# Assessing the Impact of Improved Sanitation on the Health and Happiness of a West African Local Population: Concepts and Research Methodology

**Taro YAMAUCHI[1] and Naoyuki FUNAMIZU[2]**

[1] Faculty of Health Sciences, Hokkaido University, Japan.

[2] Research Institute for Humanity and Nature, Japan.

## Abstract

Worldwide, nearly 90% of child deaths due to diarrhea have been attributed to unsafe water, inadequate sanitation, and poor hygiene. Furthermore, in developing countries, 2.5 billion people still lack access to improved sanitation facilities. In a collaborative project between Japan and Burkina Faso (Améli-Eaur Project, 2010–2015), we have installed composting toilets in pilot households in three rural villages near Ouagadougou, the capital city of Burkina Faso. For local farmers, we have promoted a breakthrough agro-sanitation business model that involves using fertilizer in human excreta form to grow vegetables for sale in the local market. In the next step, we intend to assess the composting toilet's impact on the local population's health and quality of life (QOL). We will conduct a comparison survey of households and villages where composting toilets have and have not been installed. The survey will cover the following three topics: (1) Lifestyle and Water Use; (2) Health and Nutrition; and (3) Happiness and Well-Being. We hope to demonstrate that improvements in health and QOL are crucial to the success and sustainability of composting toilet sanitation programs implemented in local West African communities.

*Keywords: Basic human needs (BHN); Happiness; Health and nutrition; Improved sanitation; Quality of life (QOL)*

## Introduction

Worldwide, nearly 90% of child deaths due to diarrhea have been attributed to unsafe water, inadequate sanitation, and poor hygiene. The United Nations Millennium Development Goals (MDGs) aim to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation" (Target 7. C) (UN 2000). The proportion of people using an improved water source rose from 76% in 1990 to 89% in 2010. Thus, from 1990 to 2010, over 240,000 people a day gained access to improved sanitation facilities. However, 2.5 billion people in developing countries still lack access to improved sanitation facilities, and over 40% of all people without improved drinking water live in Sub-Saharan Africa. In a collaborative project between Japan and Burkina Faso (*Améli-Eaur* Project 2010–2015), we have installed composting toilets in pilot households in three rural villages near Ouagadougou, the capital city of Burkina Faso (Yabui et al. 2012). Additionally, we have provided a breakthrough agro-sanitation business model to local farmers; this involves using human excreta as a fertilizer to grow vegetables that can be sold in local markets (Ushijima et al. 2014). The main achievements of the project are as follows:

1) Based on material flow and value chain analyses, we conceived a business model to create value from sanitation mechanisms in rural Burkina Faso and evaluated its feasibility by performing a simulation.
2) We developed technological elements (e.g., composting toilets, gray water treatment equipment, and

technologies for agricultural use), performed a demonstration at a pilot site, and implemented at least one cycle of kaizen improvement.

3) We conducted a cultivation test using gray water, urine, and composts and predicted the yield and revenues that will be produced as a result of agro-sanitation.

In the next step, we intend to assess the impact of the composting toilets on the local population's health and quality of life (QOL) because although we intend to support the area's economic development, we believe that improvements in people's health are also necessary if composting toilets are to prevail and the sanitation system is to be sustainable. This article introduces the framework and methodologies that will be employed by us in assessing the project's impact on the local population's health.

### Social needs in Burkina Faso

As in other Sub-Saharan countries, 43.9% of Burkina Faso's population exists in dire poverty (2009). Agriculture is the nation's primary industry; however, for the past 50 years we have witnessed serious challenges such as decreased rainfall (15–30%), the isohyetal line's southward shift by about 200km, and prolonged drought. A steady supply of safe drinking water and more widespread use of sanitation facilities are one of the Millennium Development Goals (MDGs). In Burkina Faso, however, the percentage of the rural population with access to appropriate sanitation facilities (toilets) is still extremely low at less than 1% (14% in urban areas) (Ministry of Agriculture and Hydraulics 2010). For this reason, the mortality rate for children aged five and under is unusually high at 98/1000 (compared to 3/1000 in Japan), with waterborne diseases such as diarrhea accounting for 14% of the child mortality rate (WHO 2014).

Given this situation, the Burkina Faso government formulated the National Program on Drinking Water Supply and Sanitation (PN-AEPA 2015) in 2006. Nonetheless, the growth of sanitation facilities in rural areas has so far progressed very slowly, and enhancing its growth has been a formidable national challenge. At the root of this problem lies the fact that the country is also confronting inadequate financial power and a lack of capacity for program management in the bureaucratic sector in charge of public health for rural communities (PN-AEPA 2015). Introduction of sanitation facilities is listed as a promotional focus in Burkina Faso's Strategy for Accelerated Growth and Sustainable Development (SCADD), established in 2010. In addition, procurement of clean water and sanitation facilities has been recognized as an important challenge in the nation's next AEPA five-year plan (2015–2020) in accordance with the Sustainable Development Goals (SDGs) following the United Nations' MDGs.

## 1. Concepts and Discussion

We will conduct a comparison survey of households and villages where composting toilets have and have not been introduced. The survey aims to analyze the following three main topics: (1) Lifestyle and Water Use, (2) Health and Nutrition, and (3) Happiness and Well-Being (Figure 1). Next, we plan to build a three-dimensional, sustainable model of a Sanitation Value Chain in which four elements—agricultural production, household income, food and nutrition, and health—spin around the axis of Happiness (Basic Human Needs: BHN and Quality of Life: QOL) (Figure 2). In the following sections, each of these concepts and elements will be explained in turn.

### Lifestyle and water use

A time-allocation survey will be conducted to quantitatively examine the behavioral patterns of adults and

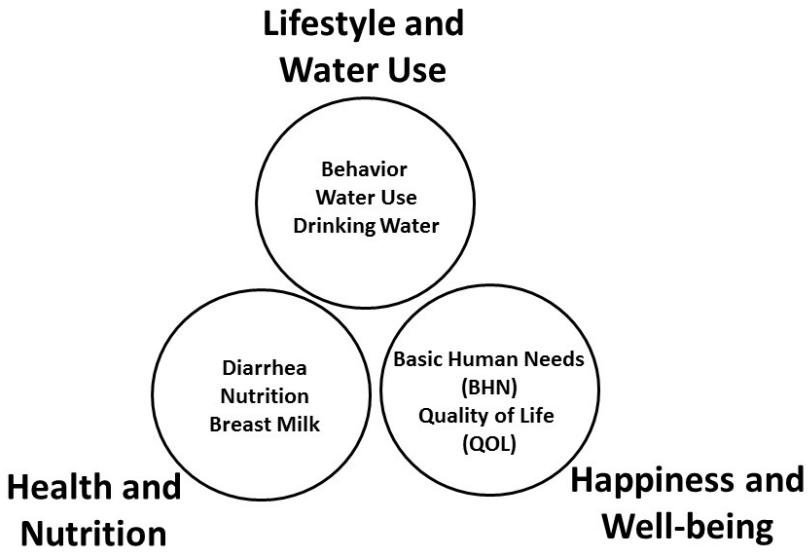


**Figure 1. Research framework.**

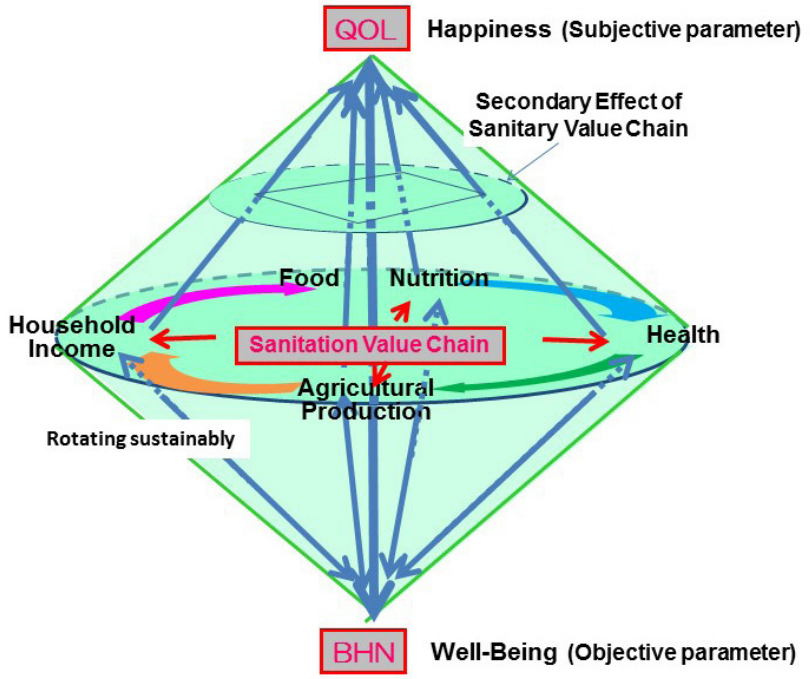


**Figure 2. Sanitation Value Chain—Happiness Spinning-Top Model.**

children, particularly with regard to water use in daily life and subsistence activities. Two types of observation methods will be used: "continuous observation of a particular individual" and "checking a particular spot at regular intervals" (Suda 1994). Information concerning the procurement and usage of water, including how drinking water is obtained, how much time is spent procuring it, how much physical effort is expended in the procurement process, and in which places water is available for washing, bathing, drinking, and toilet-related activities, will be collected. In addition to these aspects of water use in daily life, water use in subsistence

activities such as agriculture will also be examined.

### Health and nutrition

Diarrhea is a leading killer of the world's youngest children, accounting for 11% of deaths worldwide among children under the age of five years (UNICEF 2012). This toll is highly concentrated in the poorest regions and countries and among the most disadvantaged children within these societies. Nearly 90% of deaths due to diarrhea occur in Sub-Saharan Africa and South Asia. Exclusive breastfeeding during the initial six months of life is one of the most cost-effective child survival interventions and greatly reduces the risk of death due to diarrhea among young infants (UNICEF 2012). Optimal breastfeeding practices are vital in reducing the morbidity and mortality rates due to diarrhea. Our research will focus on children's health and nutrition. Because children are the most vulnerable members of a population, examining their health status can teach us not only about the health of the children themselves but also about that of the whole population. We will conduct a survey concerning the following points: (1) the incidence of diarrhea in children and (2) the adequacy of nutrition among mothers and children.

### Happiness and well-being

The ultimate goal of development is human happiness (Schneider 1995). Happiness is a noble goal for everyone on earth, and furthermore, if economic development projects are to be sustainable, they must take local people's happiness into account. A report by the Club of Rome answered the question, "What is human happiness?" The report mentioned constant interplay between two levels—the individual level and the social level. Furthermore, human happiness consists of "Happiness" that is a highly subjective and personal notion and "Well-Being" that is a relatively objective concept (Schneider 1995). We will apply the concepts of "Quality Of Life" (QOL) and "Basic Human Needs" (BHN) in examining human happiness as defined by the Club of Rome (Figure 3).

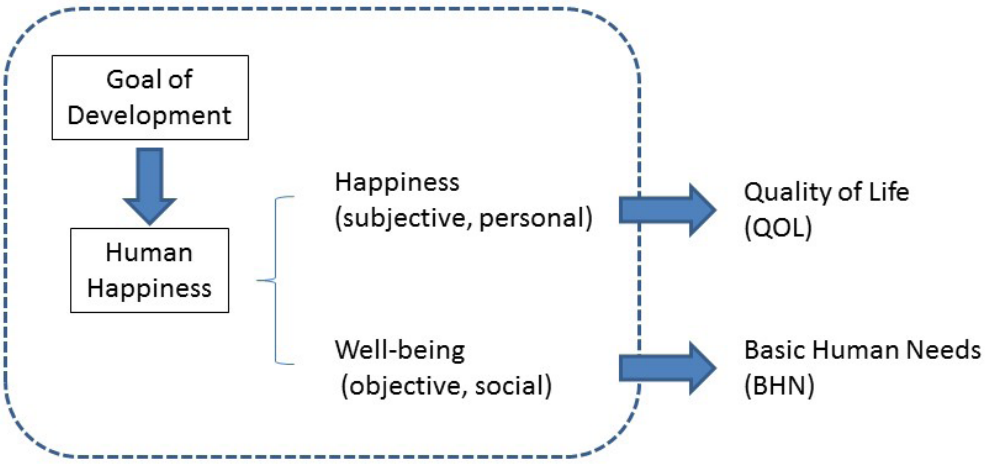


**Figure 3. Relationship among development, quality of life (QOL) and basic human needs (BHN).**

### Basic human needs (BHN)

The fulfillment of BHN is a development theory proposed since the latter half of the 1960s, and used as a means of distributing income to the poor propounded by the International Labor Organization (ILO) at the World

Employment Conference held in 1976 (ILO 1977). The following two interrelated categories are its main targets. The first category includes basic items to meet minimum personal consumption at home, including clothing, meals, and a place to live, with sufficient furniture and household goods. The second category includes public services supplied by the regional community, namely, safe drinking water, sanitation facilities, public transport, and educational facilities. As implied by its emphasis on the household, this is a bottom-up development theory, with people at its center, as opposed to a top-down economic growth strategy that presupposes the role of the state.

The attainment of BHN was originally proposed to eradicate poverty. However, if one considers various challenges associated with development, eradication of poverty is not necessarily the only goal. According to prior studies and activities focused on BHN such as UNDP's Human Development Index (HDI) and Multidimensional Poverty Index (MPI), indices for assessment can be classified into the following categories: "Standard of Living," "Knowledge," "Health," "Subsistence, Food, and Nutrition," and "Social and Politics" (Table 1).

**Table 1. Examples of indices for assessment of basic human needs (BHN).**

| |
|---|
| ***1. Standard of living*** |
| Employment, Income, Possession of goods, Food consumption, Housing, Sanitation, Energy |
| ***2. Knowledge*** |
| Literacy, Local Language, Education |
| ***3. Health*** |
| Safe Water, Health Service, Longevity, Infectious Disease, Disease and Injury, Nutrient Intake, Child Mortality, U-5 Nutritional Status |
| ***4. Subsistence, Food, and Nutrition*** |
| Food Availability, Garden, Natural Resource, Land Productivity, Labor Productivity, Livestock |
| ***5. Social and Politics*** |
| Women's Participation, Social Welfare, Political Stability, Crime, Security, War, Liberty, Justice, Equality |

## Quality of life (QOL)

The concept of QOL, as such, can be related to Aristotle of ancient Greece (Fayers and Marchin 2000). QOL, as used today, is a concept that arose in the post-World War II period. Active research has been conducted in the fields of medicine and public health in attempts to define, measure, and evaluate QOL. This is often called health-related QOL (HRQOL). However, using only the narrow definition of QOL (HRQOL) is inadequate, especially considering community residents' QOL in the process of development; hence, we need a broader definition on the concept of QOL. Metaphysical matters should also be comprehensively taken into account, for instance, values like motivation and happiness in one's life, as well as religion and faith. Among many different methods of QOL evaluation and questionnaires developed in various fields, this project selected and implemented the WHOQOL (simplified version WHOQOL-BREF, Table 2), a questionnaire developed in recent years by the World Health Organization (WHO 1996).

Two reasons for using WHOQOL are, first, its approach to attempting to gain a holistic understanding of many events related to an individual's personal life, rather than just a measurement of a certain function of, or

damage to, the human body or some disease's instrumental impact. In this respect, WHOQOL differs from many other QOL evaluation questionnaires whose application is limited to the medical category. Second, WHOQOL aims to enable international and intercultural comparisons of QOL data. QOL questionnaires have been mainly developed in Western countries, but each country targeted only its own domestic population. WHOQOL was instead developed based on the belief that previous questionnaires had not been well designed in terms of applicability to populations from diverse nations and regions of the world (Yamauchi et al. 2010).

**Table 2. WHOQOL-BREF.**

| **Domain and questions** |
|---|
| *Overall Quality of Life and General Health* |
| How would you rate your quality of life? |
| How satisfied are you with your health? |
| *Domain 1: Physical Health* |
| To what extent do you feel that physical pain prevents you from doing what you need to do? |
| How much do you need any medical treatment to function in your daily life? |
| Do you have enough energy for everyday life? |
| How well are you able to get around? |
| How satisfied are you with your sleep? |
| How satisfied are you with your ability to perform your daily living activities? |
| How satisfied are you with your capacity for work? |
| *Domain 2: Psychological* |
| How much do you enjoy life? |
| To what extent do you feel your life to be meaningful? |
| How well are you able to concentrate? |
| Are you able to accept your bodily appearance? |
| How satisfied are you with yourself? |
| How often do you have negative feelings such as blue mood, despair, anxiety, depression? |
| *Domain 3: Social relationships* |
| How satisfied are you with your personal relationships? |
| How satisfied are you with your sex life? |
| How satisfied are with the support you get from your friends? |
| *Domain 4: Environment* |
| How safe do you feel in your daily life? |
| How healthy is your physical environment? |
| Have you enough money to meet your needs? |
| How available to you is the information that you need in your daily-to-day life? |
| To what extent do you have the opportunity for leisure activities? |
| How satisfied are you with the condition of your living place? |
| How satisfied are you with your access to health services? |
| How satisfied are you with your transport? |

### Sanitation-happiness integrated model

This project's fundamental concept lies in the creation of value through construction of a sanitation value chain. Rather than emphasizing economic loss due to insufficient sanitation facilities, as was often previously claimed, this concept focuses on the creation of a value chain comprising various entities relating to sanitation, including its users. As a model, this concept addresses its ability to generate diverse benefits of return to each entity. Specifically, this model inspires an image of a rotating chain of four elements—agricultural production, household income, food and nutrition, and health. Moreover, the model introduces happiness as a new perspective to ensure sustainability of the model's functionality. Specifically, the BHN (social welfare, objective parameters) and QOL (personal happiness, subjective parameters) axis is defined to provide a panoramic view of the value chain model, that is, an inclusive three-dimensional spinning top model is constructed so that the value chain model will continue to spin around this central axis in a sustainable manner (Figure 2).

## Conclusion

In Burkina Faso, our project's goal is to improve the local population's health and QOL. We have already installed composting toilets in pilot households and have begun implementing a new agro-sanitation business model in rural villages. Furthermore, we aim to assess improved sanitation's impact on the local population's health and QOL. We will also be conducting field surveys assessing the lifestyles, health, and happiness of the local population. We intend to prove that besides economic development, improvements in health and QOL are extremely important to the success and sustainability of composting toilet sanitation programs implemented in local communities in developing countries.

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