU used the flip charts to communicate with inhabitants. A village health worker wrote articles and broadcasted using loudspeakers to all households. A bulletin board was installed to post leaflets and newsletters. Drawings and poems were also posted on the bulletin board and in the village cultural center. We assigned one person of the village to report all the activities through monthly monitoring.

How did we organize Focus Group Discussion?

We applied the importance and changeability participatory approach. Participants are requested to write their ideas regarding problems of water management. Among many problems, we categorized similar ideas. Each participant had 5 points to vote to the topic in which they think it is important and another 5 points to vote to the topic in which they think it is easy to change. Based on the importance and changeability matrix, participants narrowed down their priority which should be addressed in the village. We further discussed the details of the prioritized problem. Along with the problems, we identified its solutions and their assets to expedite the solutions. One moderator facilitated the focus group discussion and two recorders documented the conversation. Then one moderator and two recorders developed the transcript and confirmed the content.



Identified problems and strength related IEC activity

Problems	Strength
- Lack of communication materials about clean water and food safety - No chance to attend the training course - Knowledge gap between village health workers and mothers	- 15 loud speakers, Poem Club, Young mothers club, WU, CD player at CHS, TVs at HHs - Willingness to attend a workshop / training

2) Study design

Data collection

This study was carried out in the context of a repeated cross-sectional study (Model 1) and intervention study (Model 2, 3) to examine the effectiveness of the program.

Sample size was calculated based on a table which compares the difference in two groups (ratio; 1:1) with a confidence interval of 95% and a power of 80%. After the completion of the program, we expected a 15% difference in the participants' KAP toward clean water and food safety. We estimated the percentage in group I to be 60% and the percentage in group II to be 75%. The number per group minimum was 165 persons/group. Considering a drop out ratio of 30%, we decided to target all the households who have children from 6.00 months to 59.99 months in the village/ commune as this age group is considered to be most vulnerable to inadequate drinking water conditions.

To ensure all targeted households would participate in this survey, we used the list of children under five in the commune health station as this list is used for a Protein Energy Malnutrition monitoring program conducted by National Institute of Nutrition, Vietnam.

Prior to the survey, we distributed written informed consent to all the households through village health workers and collected the data on the day of each survey.

The interviewers were trained on proper use of the questionnaire to ensure accurate completion and data collection. The trainer explained details of each question.

The questionnaires used in the survey were modified from a similar survey carried out by the Ministry of Health, Vietnam and guidelines set by WHO and UNICEF (24). The questionnaire contained inhabitants KAP for clean water, food safety and nutrition. We also confirmed the appropriateness of each question to the local settings with staff members of the commune health station, village health workers, the leader of the village and the leader of the commune. The information gathered from two group discussions with local people was also reflected in the questionnaire. After developing a questionnaire in English, one Vietnamese staff member translated it into Vietnamese. Then another Vietnamese staff member translated the document back to English to confirm the meaning. We conducted a pre-test in another village to confirm the validity of questionnaire.

The study protocol was approved by the Institutional Review Board of the University of Tokyo, Japan and the scientific committee of the National Institute of Nutrition, Vietnam.

Data analysis

Data collected in the field survey were input into EPI-info 2000 after collection, and were then transferred to SPSS. All statistical analyses were performed on a personal computer with the statistical package SPSS for Windows (Version 13.0 SPSS, Chicago).

At first, we described the proportion of variables at baseline and evaluation in each group. Then chi-square tests were performed to assess the difference between groups at baseline and evaluation as well as the differences within each group at baseline and evaluation. The participants for whom relevant data were missing were excluded from the analyses. A P value of < 0.05 was considered to indicate statistical significance and all tests were two-tailed.

Secondly, we performed a bivariate analysis to examine the relationships between the food safety practices of mothers and the childhood diarrhea prevalence as well as IEC effects. We reported the odds ratio (OR) of children's diarrhoea with a 95% confidence interval (CI).

2. Technical program

1) History and current situation

In line with the Rural Water Supply and Sanitation (RWSS) program, the Ministry of Agriculture and Rural Development (MARD) constructed Huynh Cung Water Treatment Facility (WTF) in 1996, Ngang WTF in 1996 with the budget from Tu Liem District People's Committee and Quang Trung WTF in 2002 with support from International NGOs. After construction, managerial responsibilities for the WTF including water distribution systems were given to individual commune and/or village. Village leaders and operators are entrusted with the management of WTF, however if there are any important decisions, the village organizes a meeting to obtain a consensus from the inhabitants and sends the proposal to the Commune People's Committee (CPC) for approval.
Nevertheless, years of operation and limited maintenance degraded the performance of the WTF. Most of the recent development aid has gone to areas classified as urban or rural areas, and the target village was categorized as suburban and thus fell between urban and rural (25). The management of water supply system including financial aspects was not functioning well.

2) Technical activity

We have improved the treated water quality by providing some modification work for the existing community-based WTFs which supply water to more than 500 households. The individual modification works implemented at the three models varied by the type of problems and WTF. However, the approach process for finding problems and the solution process were the same.
For instance;

1) Identification of the actual WTF problems in detail (water quality, operation and maintenance status, operators' skills and reporting system, etc).
2) Design the modification program and implement the modification work in cooperation with experts. Basically, the modification work was implemented under direct participation of inhabitants and the WMU in each area.
3) Development of a "Operation and Maintenance Manual" for each WTF in project site which covers operation and maintenance instructions in detail. We also developed "Guidelines for the Water Management Union" and "WMU Detailed Activities".
4) Implementation of training programs utilizing the above manuals and guidelines. The training and education programs were conducted during a several day long school session and/or several hours of OJT (On the Job Training) at the WTF.
5) Periodic and frequent visits to WTF sites to monitor their operational procedures/data recording systems, and to explain the purpose/meaning of the activities.
6) Educate about the detection methods for water leakage/water loss in the pipeline system and countermeasures.

3) Renovation works implemented at WTF in Huynh Cung Village, Tam Hiep Commune (Model 1)

1. **The well pump** was replaced with a high capacity well pump to increase water volume from the well.
2. Aeration capability was increased by **installing additional showering towers with new nozzles** for maximizing oxidization effects.
3. A **PAC dosing system** was installed to improve the coagulation process for reducing arsenic and iron content in treated water. Structure of WTF inside was alternated to increase the coagulation effects.
4. **Sand and gravel in the Sand Filter** was completely replaced.
5. **Electric control panel** was replaced for more efficiently controlling new well pump, the existing distribution pump, new backwash pump and PAC dosing pump.
6. **Most all valves and pipelines** in coagulation zone, sand filters and storage reservoirs in WTF were replaced to promote easy-operation and easy –maintenance.
7. **Two units of new flow-meters** were installed on raw water pipeline and treated water distribution line for checking the water volume.
8. **A chlorine dosing system** was installed to chlorinate treated water.
9. **100m^3 of additional treated water reservoir** was constructed by the communes themselves in order to increase treated water distribution capacity.

4) Renovation works implemented at WTF in Ngang Village, Dai Mo Commune (Model 2)

1. **The well pump** was replaced with a new high capacity well pump to increase water volume (from 16 m^3/hr to 22 m^3/hr).
2. The aeration capability was improved by replacing **shower nozzles** on showering towers for maximizing the oxidization effects.
3. **New sand filters with settling zone** were constructed by the communes themselves under technical and financial support from Project SWAN to increase filtering capability of WTF.
4. **Sand and gravel in the sand filter** was completely replaced.
5. **A chlorine dosing pump** was installed to chlorinate treated water.
6. **The electric control panel** was replaced to efficiently control the new well pump, the existing distribution pump, backwash pump and new chlorine dosing pump.
7. **Most valves and pipelines** in the coagulation zone, the sand filter and storage reservoirs in WTF were replaced to promote easy-operation and maintenance.
8. **One unit of new flow-meter for treated water** for checking the water volume was replaced.
9. **100m^3 of additional treated water reservoir** was constructed by communes themselves with the technical advice from SWAN project in order to increase treated water distribution capacity.

5) Renovation works implemented at WTF in Quang Trung Commune, Nam Dinh Province (Model 3)

1. **A small dam** was newly constructed at the water intake channel located between the first raw water reservoir and river as water source. The purpose of dam is to keep a stable water volume in the first raw water reservoir (settling zone) regardless of the season.
2. **A raw water pump** was installed for keeping a certain amount of water in the first raw water reservoir even in the dry season.
3. **The PAC dosing system** was replaced in order to keep a precise PAC dosing volume which is very important for obtaining the optimum coagulation conditions in the WTF. The PAC dosing volume often has to control in line with raw water quality of the river.
4. **The chlorine dosing system** was replaced in order to keep a precise volume of chlorine solution to disinfect the treated water.
5. **Two units of flow-meter** were installed to the pipelines between the sand filter process and treated water reservoir. The function of the flow-meters is to monitor water volume for determining PAC/chlorine dosing volume and for checking treated water volume distributed from the WTF.

6) Technical trainings

We carried out technical trainings by using the "Operation and Maintenance Manual" for WTF, "Guidelines for the Water Management Union" and "WMU Detailed Activities".

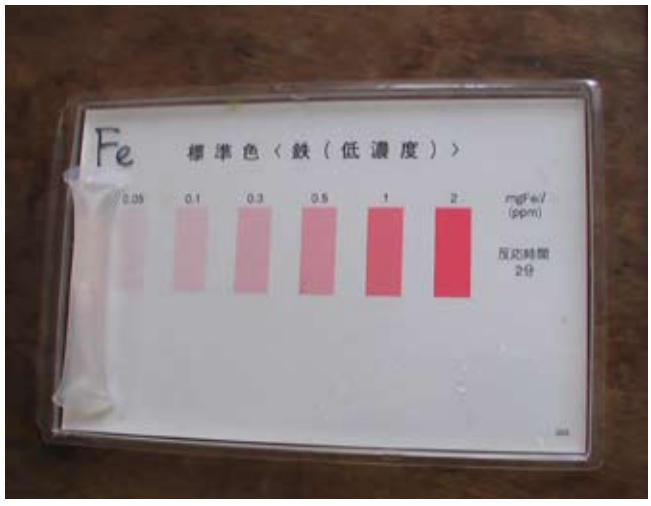
- **Model 1**: We organized three-day technical training courses for the WMU and representatives of the inhabitants in order to educate them about the basic WTF process, principals, WTF operational methods, WTF maintenance methods, water quality monitoring methods and data recording procedures. We also instructed them about measures to prevent water loss and the financial management system for water fees.

- **Model 2:** In addition to the above, the WMU in Dai Mo requested that they need more detailed explanations about the maintenance and troubleshooting procedures at WTF. We held a technical training course at the WTF site by inviting professional lecturers from Hanoi P-CERWASS. By doing this, the WMU felt more self-confident about performing their duties.

- **Model 3:** Along with the technical training as Model 1, project team held a special training course by inviting professional lecturers from Nam Dinh P-CERWASS to explain the water treatment process at WTF in Quang Trung. Attendees of the special training course were health staffs, village health workers, leaders of CPC and subgroups, WMU, operators, kindergarten, primary and secondary school teachers, etc. By conducting the special training course, we could increase the knowledge of WMU workers and operators, and also establish a dual supervision structure consisting of the WMU and the actual water consumers. We shared operational manuals to the all attendees.

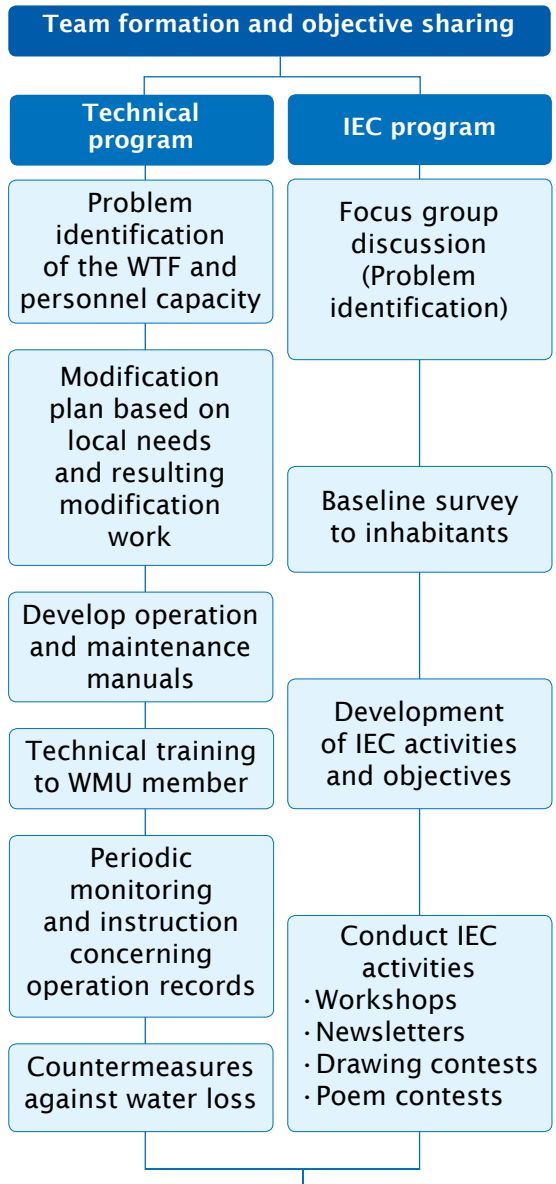
7) Countermeasure against water loss

Technical advice and countermeasures were provided to WMU for controlling water loss. High level of nonrevenue water, which is the difference in the amount of water supplied from the WTF and the amount of water billed to customers in the village, had been the norm. The experiences in India indicated that about one third of nonrevenue water results from water leaks or from water not being invoiced to customers. This seriously affects the financial viability of the water providers (26). In project sites, high nonrevenue water was a serious problem for the financial management system in the WMU. The cause of water loss appeared to be water leaks in the pipeline network, malfunctioning of old flow-meters in households and water thief. During the project, the rate of water loss gradually diminished by increasing the WMU personnel (Model 1) who monitor the distribution network and by sound collection of water fees. A penalty against stealing water also proved to be a useful countermeasure. The replacement of pipeline network part-by-part and checking the accuracy of the flow-meters also contributed to the prevention of water loss. Through these efforts, the revenue of WMU increased. Improvement of the institutional, organizational and regulatory arrangements leading to increased accountability proved to be important factors for sustainable water management.



Technical and IEC program

<First year>
Increased awareness and knowledge of inhabitants

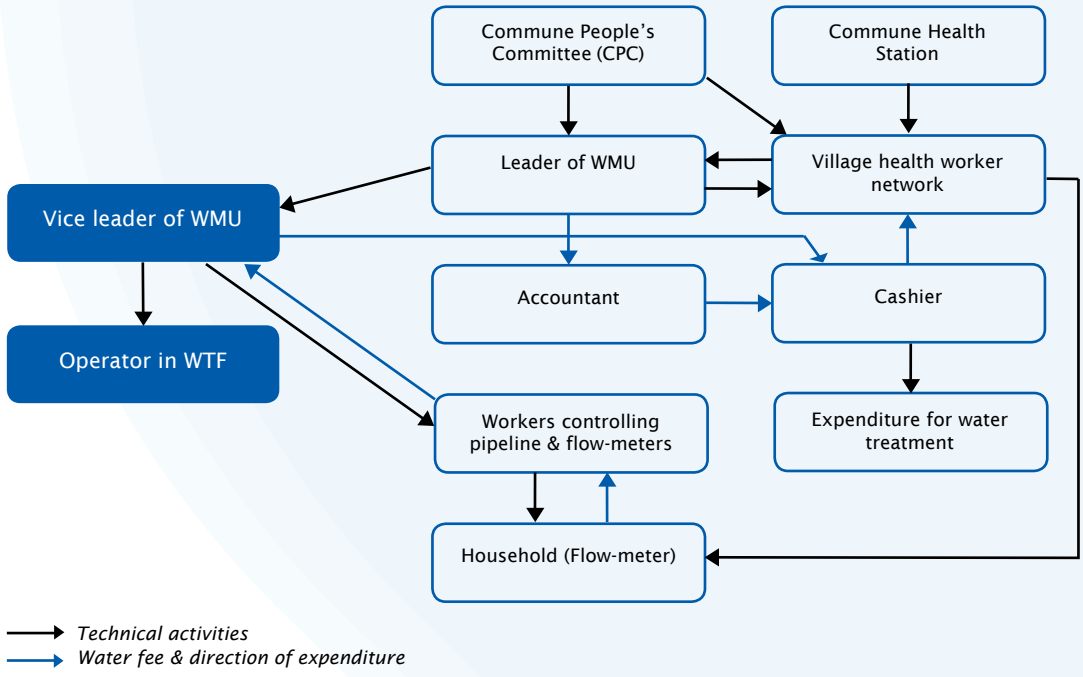


<Second year>
Induction of self-reliant efforts of the community

3. Water management system for sustainability

We implemented a community based participatory approach. The CPC and Commune Health Station (CHS) coordinated the program, and the village WMU played the main role with technical assistance from the project. WMU members varied depending on the villages and communes. However the basic members of WMU in village (Model 1, 2) were the village leader, sub-group leaders, operators, the first secretaries of the communist party of the village, the leader of the health station and village health workers (1 sub-group leader serves concurrently as a village health worker and 1 village health worker serves concurrently in the Women's Union). In communes (Model 3), WMU focused on water supplies and village health workers focused on communication activities, respectively.

1) Basic organization of WMU in village/commune



2) Flow of water fee

- How was the water fee calculated?: The water fee was calculated base on financial balance of maintaining the WTF's operation. It was accepted by residents and approved by the CPC.
- Who pays the water fee?: Water fees were collected from households based on the volume of consumed water indicated by the readings on flow meters in HHs.
- Who collects the water fees from HHs?: Depending on each management model, it is either the responsibility of Vice-leaders of villages or operators. After that they send the amount to the person in finance (accountant or cashier).
- How are water fees spent?: Operators and workers request repair and the replacement of equipment including chemicals for water treatment to the vice-leader of WMU. He then reports and submits it to the leader of the WMU. All expenditures for the water management system are implemented when it has been approved by leader of the WMU.
- What expenditures are supported by the water fee?:
  - Labor fee
  - Electricity fee
  - Chemical and filtration materials for water treatment: chlorine, PAC, sand, etc
  - Management fees
  - Expenditure for repairing and replacing wrong spare parts of equipment or broken pipe lines
  - Maintenance fees
  - A portion of the communication fee (ex. personal cost of implementing IEC activities)

3) What is the Water Management Union?

WMU is recognized as the people who operate the WTF (Operator), collect water fees and repair the pipeline network and/or flow-meters. Model 1 and 2 included village health workers in the WMU. The structure and management style depends on the village or commune (CPC).

Ngang village in Model 2 and Trung Thanh commune in Model 3 are the good system to keep up the motivation of the operators.

	Model 1	Model 2	Model 3	
Indicator	**Huynh Cung Village**	**Ngang Village**	**Quang Trung Commune**	**Trung Thanh Commune**
Management	Tam Hiep CPC assigned village leader to manage WTF.	Dai Mo CPC assigned village leader to manage WTF.	Managed by commune cooperative.	Managed by Trung Thanh CPC.
Water fee management	Collected water fees go to the village accountant.	50% of the collected water fees go to the accountant of the village. The remaining fees are used to pay for electricity.	Water fees go to the accountant of the cooperative.	Water fees go to the accountant of WMU/ CPC.
Water fee utilization	Revenues are shared and used for any kind of activity in the village (not only for WTF operation).	Revenues are separated from other activities of the village. Revenues are used only for WTF operation (repair, purchase of chlorine, communications of village health workers).	Revenues are shared and used for any kind of activity in the commune (not only for WTF operation). The cooperative can use budget collected from other activities for WTF activities.	Revenues are separated from other activities of the village. Revenues are used only for WTF operation (repair, purchase of chlorine, communication by village health workers).
Water fee collection	Previously operators collected water fees, now sub-group leaders collect water fees and send them to the village accountant.	Operator collects water fees.	Accountant of cooperative collects water fees.	CPC assigned people in each sub-group to collect water fees and to make repairs. They are paid from water fee revenues. Their salary is linked to on the percentage of water loss.
Operator's salary	Operator has fixed salary.	Operator takes remaining amount after WTF operation, maintenance and electricity. If water loss is reduced, his salary increases.	Operator has fixed salary.	Operator has fixed salary, but if water loss is reduced, his salary increases.
Source of budget for IEC activity	The budget is allocated from the total revenue of the village. CPC agreed to support IEC activity from CPC's budget. CPC has a budget from IEC for health promotion, however it depends on the priorities of CPC.	The budget is allocated from the collected water fee. CPC also agreed to support IEC activity from CPC's budget. CPC has a budget from IEC for health promotion, however it depends on the priorities of CPC.	CPC has a budget from IEC for health promotion, however it depends on the priorities of CPC.	CPC has a budget from IEC for health promotion, however it depends on the priorities of CPC.

Identified problems and strengths of WMU at baseline

Problems	Strengths
• Lack of manpower for WMU (3 people are in charge: 2 operators & 1 head of village) • Lack of knowledge by WMU members of the standard operation process of WTF • Difficulties in controlling water loss caused by pipeline leakage and inaccurate flow-meter • Weak management structure (no enforcement of regulations)	• Strong network among: CPC - village - operator • Accounting system is open (accountant, cashier, consumption of water, salary for operator)

Solutions and Improvements

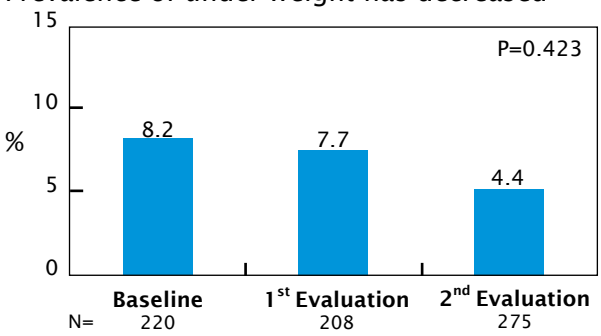
Problems Before	Action Taken
Lack of manpower for WMU (3 people in charge: 2 operators & 1 head of village)	Increased the manpower (Added 3 sub-group leaders; total 6 persons) • The sub-group leader started monitoring leakages from the pipeline and collecting water fees from households in each sub-group
Lack of knowledge by WMU members of the standard operation process of the WTF	Knowledge disseminated through courses to train of local instructors (training of trainers) • Operators recorded the operation of WTF and distribution of water to monitor the proper operation
Difficulties in controlling water loss caused by pipeline leakage and inaccurate flow-meters	• Early detection of pipeline leakages by sub-group leaders and prompt repair • Sub-group leaders visited households to check the accuracy of flow-meters
Weak management structure (no enforcement of penalties for water theft)	Developed and applied penalties for water theft

V. RESULTS

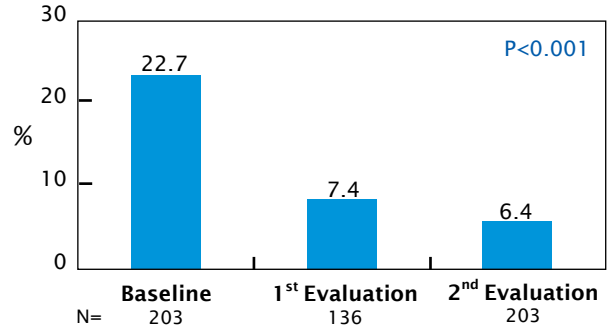
1. IEC activity

1) Health status of the children (Model 1)

Prevalence of under weight has decreased

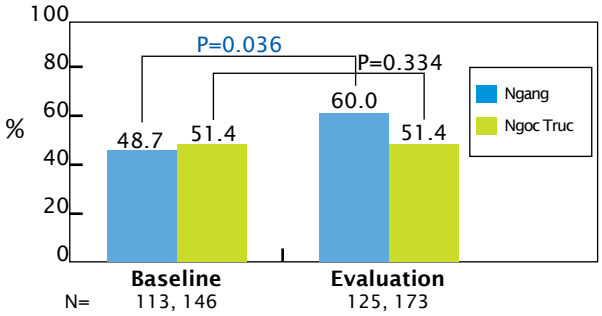


Incidence of childhood diarrhea has decreased

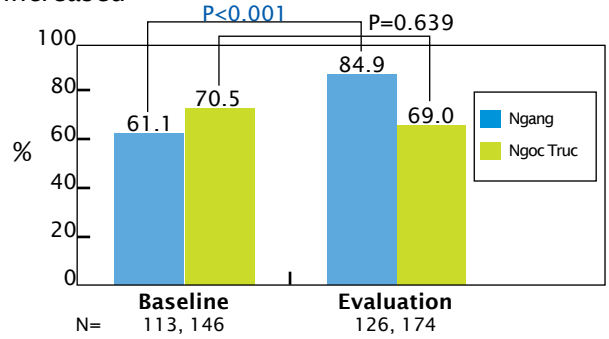


2) Changes in Five Keys to Safer Food (Model 2)

Percentage of mothers who always separate utensils and cutting-boards when preparing raw and cooked food has increased



Percentage of mothers who always wash vegetables and fruit with safe water has increased



3) Association between childhood diarrhea and the Five keys to Safer Food at baseline (Model 2)

Use of separate utensils and cutting-boards when preparing raw and cooked food

The diarrhea risk was about 4 times higher in the children whose mothers did not separate utensils and cutting-boards for raw and cooked food compared with the children whose mothers did separate the utensils.

		% Diarrhea	OR	(95%CI)	P
Ngang	Always	7.3	1	(1.244-3.230)	0.020
	Not always	24.1	4.057		Fisher's Exact Test
Ngoc Truc	Always	10.3	1	(0.682-4.645)	0.235
	Not always	16.9	1.78		Pearson Chi-Square

Wash fruit and vegetables with safe water before eating them

The diarrhea risk was about 3 times higher in the children whose mothers did not wash fruit and vegetables with safe water before eating them compared to the children whose mothers did wash fruit and vegetables with safe water.

		% Diarrhea	OR	(95%CI)	P
Ngang	Always	10.1	1	(1.046-8.3332)	0.035
	Not always	25.0	2.952		Pearson Chi-Square
Ngoc Truc	Always	11.5	1	(0.627-4.384)	0.305
	Not always	17.8	1.658		Pearson Chi-Square

4) IEC effects on the behavioral change of Five Keys to Safer Food (Model 2)

- "Hand washing of mothers before letting children eat" was significantly associated with receiving information through workshops, newsletters, loud-speakers and flip charts*.
- Flip chart communication was most effective to change food safety practices in this study.

Associations of mothers' food safety practices and IEC activities at the 2nd Evaluation

P value

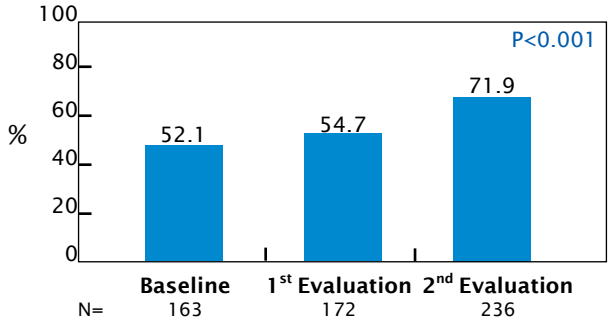
	Workshops	Newsletters	Loud-speaker	Flip charts
Hand washing of mothers before feeding children	0.017	0.049	0.014	0.037
Washing fruits and vegetables with safe water before eating them	0.375	0.792	0.666	0.000
Reheating cooked foods to a proper temperature before eating	0.047	0.042	0.265	0.038
Checking and throwing away food when it is beyond its expiry date	0.095	0.244	0.280	0.000

** Bulletin board was not installed in Ngang Village, Dai Mo Commune.*

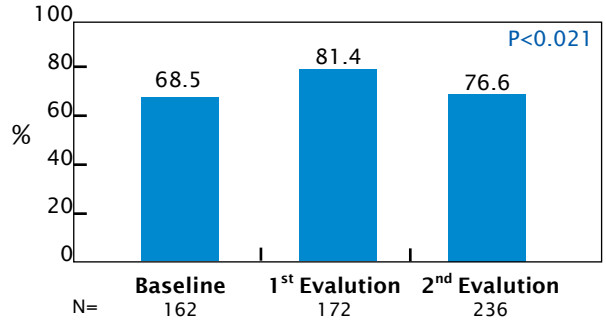
** Drawing and poem contest were not mentioned in the questionnaire as information resources.*

5) *Changes in attitudes toward clean water and water management (Model 1)*

Acceptance of chlorine smell has increased



Satisfaction with the current activities of WMU has increased



6) *IEC effects on attitudes toward clean water and water management (Model 1)*

- "Use of separate utensils" was significantly associated with reading newsletters, seeing information on bulletin boards, seeing drawings and poems.
- "Acceptance of chlorine smell" was significantly associated with attending workshops, reading newsletters, listening to information from loudspeakers, flip chart communication by collaborators and seeing drawings.
- "Satisfaction with the Water Management Union" was significantly associated with listening to information from loudspeakers, flip charts communication by WMU members and seeing information in bulletin boards.

Associations of Participants' Attitudes and IEC activities at 2nd Evaluation

P value

	Work-shops	News-leters	Loud-speaker	Flip charts	Bulletin boards	Drawings	Poems
Use of separate utensils	0.499	0.033	0.441	0.336	0.020	0.014	0.010
Acceptance of chlorine smell	0.043	0.006	0.002	0.006	0.159	0.000	0.087
Satisfaction with WMU	0.174	0.118	0.022	0.016	0.039	0.629	0.309

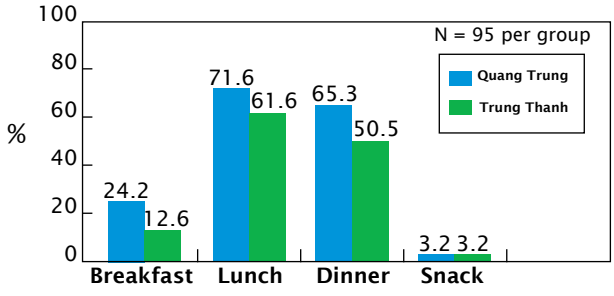
7) *Improvements on complementary feeding practices (Model 3)*

We developed a flip chart (nutritional guideline for young children) describing the proper amount of ingredients per meal for different age groups and for a variety of ingredients. We also organized cooking demonstrations for mothers. Through nutritional education;

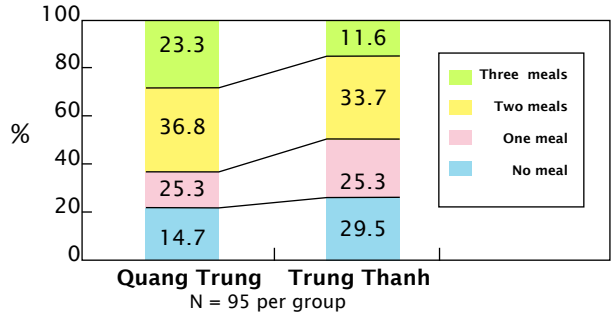
- The knowledge of mothers about combining the 4 food groups* in each meal improved in Quang Trung (intervention group).

  ** : Grain, Animal products, Vegetables & Fruits, Oil/Fat*
- More mothers combine the 4 food groups in multiple meals in Quang Trung (intervention group).

Percentage of mothers who select 4 food groups in each meal



Propotion of mothers by number of meals with 4 food groups



2. Technical activity

1) Huynh Cung Village, Tam Hiep Commune (Model 1)

Before modification

Treated water containing high arsenic (0.005-0.01ppm), high iron (0.6ppm) and ammonium (5-7ppm) derived from well water. Microbes such as coliform were often detected. The WTF capacity was lower than water demand.

After modification

All quality parameters in treated water improved enough to meet local government requirements and the treated water volume supplied increased markedly (1.9 folds).

Comparison of major quality parameters at WTF			Before modification Feb 27, 2006		After modification Mar 21, 2006	
Parameter	Unit	Standard*1	Untreated Water	Treated water	Untreated Water	Treated water
Color	Coban	---*2	115.92	0	119.34	0
Turbidity*3	NTU	2	---	4.55	28.9	0.24
Ammonium	mg/l	1.5	7.7	7.56	7.98	0.224
Iron	mg/l	0.5	6.26	0.64	6.65	<0.01
Arsenic	mg/l	0.01	0.005	0.005	0.01	0.005
Total coliform bacteria	MPN/100ml	0	1700	0	0	0
E.Coli	MPN/100ml	0	0	0	0	0
Chlorine residue*3	mg/l	0.3-0.5	0	0	0	0.3

The water samples were analyzed in the laboratory of the Center of Water and Environment, Hanoi, Vietnam.
*1: Drinking Water Hygiene Standard (Ministry of Health, Vietnam, 2002).
*2: Coban colorimetric methods were applied.
*3: Results from field test.

WTF operation and distribution

Several key figures which show the operational status was much improved between before and after renovation.

- At the WTF, daily operation time (18-20 hrs/day) and distribution pump running time (4.5 hrs/day) was not that different before and after, but the volume of treated water distributed from WTF was remarkably increased 100% (from 267m³/day to 506m³/day).
- The financial condition was improved dramatically even though the cost of treated water did not changed, i.e. even if all operational costs were deleted, the surplus revenue was 10 fold that of before (from 2.2 million VND to 23.2 million VND).
- The number of HHs who receive treated water from WTF also remarkably increased 40% (from 638 HHs to 890 HHs).
- Water loss rate was decreased from 54% to 47%.

	Feb 2006 Before modification	Jun 2007 1st evaluation	Aug 2008 2nd evaluation
WTF Operation			
Operation time of WTF (h/day)	20	18	18
Distribution time from WTF (h/day)	4.5	4.5	4.5
Flow-meter to control water volume	None	Yes	Yes
Water volume distributed from WTF (m³/day)	267 (Estimated)	377	506
Chlorine dosing	None	Yes	Yes
Operational procedure	experience	did not follow instructions exactly	followed instructions
Recording operation data	none	recorded with error	recorded correctly
Water Distribution			
Total No. of HHs in the village	979	993	1,183
No. of HHs which received treated water*1	638	721	890
No. of flow-meters in the village*1	586	627	685
Water volume (L/capita/ day)*2,3	32	52	55
Cost of treated water	2,500VND/m3	2,500VND/m3	2,500VND/m3
Rate of water loss (%)	54.1	48.8	46.9
Penalty against water theft	none	under discussion	enforced
Financial Situation (per 3 months)			
Revenue (VND)	21,197,500	37,052,500	55,130,000
Spending (VND)	18,958,700	29,043,000	31,889,400
Remaining (VND)	2,238,800	8,009,500	23,240,600

*1: The No. of flow-meter is larger than the No. of flow-meters in the village because several relatives live next door with a common garden in the same square, they share one flow-meter and a water reservoir for several HHs.
*2: Water loss was accounted for in the calculation.
*3: 4.87 people/HH are applied based on the results of the survey in this study.

2) Ngang Village, Dai Mo Commune (Model 2)

Before modification

Microbes such as coliform bacteria were detected in raw well water and treated water. The WTF capacity was lower than their water demand.

After modification

All quality parameters for treated water improved so that they meet local government requirements and the supply of treated water volume increased (1.2 folds).

Comparison of major quality parameters at WTF			Before modification Oct 31, 2006		After modification May 16, 2007	
Parameter	Unit	Standard*1	Untreated Water	Treated water	Untreated Water	Treated water
Ammonium	mg/l	1.5	7.44	4.92	6.00	4.50
Iron	mg/l	0.5	14.55	0.12	13.45	0.13
Arsenic	mg/l	0.01	0.0030	0.0017	0.0022	0.0018
Total coliform bacteria	MPN/100ml	0	43	<3	<3	<3
E.Coli	MPN/100ml	0	<3	<3	<3	<3
Chlorine residue*2	mg/l	0.3-0.5	0	0	0	0.5

The water samples were analyzed in the laboratory of the National Institute of Nutrition, Hanoi, Vietnam.
*1: Drinking Water Hygiene Standard (Ministry of Health, Vietnam, 2002).
*2: Coban colorimetric methods were applied.

WTF operation and distribution

Several key figures which show the operational status was much improved following renovation.

- At the WTF, the treated water volume distributed from WTF increased by 20% (from 270m^3/day to 320m^3/day).
- The number of HHs who received treated water from WTF increased by 32% (from 409 HHs to 541 HHs).
- Water loss rate improved from 35% to 21%.
- The surplus revenue for the WMU improved 39% (from 6.9 million VND to 9.6 million VND).

	Mar 2007 Before modification	May 2007 After modification	Jul 2008 Evaluation
WTF Operation			
Operation time of WTF (h/day)	22	16.87	15.92
Distribution time from WTF (h/day)	11.25	14.47	13.31
Flow-meter to control water volume	Yes	Yes	Yes
Water volume distributed from WTF (m^3/day)	270	347	320
Chlorine dosing	None	Yes	Yes
Operational procedure	experience	followed instructed procedure	followed instructed procedure
Recording operation data	none	recorded	recorded correctly
Water Distribution			
No. of total HHs who lived in the village	413	447	545
No. of HHs received treated water*1	409	443	541
No. of flow-meter in the village*1	597	684	712
Water volume (L/capita/ day)*2.3	67	85	67
Cost of treated water	2,000VND/m3	2,000VND/m3	2,500VND/m3
Rate of water loss (%)	35.0	30.0	21.4
Penalty against water theft	none	under discussion	applied
Financial Situation (per 1 months)			
Revenue (VND)	12,842,000	17,465,000	19,435,000
Spending (VND)	5,982,000	10,255,000	9,856,000
Remaining (VND)	6,860,000	7,210,000	9,579,000

*1: No. of flow-meters is larger than No. of HHs receiving treated water in the village because several households have more than 1 house and they registered to set up flow-meters for each of their houses.
*2: Water loss was accounted for in the calculation.
*3: 4.9 people/HH was used based on the results of survey in this study.

11) Quang Trung Commune (Model 3)

Before modification

Water source was river water. Treated water quality varied from rainy to dry season. Microbes such as coliform bacteria were often detected in treated water.

After modification

All quality parameters in treated water improved so as to meet local government requirements and the supply of treated water by volume increased (1.5 folds).

Comparison of major quality parameters at WTF			Before modification Aug 21, 2007		After modification Dec 13, 2007	
Parameter	Unit	Standard*1	Untreated Water	Treated water	Untreated Water	Treated water
Ammonium	mg/l	1.5	5.5	4.0	4.5	3.5
Iron	mg/l	0.5	0.84	0.12	0.9	0.14
Arsenic	mg/l	0.01	0.0020	0.0015	0.0030	0.0010
Total coliform bacteria	MPN/100ml	0	---	---	---	---
E.Coli	MPN/100ml	0	<3	<3	<3	<3
Chlorine residue*2	mg/l	0.3-0.5	0	0.8	0	0.8

The water samples were analyzed in the laboratory of the National Institute of Nutrition, Hanoi, Vietnam.

*1: Drinking Water Hygiene Standard (Ministry of Health, Vietnam, 2002).

*2: Results from field test.

WTF operation and distribution

Several key figures which show that the operational status improved.

- At the WTF, the treated water volume distributed from WTF increased by 48%.
- The number of HHs that received treated water from WTF increased by 22%.
- Water loss rate did not change from 42%.
- Surplus revenue for the WMU did not change, even though the water fee was risen by 15% (from 2,000 VND/m3 to 2,300 VND/ m3).
- The treated water volume distributed from WTF increased by 47%.

	May 2007 Before modification	Dec 2007 After modification	Jul 2008 Evaluation
WTF Operation			
Operation time of WTF (h/day)	11.6	12.1	17.6
Distribution time from WTF (h/day)	5.66	5.96	8.53
Flow-meter to control water volume	None	Yes	Yes
Water volume distributed from WTF (m^3/day)	349	362	512
Chlorine dosing	Yes	Yes	Yes
Operational procedure	experience	did not follow instructions properly	followed instructed
Recording operation data	none	recorded with error	recorded correctly
Water Distribution			
No. of total HHs who lived in the village	1,650	1,650	1,650
No. of HHs received treated water*1	1,219	1,378	1,485
No. of flow-meter in the village*1	990	1,078	1,122
Water volume (L/capita/ day)*2,3	74	60	85
Cost of treated water	2,000VND/m3	2,000VND/m3	2,300VND/m3
Rate of water loss (%)	42.0	39.2	42.2
Penalty against water theft	None	Under discussion	Applied
Financial Situation (per 1 months)			
Revenue (VND)	12,524,000	10,712,000	16,553,100
Spending (VND)	7,523,800	10,774,660	11,424,000
Remaining (VND)	5,000,200	-62,660	5,129,100

*1: The No. of HHs that received treated water is larger than the No. of flow-meters in the village because several relatives live next door with a common garden in the same square in this village and they share one flow-meter and a water reservoir for several households.

*2: Water loss was accounted for in the calculation.

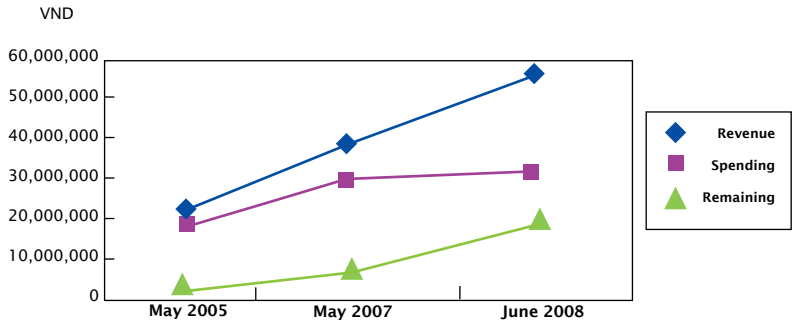
*3: 4.86 people/HH is used based on the results of survey in this study.

3. Water management system for sustainability

The training of WMU members about clean water, food safety and nutrition and comprehensive communication materials increased the confidence and responsibility of WMU members. From the second half of the project, the project team remained in a support role and together with the efforts of the inhabitants, WMU led the activities of both water management and communication in the local areas. This approach has ensured the sustainability of WMU. We also established sound water fee collection systems and carried out measures against water loss and theft. This led to increases in the revenue of WMU, and WMU decided to allocate the revenue to the maintenance fees of the WTF, salaries of WMU members, purchase of chemicals, personnel costs of IEC activities. These results strengthened the financial independence of the WMU.
Furthermore, the WMU members of the project site became local consultants for the other villages and started promoting the knowledge leaned from Project SWAN.

Revenue

The revenue of WMU has substantially increased (model 1)



4. Conclusions

As a result of the above activities, the knowledge of inhabitants about safe water, food safety and nutrition has significantly improved and the incidences of childhood diarrhea and underweight decreased. We have confirmed that the water quality has been improved and now meets the national standards following the WTF renovation and training operations. Furthermore, the number of households who receive treated water and the total water volume (L/capita/day) have increased. The satisfaction of inhabitants for clean water and water management has also increased. The motivation of inhabitants and WMU members has increased and they are now able to communicate actively and decisively.
We also established a sound water fee collection system and carried out measures to reduce water loss and theft. This strengthened the financial independence of the WMU.

To establish a sustainable water supplies and health communication model in rural areas through a participatory approach with inhabitants

OUTCOMES of IEC activity

- Improved nutrional status of child
- Decreased childhood diarrhea
- Improved Food safety practices
- Improvedattitute toward:
  - clean water
  - water managerment

OUTCOMES of Technical activity

- Improved water quality
- WTF operation
  - Maintenance
  - Recording
- Improved water distribution
  - -Increased water volume
  - -Decreased rate of water loss
  - -Penalty against water theft

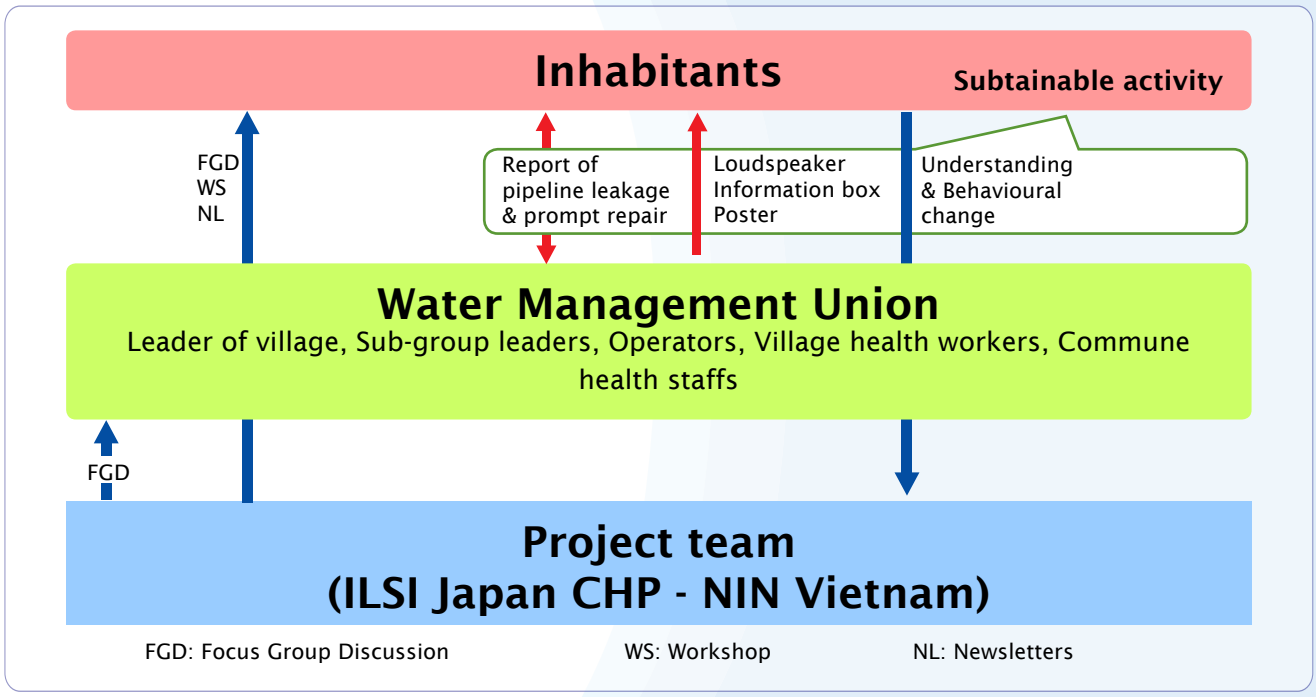
OUTCOMES of subtainability

- Increased cofidence
- Increased responsibility
- WWM leads:
  - Water management
  - Communication
- Increased revenue

VI. ASSESSMENT

1) Process

There was no problem in the minds and understanding of the inhabitants to combine improvements of safe water supply and IEC activities, which are totally different fields. The operations of the WTF, safe water, food safety, nutrition and health have always been closely related, thus Project SWAN successfully combined IEC activities and water quality improvements, which require different areas of expertise, to act as two wheels of the same cart for achieving the project goals. This led to great achievements.



For example in Model 1, at the beginning of the project, we initially approached to the WMU by organizing FGDs, however WMU did not respond positively. Therefore we approached the inhabitants directly by organizing workshops, providing newsletters and FGDs. After that the inhabitants understood the importance of the activities and changed their attitudes, and started appealing to the WMU on behalf of the project. Thereafter, WMU changed their attitude and became more receptive. WMU started working actively, by providing information through loudspeaker announcements, placement of information on bulletin boards and flip chart communication. By the time of the evaluation, the project team was able to obtain good results, improving the practices of the inhabitants. This dual supervision approach from both the project team and the inhabitants was effective in changing the responsiveness of the WMU.

We collected data by FGDs, observation and recording. This triangulation approach made sure we confirmed the information we collected in each locality.

The National Institute of Nutrition, Vietnam (NIN) was able to manage not only food safety and nutrition issues but also water quality and water management in the community.

2) *Impact*

The greatest success was a result of capacity build-up of the local partners with effective material support. The direct bottom-up and customized approach based on problem and asset identification and need assessment was useful in responding to local needs. Through the training of local instructors, once the local team understood the objective and the usefulness of Project SWAN, recognized the benefit, and became confidence on the information, the promotion of IEC was accelerated.
The training of local instructors focused on practice and theory enhanced the knowledge and abilities of the local partners. Showing them the experiences and actual feelings of the local people were the most effective way to change the attitudes of local partners. All the information provided from the project was easy to understand for the inhabitants and applicable in the home. Hot topics published in newsletters urged inhabitants to change their attitudes towered targeted topics.

3) *Sustainability*

We conducted FGDs with the WMU and leaders of Commune People's Committees (CPC) in 3 communes to identify factors necessary to maintain project activities after the completion of Project SWAN.

Through these investigations, we found that WMUs in 3 communes strongly recognize the benefit of Project SWAN. Furthermore, we confirmed that WMUs have been making efforts to sustain the outcomes of Project SWAN. For instance, the WMU assigned a person to regularly conduct the IEC and the technical activities, and also sought financial support. WMU members were well aware of the importance of the communication, therefore in addition to the good operation of the WTF, they have been trying to maintain the IEC activities with funds from the CPC in ways that are the most effective for their community. Particularly for Model 3, we were not able to confirm the sustainability of the project by the end of the initial project. However this investigation enabled us to confirm the benefit and effectiveness of the project in Model 3, and consequently the CPC decided to support the continuation of both the technical and IEC activities.
We were also able to verify the sustainability of the policy aspects, technological aspects, environmental aspects, socio-cultural aspects, institutional and management aspects and economic and financial aspects of the project. As a result, consistent support from CPC related to the initial set-up (giving responsibilities to WMU members) and management of IEC activities was shown to be the most effective way to maintain the project activities.

In order to learn the opinion of the inhabitants, particularly mothers, we conducted a survey with mothers on the activities of WMUs after completion of the project. As a result, we found that the inhabitants were more satisfied with the water quality, water quantity, water fees and prompt repair of the pipeline in project sites than in other areas.
FGD with mothers also revealed the factors which encouraged them to maintain clean water, food safety and feeding practices, which were the following: 1) understanding how these benefit the healthy growth of children, 2) information frequently provided by village health workers and 3) support from family members. Especially effective communication methods were direct contact with mothers at workshops, newsletters which can be kept in the home and reviewed at any time, and flip charts in which the descriptions and drawings are easy to understand and are also applicable in the home.

VII. LESSONS LEARNED

1) Approach to three different models

Each model site had different characteristic, depending on the local conditions, therefore we had to be flexible. We changed the order of implementation, but not the content.

- **Model 1:** First, we organized a workshop. The local team was not very strong and the inhabitants did not trust the local team. The project team communicated directly to the inhabitants by way of the workshop to obtain the understanding of the inhabitants. Thereafter, together with the knowledge enhancement of the inhabitants, as a result of interest in project's activities, WMU started responding positively.
- **Model 2:** At the beginning, we organized training for key persons in the commune as the local team was strong and had the trust of the inhabitants. The project team conducted training courses for local teams on how to use flip charts to communicate with inhabitants. Thereafter, WMU played a role of communicator and provided educational information to inhabitants. Consequently, the knowledge and habits of inhabitants has improved.
- **Model 3:** Nam Dinh Province is geographically far from Hanoi. We established the focal point in Provincial Preventive Medical Center (PMC) and the Provincial Center for Rural Water Supply and Sanitation (PCERWASS), and based from these two organizations, the project team implemented the activities.

2) Combine two activities of Water Management Union

It was important to combine the technical activities and IEC activities.

- **Model 1:** After the modification of WTF, we explained how we modified the WTF through IEC activities with inhabitants. Then inhabitants began to understand the complicated water treatment process necessary for clean water, after that it became easier to collect water fees.
- **Model 2:** A chlorine dosing system was installed in the WTF in order to disinfect the water. However, in order to buy chlorine, WMU needed to increase the water fee. WMU conducted IEC activities with inhabitants to get the understanding of the importance of chlorine for health and got their agreement to the increase of the water fee.
- **Model 3:** We approached at the commune level, therefore the number of WMU members and village health workers increased. The project team gave them a specific task. Specifically, WMU worked on WTF operations and water supplies whereas village health workers worked on communication activities.

3) Share expertise to neighboring communes

- **Model 1:** A neighboring village was interested in the poster communication. A village health worker went to the neighboring village to make a presentation using flip charts about the project.
  The village health workers of the project site became instructors for the other village.
- **Model 2:** A neighboring village wanted to modify their sand filtration and well pump. The operator of the project site went to the neighboring village and advised the people how to modify them. Thereafter the operator played the role of a local expert.
- **Model 3:** In the training to local key persons (WTF operators, managers and village health workers), we provided information of water treatment process, WTF operations, safe water supply, food safety and nutrition. The expertise of local key people was differed, but they understood the operation of WTF, safe water supply, food safety, nutrition and health are closely related, consequently they started conducting the project activities with better understanding about this key concept and its effects in mind.

4) Partnership between ILSI and NIN

- It is important to share goals and objectives and obtain agreement between the two organizations.
- Each party should become active in the work of project and should not be passive.
- Each party has a responsibility to convey the advice of international consultants to local teams. However when the advice of international consultants does not fit the local conditions, the counterpart should take the initiative in modifying the details to correspond to local conditions and yet retain the essential meaning.
- The support of local interests and willingness is important.
- ILSI Japan set up a project office in NIN and a Japanese coordinator was stationed in the office to manage the activities and finances.
- One responsible coordinator from each party.
- Project team hired two assistants: one for responsible for the following activities: developing meeting minutes, translation of documents into English (to share with experts to receive feedback), and the other responsible for finance & administrative work, financial reports on the project and reports to the counterpart, and administrative papers necessary for project activities.
- The budget was shared, thus each took responsibility for their own work.

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- Nam Dinh Province Preventive Medicine Center
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Industries

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XI. ABBREVIATIONS

CHS.....Commune Health Station
CPC .....Commune People's Committee
CERWASS.....Center for Rural Water Supply and Sanitation
FGD.....Focus group discussion
HHs.....Households
IEC .....Information, Education and Communication
KAP.....Knowledge, Attitude and Practice
MoH.....Ministry of Health
NIN.....National Institute of Nutrition
PMC .....Provincial medical center
WMU.....Water Management Union
WTF.....Water treatment facility

WHAT IS ILSI?

Founded in 1978, the International Life Sciences Institute (ILSI) is a nonprofit, worldwide foundation that seeks to improve the well-being of the general public through the advancement of science. Its goal is to further the understanding of scientific issues relating to nutrition, food safety, toxicology, risk assessment, and the environment by bringing together scientists from academia, government, and industry.
A nonprofit organization, the International Life Sciences Institute Japan (ILSI Japan) was established in 1981 as a regional branch, and plays a role in the worldwide activities of ILSI, and consults on the specific issues in Japan.
ILSI Japan CHP is dedicated to making contributions towards solving critical global public health issues by utilizing all the knowledge and technology related to nutrition, public health, food science and environmental health which has been accumulated in Japanese industry, academia, and the government. We work most actively on the implementation of public health programs for targeting high-risk populations based on solid scientific research by forming expert project teams to address each targeted issues.

WHAT IS NIN?

The National Institute of Nutrition (NIN), Vietnam under the Ministry of Health was established in 1980 by the field of nutrition, food sciences and clinical nutrition for the whole country of Vietnam. During nearly 30 years, NIN has accomplished the following major achievements:

- Assessed the nutritional status and dietary intake of Vietnamese people in different ecological regions yearly for a period of many years.
- Established dietary allowances and food based dietary guidelines for Vietnamese people and developed a nutrition policy for Vietnam.
- Developed and updated food analysis data, thus establishing the Vietnamese Nutritive Composition Table.
- Investigated food safety and food hygiene, contributing to the development of food regulations.
- PhD training in community nutrition and masters of science in community nutrition in collaboration with Hanoi Medical College.
- Implemented the National Nutrition Strategy (NNS), the National Focal Point for Nutrition Coordination of the Protein Energy Malnutrition Program (PEM) and the Micronutrient Deficiency Control Program.

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