**Social Republic of Vietnam**

# Preparatory Survey
# on
# BOP Business
# on
# Dissemination of Point-of-Use Water Treatment Technology in Vietnam

**Final Report**

**(Summary)**

**March 2014**

**Japan International Cooperation Agency (JICA)**

**Kanematsu Corporation**

**Nikken Co., Ltd.**

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# Chapter 1 Vietnam

## 1.1 Overview of Vietnam

| | | |
|---|---|---|
| Area | | 329,241 square kilometers |
| Population | | 91.7 million (as of 2013) |
| Capital city | | Hanoi |
| Ethnic group | | Kihh (86%), 53 minority groups |
| Language | | Vietnam |
| Religion | | Buddhism, Catholic, Cao Dai |
| Political system and diplomacy | Political system | Socialist republic |
| | Ruling party | Communist party (only legal political party) |
| | National congress | Unicameral (Out of 500, 499 seats are occupied as of Oct. 2013), Multiple-seat constituency system, 18 and above are eligible for vote and 21 and above for election) |
| Economy | Major industry | Agriculture, forestry and fishery, mining, light manufacturing |
| | GDP | USD 170 billion (2013, IMF) |
| | GDP per capita | USD 1,896 (2013, IMF) |
| | Economic growth rate | 5.4% (2013) |
| | Inflation rate | 6.6% (2013) |
| | Unemployment rate | 2.2% (3.58% for urban, 1.58% for rural, 2013) |
| | Trade | Export: USD 132.35 billion (15.6% increase from previous year)<br>Import: USD 132.13 billion (16.1% increase from previous year) |
| | Major trade item | Export: Textile, cellphone and its component, crude oil, PC・electronic device・component, footwear<br>Import: Machinery and its component, PC・electronic device・component, petroleum products, fabric, iron and steel |

| | | |
|---|---|---|
| | Trading partner | Export: USA, Japan, China, Korea, Malaysia<br>Import: China, Korea, Japan, Taiwan, Singapore (2012) |
| | Currency | Dong |
| | Exchange rate | USD 1 = VND 21,036 (as of February 2014, Central Bank) |
| | Foreign investment | USD 21.7 billion (55% increase from previous year) |

## 1.2 Description of the BOP Population in Vietnam

According to “BOP Business – Market Needs Assessment: Education and Vocational Training Sector in Vietnam” published by JETRO, the average wages in Vietnam, even for the higher socioeconomic group, is less than the threshold of BOP household income, USD250 per month, leaving 90% of its population living at the Base of Pyramid (BOP). The World Resources Institute (WRI) and International Finance Corporation (IFC) support this assessment in their publication “The Next 4 Billion” in 2007 and confirmed that 95% of Vietnam forms the BOP population.

## 1.3 General Situation of Water Sector in Vietnam

While 78% of the rural population has access to water, according to the National Center for Rural Water Supply and Environmental Sanitation (CERWASS), this figure drops to 38% when it comes to access to clean water that meets the 14 criteria set by the Ministry of Health and further drops to 2 % for access to drinking water.

As is the case for most developing countries, in Vietnam, the poorer the household, the less access there is to safe water sources including piped water. Low income populations largely depend on surface ground water, rainwater and rivers as its source for use in daily consumption (drinking). Thus, increasing awareness on the appropriate Household Water Treatment and Safe Storage (HWTS) is considered an important element in the Vietnamese National Development Strategy set by the Vietnamese government and the Country Assistance Strategies formulated by international aid agencies such as the World Health Organization (WHO).

# Chapter 2 Overview of the Proposed Project

## 2.1 Background and Assessment of Need

Access to clean and safe water remains a significant development challenge in Vietnam and the government is keen to improve water-related-infrastructure. However, for most of the poor population, even when residing in an area where piped water is available, they lack access to safe water. In view of their level of contribution to the country's economy, the BOP in Vietnam is less likely to be included in the target population who can enjoy improved piped water in the future.

As a result, incorporating Point-of-Use (POU) technology that enables each household to purify water through a filter would play a critical role in fulfilling the needs of the BOP. It is also thought that there is a significant demand for a "low-cost and non-chlorinated-odor disinfectant" among the BOP population.

## 2.2 Objectives, Contents and Formation of the Study

The main objectives of this Study are to explore the possibility of developing a low-cost POU technology that the BOP population finds affordable and subsequently build an on-site production system and distribution network, as delineated below:

- Test effectiveness and applicability of and build business model for Clinca 205 in the Vietnamese market;
- Develop POU product that fulfills market needs; and
- Build on-site production system and distribution network

The product introduced in the Study is a sand-like catalyzing disinfectant called Clinca 205 developed by Nikken Co., Ltd (Nikken). Clinca 205 is effective against bacteria, viruses and some protozoa, and can be used continuously for 2 years. It is odorless and requires low maintenance and minimum production costs, hence, Clinca 205 is considered to be an essential product for the BOP population.

# Chapter 3 Description of Clinca 205

## 3.1 Characteristics of Clinca 205

Clinca 205, produced by Nikken, is a sand-like disinfectant composed primarily of silicon dioxide, aluminum silicate, silver and copper. It is significantly effective in killing bacteria and eliminating odor and can be continuously used for 1-2 years depending on water quality. Clinca 205 can lessen chlorinated or chemical odors while possessing a powerful disinfecting capability. The product is expected to be taken in by the communities and populations where access to conventional water treatment products are limited to date due to such characteristics in addition to availability at an affordable price .

## 3.2 Product Safety

Clinca 205 has already been certified by dissolution tests conducted by the Japan Food Research Laboratories to be non-toxic and safe. The test result show that water disinfected by Clinca 205 meets the standards of drinking water in Japan.

## 3.3 Function and Effectiveness of Clinca 205 (Joint Research with Tokyo Institute of Technology)

The Study Team, together with Institute of Environmental Science and Engineering (IESE) of Hanoi University of Civil Engineering (HUCE) verified the effectiveness of Clinca 205 to water native to Vietnam. For the overall disinfection capability of Clinca 205, the test including theoretical analysis was conducted jointly with the Tokyo Institute of Technology (TIT) from October 2012. Through this joint research with TIT, the Study Team attempted to carry out in-depth analysis on the disinfection mechanism of Clinca 205, given the high probability of business expansion in the future. When tapping into new regions other than Vietnam, it will be helpful if the bacteria content in locally available water is analyzed in advance so that the effectiveness of Clinca 205 is verified prior to introduction.

### 3.3.1 Analysis of Raw Materials

Thermal Analysis (TG-DTA)

Results of thermal analysis called TG-DTA shows that the raw materials contained in Clinca 205 after the fast-high temperature heating test remained stable.

Test on Element Abundance Ratio through Magnifying Lens

In order to further understand the efficiency of Clinca 205, analysis on the antibacterial substance content of the product and element abundance ratio was conducted by using a magnifying lens and X-ray diffractometer (XRD) respectively. With this test, the condition of material elements was identified.

Measurement of Absorption Equilibrium in Silver

The absorption equilibrium of silver ion in aqueous solution containing zeolite and silver was analyzed in order to examine the continuous usability of and maximum amount of water processed by Clinca 205. The saturated amount of absorption of the ion exchange medium used in Clinca 205 was identified.

### 3.3.2 Antibacterial Mechanism

Analysis on antibacterial effectiveness towards microorganisms contained in sample water in Vietnam

During the second field study in November 2012, sample water was collected from wells, rainwater and river water from a Ha Nam Province commune, piped water, and water purified by the Reverse Osmosis (RO) membrane system in Hanoi for analysis.

TIT then cultured organisms from all of the collected sample water and performed observational analysis. Results show that, with the application of Clinca 205, the bacterial concentration was reduced to a detection threshold within one (1) hour for rainwater, river and processed water and three (3) hours for water collected from wells.

Analysis of water in Japan

(1) Antibacterial effectiveness towards microorganisms contained in pond water near Tokyo
Since it is less likely to find clean water or drinking water contaminated by bacteria or microorganisms in Japan, a water sample was collected from a pond near Tokyo to test the effectiveness of Clinca 205. The results show that the product exercised immediate antibacterial effectiveness.

(2) Antibacterial effectiveness towards bacillus coli
Bacillus coli were reduced to the level of detection threshold within three (3) hours.

(3) Antibacterial effectiveness towards staph aureus and pseudomonas aeruginosa
Both staph aureus and pseudomonas aeruginosa were reduced to the level of detection threshold within three (3) hours.

Antibacterial Mechanism

Through the analysis presented above, it is assured that the bacterial concentration in supernatant is reduced by applying Clinca 205. The Study Team initially assumed that it was Clinca that absorbed the microorganisms contained in water, however, this conclusion was soon overturned. It is the silver ion in Clinca 205 that causes oxidative damage to microorganisms.

### 3.3.3 Continuous usability of Clinca 205

Amount of Processable Water and Validity

Based on the results of analysis on the absorption equilibrium of silver and silver ion concentration, the Study Team carried out mass calculation for silver contained in Clinca 205. It was found that Clinca 205 could be continuously used for about one (1) year. If mass fraction of silver is well adjusted, the lifetime of Clinca 205 will be extended to ten (10) years.

### 3.3.4 Product Development

Although the amount of time required to immerse Clinca 205 into water has been set to six (6) hours so far, the various test results demonstrate that this can be reduced to three (3) hours or less.
An antibacterial test was also conducted for distilled water for which Clinca 205 was immersed for a certain period of time. Results show that bacillus coli are reduced to the level of detection threshold within less than half the normal time.

These test results will be taken into consideration for product development in the future.

# Chapter 4 Study on Local Market

## 4.1 Market Study for Water in Vietnam

Urban Area (Hanoi, Ho Chi Minh)

- The piped water system is relatively well established in urban cities like Hanoi or Ho Chi Minh and provincial cities in Vietnam when compared to other developing countries. However, the water is contaminated by bacillus coli and not suitable for drinking..
- Middle to high income households purchase bottled water (20 liters) and dispensers for drinking.
- Ceramic filters (locally called mineral pots) are available for USD 10-20 at supermarkets in urban areas. Since the quality is questionable, these filters are not widely accepted in the local markets.
- Relatively high income households purchase the RO membrane system at a price ranging from USD 300 to 500 although all three membranes require replacement periodically. Given the high price and cumbersome maintenance, the RO membrane method is not widely accepted by the local people.

Rural Area

- Northern Red River Delta (Ha Nam Province, Environs of Hanoi)
  - Access to piped water is still limited and the amount and hours of water supplied is restricted in most cases.
  - For most of the communities, groundwater is not suitable for drinking since contaminated by arsenic and iron. People living in these areas purify rainwater by using built-in-sand-filters and store it in water storage tanks made of concrete for drinking.
  - For relatively high income families and in dry season, polyethylene terephthalate (PET) bottled water (20 liters) is widely available at the price of VND 45,000 (USD 2.3). A small sized PET bottle is also available for drinking. Few families own RO membrane systems.

- Southern Area (Tra Vinh Province)
  - Access to a piped water system is limited to urban areas and people in rural areas depend on rainwater for drinking. Unlike the Northern area, most of the families

utilize large water ceramic pots for storing rainwater. Water is boiled with propane or firewood before consumed for drinking.

- Groundwater is highly contaminated by arsenic, heavy metal and other toxic substances. On the other hand, since fetching water for daily activities such as laundry, washing, and cooking requires considerable amount of time and labor, most families drill wells with financial support that comes from micro-finance.
- Color of river water is dark brown and contamination is accelerated not only by organic matter but also chemical substances requiring appropriate water treatment prior to drinking.

## 4.2 Market Analysis for POU Technology

While the boiling of water is widely seen in the area where access to piped water is available, in urban areas and for high income families in rural areas, purchasing and relying on delivery service of PET bottled water (20 liters) is predominant. The ceramic filter system called mineral pots is also sold at the supermarket and there are few restaurants and families utilizing this technology.

On the other hand, chlorine disinfectant is distributed mainly during times of crises and generally not utilized.

# Chapter 5 Business Model

## 5.1 Value Proposition

In this section, the value of Clinca 205 and a comparative analyses with other water treatment technologies are examined.

Clinca 205 does not work as coagulation filtration, hence, it is not able to decontaminate chemical substances such as arsenic or heavy metals. However, it entails strong antiseptic effects similar to chlorine and is highly effective for biological contamination. Clinca 205 maintains an advantage over chlorine in that the water treated by Clinca 205 is tasteless and odorless. Clinca 205 is also made available at a very competitive price. To produce 25g of Clinca that is enough to treat 1 liter of water, it would only cost about USD1. Considering a two-year lifetime with a twice-a-day application, treating 1 liter of water only requires USD 0.0007.

In regards to maintenance, Clinca 205's user-friendliness also stands out. It is easy to replace with a new one and is required only when the lifetime of Clinca 205 expires. Finally, in addition to the above mentioned user-friendliness, Clinca 205 involves minimum logistics and installation requirements (lightweight, compact size and hardly damaged), minimizing any related costs incurred for distribution. This is an essential element when distributing the product in broader markets.

## 5.2 Business Model

During the Study, the following four business models were examined and partner institutions were identified:

(1) Business Model for Pitcher Type Water Treatment Technology (Business to Consumer; B to C)

In order to attract target consumers among the middle class and among the BOP population in urban areas, the Study Team attempted to establish a brand image by conveying marketing messages such as "Clinca 205 can improve the taste of water" or "Clinca 205 is good for your health". The lifestyle of urban residents was taken into consideration when designing a pitcher.

(2) Business Model for Urban Municipality Water Tank Technology (Business to Business; B to B)

A low-cost and effective business strategy was sought for this business model. To this end, the decision was made to apply Clinca 205 to the water storage tank installed in each household.

(3) Business Model for Rural Water Treatment Technology (Business to Business; B to B)

Characteristics of Clinca 205 (low production cost, high disinfection effectiveness, odorless and tasteless, easy maintenance and delivery) have demonstrated its capability to fulfill needs of low income populations as a whole and people living in rural areas. Thus the marketing strategy for this business model put emphasis on promoting the competitive strategic advantage of Clinca 205. However, securing distribution channels and providing capacity building opportunities to trainers who can raise awareness about the technology impose challenges to Nikken. The Study Team therefore explored the possibility of collaboration with business partners through tailor-making the product for the local people, building sales networks, and strengthening education and raising awareness efforts.

(4) Business Model for Small Sand Bag Technology (Business to Government; B to G)

At the beginning, the Study Team attempted to develop a business model targeting the bottom of the BOP by introducing low-cost packaging for sand-like Clinca. All of the available possibilities were sought out and even distribution through women's associations, health centers, other NGOs/NPOs and local communities were considered. However, it was concluded that this model requires significant costs for market building. Nonetheless, the Study Team is keen to promote the sales of the sand bag type of technology to governments and donors (B to G model). Through distribution by public entities, it is expected that the poorest populations would be direct beneficiaries of Clinca 205.

### 5.3 Partnership Building

For the four business models presented above, the possibility of collaboration with potential partners was explored as follows:

(1) Partnership Building for Pitcher Type Water Treatment Technology

The Study Team, through close collaboration with a company called i-Lab who specializes in designing BOP products in Cambodia, designed and developed a prototype of a pitcher.

However, a decision was made to hold commercialization of this pitcher type water treatment technology for the time being since it requires significant marketing costs and lacks a domestic sales channel. The Study Team was also unable to identify potential partners who have enough experience to fill these gaps. Therefore, for the urban population, scaling-up the business model for water tank technology was explored, while for the rural population looking into the feasibility of building a model for a water treatment system was examined.

(2) Partnership Building for Urban Municipality Water Tank Technology

Through collaboration with a company called Son Ha International Corporation, one of the largest water tank manufacturers in Vietnam, a water tank specifically designed for the BOP population was produced. One of the features of this tank is that the inside is coated with Clinca 205, allowing it to kill bacteria contained in water.

(3) A. Partnership Building for Rural Water Treatment Technology – Shiny Vietnam Joint Stock Company (Shiny)

The Study Team was able to identify a local manufacturer who produces a community-based compact water purification system in south Vietnam.

| | |
|---|---|
| Name of the company: | Shiny Joint Stock Company |
| HP: | http://www.shinyvietnam.com/jp/ |
| Location of head office: | Ho Chi Minh city |
| Major product: | Activated carbon, water purification system using ceramic ball |

Test results carried out for a prototype demonstrated that the technology is able to eliminate bacillus coli. With this result, Shiny decided to proceed with the commercialization of the prototype. Water treatment technology incorporated Clinca 205 is now installed in a school in Dong Nai Province where Shiny has maintained a good business relationship for a long time.

(3) B. Partnership Building for Rural Water Treatment Technology – NUSA Vietnam JSC (NUSA)

One more local manufacturer of community-based compact water treatment system was identified during the field research.

| | |
|---|---|
| Name of the company: | NUSA Vietnam VSC |
| HP: | http://nusa.vn/en/default.aspx |
| Location of head office: | Hanoi city |
| Major partner: | CERWASS, Unilever, AusAID |
| Major product: | Activated carbon, water purification system using bio sand |

Based on the results of the experiment conducted at the Chemical Environment Department of the Vietnam Academic Institute for Science and Technology in the summer 2013, Shiny produced a prototype incorporated Clinca 205. The company also displayed the prototype at an exhibition organized by the Ministry of Science and Technology (MOST) in Tai Binh Province in the Red River Delta in August and was able to attract interest from MOST and other relevant stakeholders.

The advantage of this business model is that the periodic replacement of Clinca 205 is expected (demand creation) since activated carbon and bio sand installed in the technology needs to be changed every year.

(4) Partnership Building for Small Sand Bag Technology

Distribution of a sand bag type technology is a business model where Clinca 205 could demonstrate its price advantage. However, it was difficult to secure the sales channels in Vietnam since local NGOs/NPOs lack capacity in building their own distribution network. Since provincial health centers currently play a major role in distributing water purification products to end users, the Study Team sought the possibility of collaborating with CERWASS, an affiliated health center with the Ministry of Agriculture and Rural Development. Unfortunately, signing a contract with CERWASS was not achieved during the Study, thus, sales to governments and aid agencies was explored as the need for Clinca 205 would arise when responding to emergency situations such as natural disasters or conflicts.

## 5.4 Local Production in Vietnam

One of the objectives of this Study includes examining the possibility of building a local manufacturing system in Vietnam. If this possibility is materialized, the price of an end product would be reduced, allowing it to be supplied to neighboring countries along the Mekong Delta by a land route. Negotiation with NUSA has been underway and once both parties, Nikken and NUSA, agree on the terms and conditions, the production of Clinca 205 will be commissioned to NUSA.

# Chapter 6 Pilot Test

## 6.1 Prototype Development and Mini-Pilot with i-Lab

### Business Objectives

i-Lab is to develop a prototype that serves the lifestyle and needs of consumers in rural areas in Vietnam.

### Implementation and Methodology

In addition to desktop research, a mini pilot project was implemented during the field study. In conducting the pilot, the demands and incentives of local consumers towards the sand bag Clinca 205 were assessed since understanding these elements are key to the success of the pilot project. The Study Team developed several different types of prototypes and received feedback from end users, which helped identify the type of prototype that would best serve the needs of the local people.

### Locations for Mini Pilot

An Giang and Tra Vinh Provinces were selected as pilot locations. These provinces are located in southern Vietnam around the Mekong Delta and characterized by high population density. Low to middle income populations are dominant and there exists a huge demand for securing access to safe and clean water.

### Implementation Process and Schedule

A pilot project was conducted from June to October 2013. A series of desktop study, prototype design, field study and mini pilot were repeated to identify the needs of end users. Findings were reflected in the design of the prototype. The Study Team monitored the entire process and accompanied i-Lab in the field study and mini pilot.

### Results of Field Study

The following feedback was obtained from end users living in the pilot project areas on their access to safe water:

- Major water sources for drinking and daily activities include rainwater, bottled water (20 liters with refill service), piped water, and surface water sourced from wells and the river.
- Rainwater is considered the safest water followed by bottled and piped water.
- Surface water (well and river) contain impurities like salt which cannot be removed entirely by bacterial agents.
- Rain and bottled water are used for drinking, piped water is utilized for cooking and washing and well and river water is used for washing and bathing.
- In many areas in Vietnam, groundwater containing arsenic is considered not suitable for drinking. Water sourced from the Mekong Delta also contains salt therefore, water fetched from wells and the river is normally utilized for daily activities.

Feedback for prototype received from end users are summarized below:

- As bottled water is widely accepted in Vietnam, it is expected that a relatively large number of low income families would spend money to a certain extent to obtain safe and clean drinking water.
- Odor and taste are important elements to assure quality of water (there are reservations to chemical substances such as chlorine and disinfection powder which may change the taste and odor of water).
- It is important to make the purification process visible (e.g. bubbles arising when water is boiled). It is better if the purification process takes time.
- Given concerns towards imitation products, it is important to secure the credibility of the product and manufacturer. In particular, obtaining approval from the government is key to succeeding in scaling up the demand of end users.
- Securing the credibility of sales channels is also critical. To this end, it is important to identify a manufacturer who is trusted by the local community.

Taking into account all of this feedback, several prototypes were developed and tested during the implementation of the mini pilot. As a result of the discussions held with local people and relevant stakeholders, the Study Team was able to produce the following prototypes.

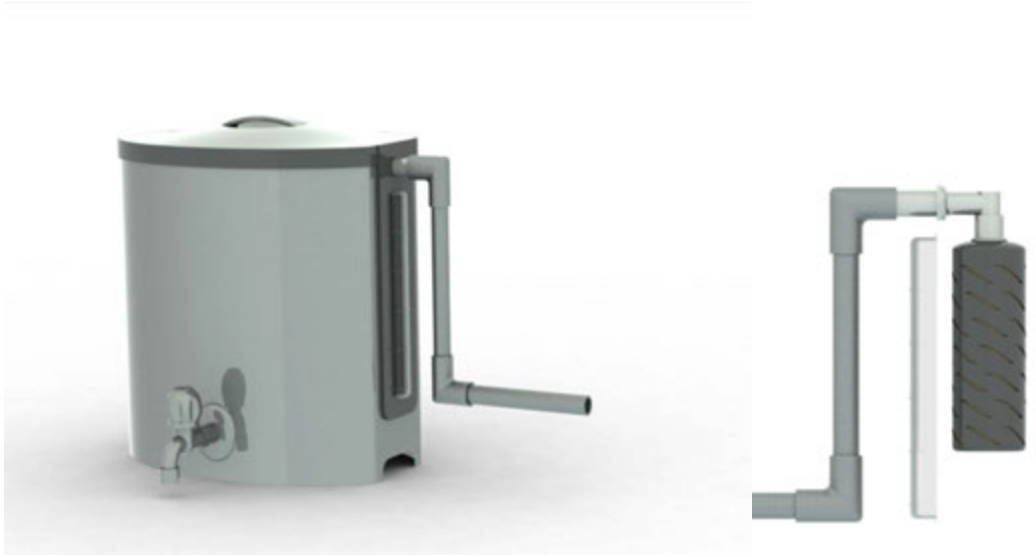

**Image of Prototypes**

However, the following comments were received for these prototypes:

(1) Pipe attached to a prototype is designed to be directly connected to faucet or gutters but most of the families utilize water pots to store rainwater as piped water is installed in only a few houses. Therefore, pipes may be removed from the prototype.
(2) Filter where Clinca 205 is placed cannot always be soaked in water.
(3) Design will be well received but local people may not spend USD 50-70 just for a container. This price may be accepted by middle to high income populations living in urban cities while it may not be accepted in rural areas.

These comments were taken into consideration when developing a POU product for rural communities with NUSA.

### 6.2 Pilot Project with NUSA

The Study Team and NUSA jointly developed a prototype taking into consideration research findings from the mini pilot conducted with i-Lab. NUSA has been selling its original water purifier system utilizing activated carbon. This time, Clinca 205 was installed into the existing NUSA's product, which was named NN306-15.

In designing the prototype with NUSA, efforts were made to ensure that NN306-15 can/is:

- ✓ Available at an affordable price (less than USD 50 )
- ✓ Purify equivalent amount of water consumed by one family (3-5 people) in one day (15-25 liters, assuming one can consume 5 liters).
- ✓ Accommodate characteristics of Clinca 205 (Clinca needs to be soaked in water all the time)
- ✓ Easy to use
- ✓ Durable
- ✓ Designed in aspirational manner; and
- ✓ Purify various kinds of raw water including rain, piped, surface and ground water

| | |
|---|---|
| Size of the Purifier: | 2.3m x 4m |
| Capacity: | 15 liters (including ceramic filter, lid and container) |
| Usage: | Pour raw water from the top and discharge drinking water from faucet underneath the product. |
| Maintenance: | Replace ceramic filter and Clinca 205 once a year. |

Above specified model was tested for one month in order to receive feedback from rural communities in Xa Cam Commune in My Hao District and Dong Than Commune in Yen My District. Both districts are located in Hung Yen Province.

## Business Objectives

a. Test the usability of NM306-15 in rural communities to examine the effectiveness of the technology.
b. Receive feedback and comments on the willingness to pay, usability and impact on health from end users.
c. Based on the results of (a) and (b) above, explore the users' motivation to purchase NN306-15.

## Implementation and Methodology

Under the supervision of Nikken and NUSA, NN306-15 was distributed to local communities. Interviews among the end users were jointly conducted by NUSA and Hanoi University of Civil Engineering. Seven (7) households of Xa Cam Commune (My Hao District) and 14 of Dong Than Commune (Yen My District) tested NN306-15 and 52 water samples were collected from 26 households. The following parameters were researched at the lab of Hanoi University of

Civil Engineering.

Table: Test Method for Water Quality and Parameters

| Parameter | Type of Test | Method of Test |
|---|---|---|
| T ($^{o}$c) | Field test | Analyser |
| pH | Field test | Analyser |
| TDS (mg/L) | Field test | Analyser |
| Coliform (MNP/100ml) | Laboratory | |
| Ecoli (MNP/100ml) | Laboratory | |

Most of the households where NN306-15 was distributed depend on groundwater for daily activities. Since a slow filtration system had already been used to purify the water, the value of coliform and ecoli contained in water before testing was relatively low, 100-350 MNP/ml and 0-22 MPN/100ml respectively. This value was reduced to nearly zero (0) after the introduction of NN306-15.

Most of the users compared the usability of NN306-15 with the existing Reverse Osmosis (RO) membrane system available on the market. However, users made many comments as to NN306-15 requiring no electricity and less water for pumping and is portable within the house. As to the evaluation on willingness to pay, most of the respondents mentioned VND 1–1.5 million (USD 45-70) is an acceptable range.

# Chapter 7 Schedule for Commercialization

## 7.1 Objective, Concept and Goal of the BOP Business under the Study

The business objective initially envisioned for this Study was to develop a POU product which is tailor made to the BOP population in Vietnam. Reviewing the competitive advantage, business model and applicability to the local market of Clinca 205, it was concluded that this avenue will continue to be explored. Nikken is going to play a central role, for the time being, in carrying on a joint venture with local partners not only in Vietnam but also in other developing countries. On the other hand, Kanematsu will continue to support the project especially in light of logistics.

## 7.2 Competitive Advantage

Competitive advantage of Clinca 205 is summarized below:

- Performance: Clinca 205 demonstrates strong antibacterial effectiveness similar to that of chlorine. However, there are reservations toward using chlorine due to its odor and taste, Clinca 205 possesses a competitive advantage over chlorine.
- Cost: Clinca 205 can be available at a competitive price. Once the initial cost is paid, almost no operation and maintenance cost is incurred for the next 1-2 years.
- Maintenance: Clinca 205 requires minimal maintenance.

After careful consideration of the above competitive advantage and findings obtained from pilot tests and desktop research, two business models were established as explained in the ensuing section.

## 7.3 Risk Analysis

The following risks are envisaged in implementing the business:

(1) Legal Risk

Despite the fact that economic deregulation has progressed in Vietnam, enterprise regulation is not well established, which imposes private companies to take risks with almost no legal protection. In addition, it is difficult to form a business or capital alliance with local private firms given stringent foreign currency restrictions.

(2) Currency Exchange Risk

Looking at fluctuations of the Vietnamese Dong in the past 10 years, there has been a concern over exchange rate loss due to the weak currency until 2011. However, from 2012, the market has been in favor of the Dong, which was partially influenced by the weak Japanese yen. With this trend in mind, it was decided to shift most of the production process of Clinca 205 to Vietnam in order to keep the production and sales costs low.

(3) Inflation Risk

Although Vietnam demonstrated the highest inflation rate in Asia in 2011, it decreased to 6.82% and 8.20% in 2012 and 2013 respectively. This illustrates that the economic situation in the country has stabilized. Therefore, while keeping a close eye on inflation trends, no measures would be required to be taken for the time being, largely due to the limited size of the business.

(4) Natural Disaster Risk

Since hydroelectric power generation represents one third of the generation mix of Vietnam, the country is prone to power shortages during the dry season. This would result in the factories having to halt its operations for a while, thus, it is important to have advance preparation for any damages resulting from natural disasters.

## 7.4 Business Model

As was previously explained in Chapter 5, four business models were reviewed in the Study and findings showing that Clinca 205 can accommodate the needs of urban and rural populations and be applicable to various water sources including piped, ground and river water. Despite such high usability of the product, the Study also proved that it is the approach for market creation, rather than for market entry that needs to be pursued since a product similar to Clinca 205 does not exist in the local market to date. Exploring this avenue would require a significant amount of investment for marketing, for example. Therefore, it was decided that the creation of the business model for (3) “Rural Water Treatment Technology” and (4) “Small Sand Bag Technology” would be further explored. On the other hand, the Study Team will continue to identify local business partners to promote the (1) Pitcher Type Water Treatment Technology as a B to B business model, though it may take time.

Business Model for Rural Water Treatment Technology (B to B)

The water treatment system for rural populations will be further promoted in the northern part of Vietnam. Nikken will work closely with NUSA in improving, manufacturing and delivering the technology. For the southern part and Mekong Delta area of the country, the system will be installed in public spaces such as hospitals, schools and health centers through collaboration with Shiny.

a. NM306-15 jointly developed by Nikken and NUSA

Drawing lessons and findings from the study done by i-Lab, the Study Team was able to develop a prototype and implement a pilot project with NUSA. Demands of end users in rural areas were also successfully identified. The current model will be improved and be sold through NUSA's sales channels in Vietnam.

Stakeholders outside of Vietnam are also showing strong interest to NN306-15 and Nikken will continue to explore the possibility of expanding the business globally especially in the following areas:

- Emergency Assistance to Myanmar
- Partnership with Social Entrepreneurs in Cambodia
- Feasibility Study in Kenya

b. Sales to Shiny

Shiny was able to enhance disinfection effectiveness of its original product by adding Clinca 205. Thus, targeting the high income BOP population, the first batch of Clinca 205 has already been delivered to Shiny during the Study. If this collaboration continues, demands for a new product may be created in the local market in Vietnam.

Small Sand Bag Technology (B to G)

Considering the lower cost and usability of Clinca 205, selling it in a small sand bag is an attractive business option where the competitive advantage of the product would be maximized. It was proven during the Study that there is demand for small sand bags for the emergency assistance sector and the Team is currently engaged in talks with Nippon Foundation and international NGOs including Plan for possible collaboration.

## 7.5 Mid-Term Business Plan and Longer-Term Perspectives

Discussion on a mid to long term business plan is underway between the Study Team and NUSA. In the meantime, it was agreed upon to pursue the following steps for NN306-15:

- Improve design
- Conduct further surveys on water quality
- Explore effective instruction methods for appropriate usage

Once the business model for NN306-15 is established, Nikken and NUSA will move on to the next step that is to establish a social enterprise, aiming to distribute Clinca 205 to the poorest of the poor who have limited access to clean water.

# Chapter 8 Expected Development Effectiveness

## Enhancement of the Access to Clean Water

Credible statistical data on the impact of Clinca 205 towards water borne diseases was not obtained during the Study due to time and scale constraints. However, in “the Feasibility Study on Dissemination of Point-of-Use Water Purification System in Mekong Delta in Cambodia” conducted by Nikken in 2014, it was proven that the time prevalence of diarrhea was 56.5% lower for households provided with Clinca 205 and appropriate education than that for controlled households provided with none of the above.

The results of this study in Cambodia cannot be directly applied to the case in Vietnam, however, given climatic and geographical similarities, can be referenced to some extent.

## Reduction in Energy and Insurance Costs

Whether Clinca 205 would contribute to the reduction of expenditure including energy and insurance costs depends on variables such as the actual level of usage of purified water, degree of contamination of raw water and so on. Unfortunately, the Study was not able to prove this aspect and such research would require further examination during another feasibility study, if such an opportunity arises.

# Chapter 9 Possibility of Aligning with Other JICA Projects

## 9.1 Grassroots Technical Cooperation

JICA provides grassroots technical cooperation programs which aim at promoting community-based development assistance conducted by Japanese NGOs, universities, local government and public interest corporations. For example, in Vietnam, “Community Participatory Project to Improve Public Health and Access to Clean Water” and “Project to Promote Understanding on the Necessity of Improving Water Environment in Hanoi” have been carried out as grassroots programs to date.

In the case of Clinca 205, it is possible to align with JICA’s grassroots technical assistance to further promote the dissemination of water treatment systems in rural communities currently carried out by NUSA and Shiny.

## 9.2 International Emergency Assistance

In order to assist the rebuilding effort of disaster-affected areas, JICA provides 8 emergency goods including tents, sleeping pads, plastic sheets, blankets, water tanks, water purifiers and electricity generators. These items are distributed in accordance with the needs of the victims of such catastrophes. Recently the Agency provided water tanks, polyethylene tanks, electricity generators and cord reels to Vietnam in response to the flood disaster in the Mekong Delta which took place in September 2011.

As discussed in the forgoing section, Nikken has already been in talks with Nippon Foundation to dispatch Clinca 205 (in the form of a water treatment system tailor made to rural communities) as emergency goods to Myanmar. As to a sand bag type, on the other hand, Nikken has started negotiations with Nippon Foundation and international NGOs including Plan on the delivery schedule. In view of these developments, it is expected that Clinca 205 could contribute to JICA in promoting the effectiveness of its emergency assistance program.