

The Benefits of Improved Water Supply: Lessons learned from Sri Lanka

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Abstract: The main objective of the study was identifying the benefits of improved water supply on households in Sri Lanka. The study area was selected based on the data provided by the National Water Supply and Drainage Board in Sri Lanka. In this study, we have employed the purposive sampling method to select the households. To understand the benefits experienced by households through piped water, mainly a structured survey questionnaire was provided to gather relevant information. Further focus group discussions and in-depth interviews were conducted with selected households by the researcher.

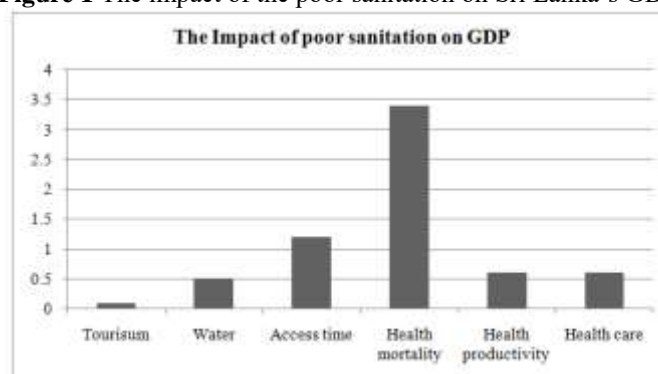
A closer look at the benefits of the improved water supply on households shows that the reduction in workloads and time spent to fetch water is a remarkable advantage that in turn to be readily transformed into enhanced economic opportunities. This study clearly shows that an appropriate institutional support was given with an easy access to resources; like water rural women have the ability to sustain their household economy participating at productive activities.

Keywords: Benefits, Improved water supply, Households

I. Introduction

Water is essentially a crucial factor for the survival of all human beings, living beings and also the economic development of a country. The definition of economic development provided by Professor Todaro and Smith (2012) [1] is an increase in living conditions, improvement of the citizens' self-esteem needs and a free and just society. Therefore, the provision of adequate supply of water to people living in urban and rural areas has been of much prominence both in developed and developing countries in the world for economic development. For instance, developing countries supply water for drinking in addition to sanitary purposes with the intention of the improvement of the health sector reducing incidents of the spread of water-borne diseases and epidemics such as diarrhea, cholera. Thus, the supply of purified water on one hand reduces the mortality rate of the country and, on the other hand to increases the number of working days contributing to the Gross Domestic Product (GDP). Further, in the least developed countries, it is a strategic approach to manage the balance of payment and minimize the growing demand for the imported medicine in the third world countries as a result of the implementation of the gradual improvements to the standard of living caused by the natural growth and the rural-urban migration. The need of water for sanitary requirements is fundamental to all citizens, and the increased coverage and the supply of this essential service will significantly contribute to the welfare of the population and the wealth and the stability of a country. In an economic study conducted by the neighboring India, it has been identified that the impacts resulting from the poor sanitation and the hygiene cost 6.4% of its annual GDP in the economy of India. In the context of Sri Lankan Economy, the predicted impacts in the form of the poor sanitation and hygiene have cost 222 Billion Rupees (US\$ 2 billion) per year. Figure 01 reflects the adverse health effects associated with the poor sanitation and the water supply on health mortality, the costs incurred for the health related issues including treatments, the decline in the productivity when the family members have to care for the victims, the time spent to access services, water pollution, and the adverse impacts on tourism.

Figure 1 The impact of the poor sanitation on Sri Lanka's GDP



Source: Performance report – 2011- Ministry of Water Supply and Drainage

Child mortality is identified as an important contributor to this expenditure: the WHO estimates that diarrheal diseases have caused the deaths of around 200 children under five years old in Sri Lanka in 2008. The indirect effects of Malnutrition to which poor water facilities and sanitation gives a 50% contribution according to WHO, has been the root cause for the loss of many other lives. Malnutrition too plays a significant role in Sri Lanka, as evidenced by high rates of moderate and severe stunting and underweight in children under five: 18% and 15%, respectively. Further, Studies have shown that malnutrition leads to lower school and work productivity as its inherent nature to impair the cognitive function and the learning capacity (Performance report 2011)[2].

Based on the information collected from the National Water Supply and Drainage Board (NWSDB), the most popular existing water supply source is ground water from the well to a large extent. The present drinking water supply coverage in Sri Lanka is estimated to be 78%. Out of this, 35% of the population enjoys piped borne water. The balance 43% relies on sources such as dug wells, tube wells, spring and rain water harvesting. 12% of the population uses the hand pump tube wells as another alternative. Government has targeted to increase the coverage with pipe borne water to 45.7% by 2015 in line with the United Nations Millennium Development Goal: 85% safe drinking water coverage. People in the areas where there is no sufficient main water resource generally depend on the multiple water sources to meet their daily water requirements. In most of the cases, these sources are private wells, common wells, tube wells, rivers/lakes and other sources. The most popular drinking and cooking water source both in rigid and wet zones is the common wells and the private wells in sequence. Based on this background we have developed the objectives of the study as follows.

Main objective of the study is to examine the benefits of improved water supply on households in Central province in Sri Lanka. In the study we consider piped water supply as improved water supply in the study area. We measured benefits as increased opportunities of the people, time saving, decrease workload, reduced health cost due to piped water supply.

The rest of the paper is organized as follows: Section 2 discusses the empirical literature and section 3 reports the results of the study. This part is composed of two subsections: the first discusses briefly the characteristics of the household and the second part present empirical result of the study. Finally, section 4 concludes the paper.

II. Literature Review

In the urban and industrialized areas of the developing world, the access to clean and plentiful water is regarded universal and approximately equitable. Rural areas in particular find it difficult to access to water and for them it is more problematic, differentiated, and less secure.

Feenberg and Mills (1980)[3] showed that water quality provides two types of economic benefits, withdrawal benefits, and instream benefits. Withdrawal benefits include household drinking, cooking, washing, and cleaning and domestic use benefits, agricultural irrigation and livestock watering benefits, and industry process water benefits. Instream benefits which are the benefits of water quality arising from water left “in the stream” and not withdrawn. It includes two subcategories: use benefits and nonuse benefits. Instream use benefits include swimming, boating, and sport-fishing benefits—benefits associated with direct human interaction with water in the stream/river. Other instream use benefits include the esthetic value of water quality that may accrue to nearby picnickers, streamside trail hikers, and streamside property owners.

In the literature review, it is intended to discuss how the provision of improved access to clean water supply to rural communities as a development intervention may contribute to improve the health and educational options for girls, as the empowerment of women. It is a known fact that a large number of women still spend substantial portion from their precious timeto carry domestic water for the family and livestock. Water collection reduces the time to work and wastes human energy due for income-generating activities and hence, considers as a drain on household labor resources (Kamminga 1991)[4]. Specially, rural women in low-income countries spend a large part of their working hours to fetch water. In a study based on Africa, it has been revealed that a typical woman spends 1 to 4 hours per day on water transport from distant location (Barwell, 1996)[5]. In Ghana, it has been estimated that rural men spent one third of the time and one quarter of the energy to carry water.

According to the United Nations Economic and Social Council (ECOSOC 2009)[6], the lack of safe drinking water and poor sanitation practices are the major factors that affect poor health conditions in many developing countries. It also records that 470,000 deaths of the annual death toll could easily reduce if they were provided an access to safe water. Studies undertaken in developing countries have too emphasized that the provision of safe drinking water and sanitation result a significant reduction in child mortality and diseases such as diarrhea, and cholera. The average time spent to fetch water is an important measurement of the level of efficiency of rural water supply within the rural population. In developing countries, women and girls spend a considerable amount of time daily to collect water from different water sources. As reported by UNPF

(2001)[7], women in low- income countries walk an average of 6 kilometers every day to collect drinking water. And at the same time, it has been found that, this situation differs from country to country. In Cameroun, an average of 6 hours per day is spent by women (NISC, 2004)[8] whereas in Kenya, it is approximately 4 hours in dry season and 2 hours in wet season. Averages of 4-6 hours have been estimated in Burkina Faso, Botswana and Ivory Coast. About 17 hours a week has been reported for Senegal (UN, 2000)[9]. In general, the average loss of time of children and women in search of water in a day is 200 million hours.

In the meantime, there is a possibility to use the time spent for search for water for economic activities that generate financial benefits to the poor rural families. According to Whittington, et al. (1990)[10] a study in Kenya among rural dwellers of Ukanda has indicated that households in the village put a surprisingly high value on the time they spend collecting water. Coasta, et al. (2009)[11] a study in Ghana has found that the time spent on remunerated job increases when households are provided with electricity and the supply of water. According to David and Inocencio (1998)[12], poor access to water is an indicator of less involvement of women and children in income generating economic activities, as they spend more time caring for their sick children and relatives due to unhygienic living standard. Lack of proper access to water and the amount of time spent collecting water may also lead to female child illiteracy and perpetration of female poverty. It is added that by now, 2/3 of illiterates in the world are women (UN, 2000)[9].

One of the main measures to resolve the issue of time wastage in water resource management is the improving access to water. According to World Bank (2003)[13], Morocco, with the introduction of water projects has been able to successfully reduced the time spent for the collection of water by girls and women by between 50-90%.The project has also increased the female attendance in schools by 20% within four years. A study in India has reported that the combining improvement in access to water supply with income generating projects for women results in higher income for women and improved status of women in India (Verhagen, et. al. 2004;[14]Sijbesma, et. al. 2009[15]). Saskia (2008)[16] has observed that the accessibility to water improves female health, increased dignity, less exposure to both gender related hazards and water borne diseases. It has also increases the school attendance and performance of female children. An important feature of the studies of water supply and demand at the household level is that it is always complex and their results are unique and cannot be readily applied for any other area.

Women and girls in rural parts of eastern Africa spend a considerable amount of their day travelling long distances to collect water from unsafe sources and carrying heavy jerry cans back to their families. Their journey through dark, unsafe environments exposes them to threats of violence, sexual abuse and other health hazards. Further, there is no alternative for them as fetching water is one of the main domestic roles of 'women's work' and primarily allocated to girls and women. The long hours spent for water collection reduces the amount of time spent on education, income generation and other productive activities (Empowering women and girls-Eastern Africa2012)[17].

Collection of water is a main activity of the work of women in rural areas of the global south. There is little systematic research and data on this area, but according to available evidence from African and Asia reports, the time spent to fetch water is significant. In Senegal, women spend 17.5 hours per week to collect water. In Mozambique, they spend 15.3 hours per week in the dry season. In the Baroda region of India, women spend 7 hours per week. Observations from Nepal indicates that the important role of female children in the collection of water, with girls of 10 and over devoting almost 5 hours per week to the task (U N 2000)[9]. In Bangladesh, women and girls have been found to walk between 2 and 5 hours each day to fetch water (Shamim and Salahuddin 1994)[18].

Kahinda et al. (2007)[19] pointed out that water plays an important role in economic growth by increasing the assurance of supply of water, enhancing water quality and human health conditions. Research conducted by Sijbesma et al. (2009) [15] emphasized that potential economic benefit of improved water supply. Further the researches have explained that especially women get access to improved water supply, the decrease in water collection time and their energy could be transformed into economic activities. It can be seen that considerable increase in their family income. The study examined (Ifabivi et al. -2010)[20] productive time of women and water supply in Nigeria. They pointed out that water use characteristics at the household level differ from place to place while they revealed that improved access to water will support to young girls to reduce their workload and they allowed to go to school. Further they could use their additional time for productive activities.

Reducing time spent to fetch water creates an important opportunity to free them to use their time and energy for productive and economic activities. Barwell, (1996)[5] has showed with evidence that "the labor resources released by reducing the transport burden of women would be reallocated to beneficial reproductive or productive activities". Malmberg (1994)[21] indicates a number of examples to show how women have used the time they saved through better transport systems to other economic activities: food production, childcare, nutrition, hygiene and health, and enhance the participation of women and girls in education and income generating activities, as well as their labor productivity. Reducing the women time spend on collecting water could, hence, unlock the productive potential of women's time and energy.

Literature on the analysis of the health impact indicates correlations between the behavioral change and the exclusive use of clean water, sanitation and proximity of the water resource. Suitable domestic and personal hygiene are influenced by the quantity of water used, which is determined, in turn, by the distance to the improved source. In fact, it has also been pointed out that communities were more likely to use the new water system if it is closer than the older one. In Mali, researchers have found that children who exclusively used water from an improved source had a lower diarrheal prevalence level than those who relied on a spring or stream water sources (Esrey et al. 1988,[22] 1991[23]; Carter et al. 1999[24]Checkley et al. 2004[25]).

Tay (2005)[26] has also showed a clear relationship between the health of children and their school performance. Worm infestation is known to affect the child’s concentration in class, and the absence of water supply and sanitation often impede children’s education. Every year, about 443 million school days are lost as a result of water and sanitation related diseases. In many cases, the effects of lack of access to clean water victimizes generations of children in a cycle of poverty, as the lack of clean water causes ill health, which results in lost education and finally, poverty in adulthood (UNDP 2006)[27].

Women are primarily responsible for the collection of household water requirement and have to spend a significant amount of time and energy for it. It is believed that women in sub-Saharan Africa spend about four hours per day on water errands (Momsen 2004)[28] . For women, collecting water could have been a time spending undertaking and a relatively more rewarding activity, meanwhile for girls, it could mean sacrificing critical school hours (Ivens 2008)[29]. Studies on the impacts of the water projects on women in developing countries such as India, Indonesia, Kenya, Nepal, Zambia and Pakistan demonstrate that women’s socioeconomic conditions can be enhanced when they receive access to improved safe water (GWA, 2003)[30].

Abebaw et al. (2011)[31] examines the sources of drinking water used by people in remote rural localities in Ethiopia and whether access to an improved water supply has increased the level of satisfaction of the users with quality and availability. The empirical data have also been collected in this regard from a random sample of 1,117 rural households residing in eight districts from seven regions of the country. Here, the researchers have employed the univariateprobit model and the bivariate probit model to explain the effect of access to an improved water source on user satisfaction with the quality and availability of water. The regression results have revealed that the improved water sources have increased user satisfaction with both quality and quantity of drinking water. An important feature of the studies of water supply and demand at the household level is that it is always complex and it seems impractical to use the conclusions thus arrived at to interrupt with other areas and other countries. Hence, this paper particularly focuses on the study of the pattern of the water supply and the productive time of households in the central province in Sri Lanka.

III. Method

Sample: The study area was selected based on the data provided by the National Water Supply and Drainage Board regional support center in Kandy, Sri Lanka. In this study, we have employed the purposive sampling method to select the households from the following areas; Ihagama, Muthukeliya, Hedeniya and Dibulkubura in North Kandy, Central Province in Sri Lanka during the period of September 2015 to October 2015. In the selection of the households the information provided by regional water supply office in Poojapitiya were used. 53 households situated in the above areas were selected for data collection. To understand the benefits experienced by households through piped water, mainly a structured survey questionnaire was provided to gather relevant information. Further focus group discussions and in-depth interviews were conducted with selected households by the researcher.

Background Information of the Respondents: As presented in Tables 1, there are 58.5% female respondents and 41.5% male. Out of 53 selected respondents, 20 respondents are in the age limit between 40 and 49; and only the 4 respondents are between 18 and 29. Most of the respondents have completed their studies up to Advanced Level Education (84.9%), while the lowest numbers of respondents have completed their studies up to the ordinary level (3.8%). Out of 53 respondents, 06 respondents have higher level of education. By the size of the family, the majority belongs to 1 to 4 member family which is (77.4%) and 22.6% are in families above five members.

Table 1 Demographic Profile of the Respondents

| Variable | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------------|-----------|---------|---------------|--------------------|
| Gender | | | | |
| Male | 22 | 41.5 | 41.5 | 41.5 |
| Female | 31 | 58.5 | 58.5 | 100.0 |
| Total | 53 | 100.0 | 100.0 | |
| Age | | | | |
| 18 – 29 | 4 | 7.5 | 7.5 | 7.5 |
| 30 – 39 | 12 | 22.6 | 22.6 | 30.2 |
| 40 – 49 | 20 | 37.7 | 37.7 | 67.9 |

| | | | | |
|----------------------------|----|-------|-------|-------|
| 50 + | 17 | 32.1 | 32.1 | 100.0 |
| Total | 53 | 100.0 | 100.0 | |
| Education | | | | |
| Ordinary Level | 2 | 3.8 | 3.8 | 3.8 |
| Advanced Level | 45 | 84.9 | 84.9 | 88.7 |
| Higher (Degree or Diploma) | 6 | 11.3 | 11.3 | 100.0 |
| Total | 53 | 100.0 | 100.0 | |
| Family Size | | | | |
| 1- 4 | 41 | 77.4 | 77.4 | 77.4 |
| 5 and above | 12 | 22.6 | 22.6 | 100.0 |
| Total | 53 | 100.0 | 100.0 | |

Source : Author compiled based on survey data

Most of the residents from Ihagama, Muthukeliya, Hedeniya and Dibulkubura areas are daily wage earners who supplement their income with odd jobs and agriculture. Of the 50 household heads, 20 (40%) are permanent workers in the private or government sector. 08 are self-employed. 04 are on their retirement drawing a pension for their previous employment. 07 person are daily wage earners which to a great extent includes Mesons and Salesman. According to the survey data, only a few spouses are involved in permanent jobs and the majority (61%) is housewives. They are engaged in day-to-day activities entrusted on them in houses. They spend more time for cooking and take care of children.

IV. Results

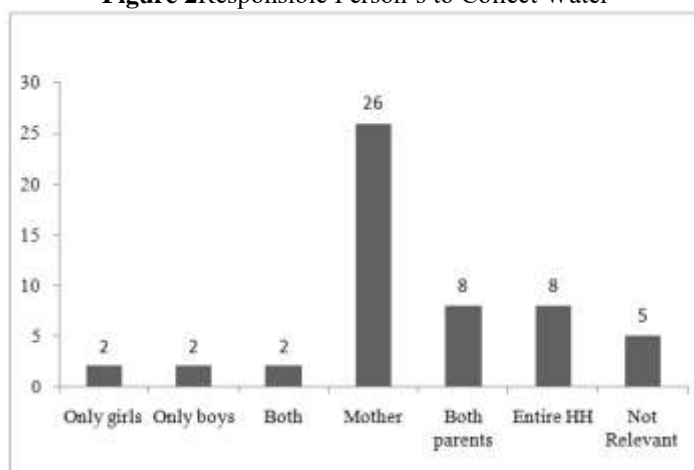
Main objective of the study is to examine the benefits of the improved water supply on the households in Central province in Sri Lanka. The researcher has collected data through a self-administered questionnaire. The important information collected through the questionnaires and the characteristics of the sample subject to observation are discussed below. Collected data indicate, prior to the supply of the tap water, the majority of the respondents are using their own well to collect water for their necessities. When water in their own well is not sufficient, they have used boreholes also. Five households are using the common well and the boreholes to collect water. The Table 2 shows the distance from their houses to water collection point. Since personal wells are very in close proximity (less than 1 km), they spend less time on collection water.

Table 2 Distance from House to Water Collection Point (Kilometers)

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|-----------|---------|---------------|--------------------|
| Very close | 44 | 83.0 | 83.0 | 83.0 |
| 1-5 | 3 | 5.7 | 5.7 | 88.7 |
| 6 – 10 | 1 | 1.9 | 1.9 | 90.6 |
| Not Relevant (Own electric water motor) | 5 | 9.4 | 9.4 | 100.0 |
| Total | 53 | 100.0 | 100.0 | |

As in the Figure 2, in most of the cases, it is mothers who dedicate their time to collect water. Even in this sample, the total respondents are 26 and equal to 50%. In eight households, both father and mother share their time to collect water. Only in six households, children were responsible to collect water for their needs at the house.

Figure 2 Responsible Person's to Collect Water



The Table 3 is an indication of the number of the trips of each household undertaken within one day to go to collect water from the different sources and it is notable that, this depends upon the sizes of their family and their requirements. Majority of the households collect water 3-6 times per day which is equal to the 72%. Furthermore, it shows that this question does not bare any relevancy with respect to five households as they have a supply of water pumped through their own well.

Table 3 Number of trips per Day

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|-----------|---------|---------------|--------------------|
| Less than 3 | 6 | 11.3 | 11.3 | 11.3 |
| 3 – 6 | 38 | 71.7 | 71.7 | 83.0 |
| More than 6 | 4 | 7.5 | 7.5 | 90.5 |
| Not Relevant | 5 | 9.5 | 9.5 | 100.0 |
| Total | 53 | 100.0 | 100.0 | |

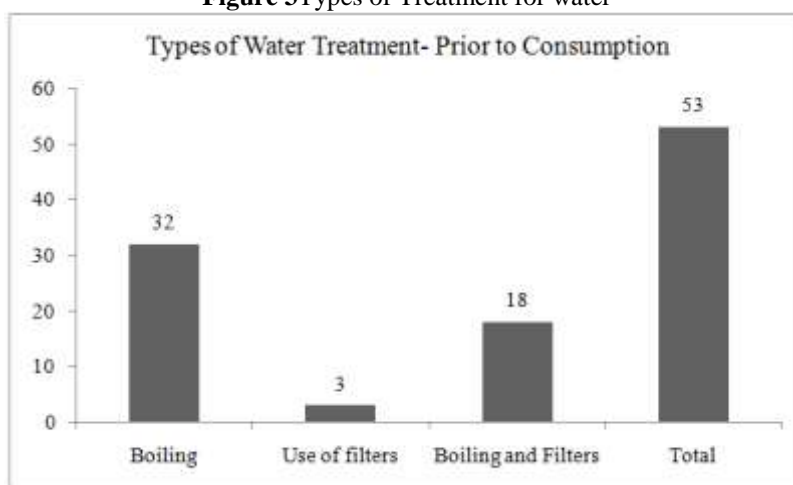
The following Table 4 indicates that the purposes of the use of piped water in households. Majority of the people use piped water for all the necessities. Though they use piped water for drinking purposes, they are still with the opinion that they are not satisfied with its quality for drinking. The main reason for this is the available chlorine level.

Table 4 Purposes of the use of Piped Water

| | Frequency | Percent | Cumulative Percent |
|---|-----------|---------|--------------------|
| Drinking and Cooking | 2 | 4.2 | 4.2 |
| Drinking, Cooking, Washing and Cleaning | 46 | 95.8 | 100 |
| Total | 48 | 100 | |

According to Figure 3, the majority of the people in the study area do not use the piped water as it is. They use some treatment methods to clean the water before drinking. They believe that the chlorine level in the water they receive is high and is not suitable for drinking.

Figure 3Types of Treatment for water



As most of the natural water sources are dried up during the dry season, the majority of the respondents rely on piped water. Out of 53 respondents, 50 (94%) respondents agree that piped water is more reliable than the other water collection sources in this area. It is interesting to note that any significant seasonal variation (dry and rain) in terms of access to improved water source is not identified. A household is considered to have an access to an improved water source if it gets drinking water primarily from a private standpipe, a public standpipe, a protected spring, and a dug well with a pump. Sources such as rivers, lakes, ponds, and unprotected wells are regarded as unimproved water sources.

In an attempt made by the Researcher to find out the other sources reliable when the tap water is not adequate to satisfy their water requirement, it was found that for most of the respondents the borehole is more reliable than the other sources. Second important source is neighbours' well in this regard. According to the respondents' view, the safest source of water is the borehole water the quality of the borehole water is higher than the other sources as revealed by the respondents.

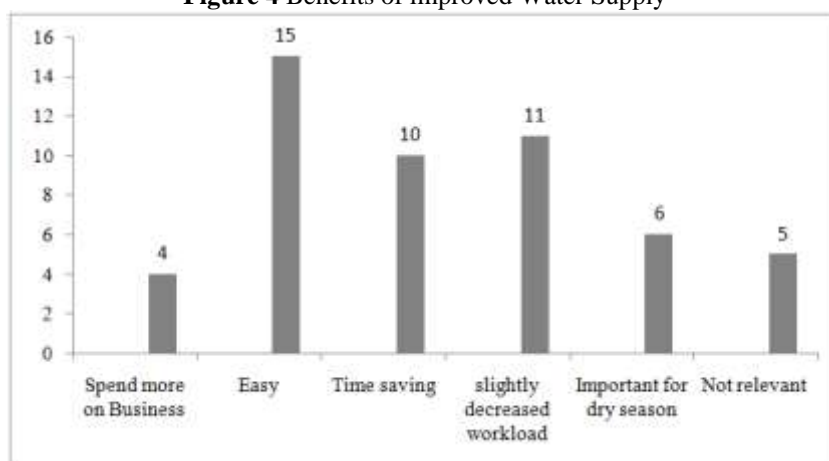
Table 5 demonstrates the results of the reliability tests by which the Cronbach's alpha reliability coefficient is taken for all variables. All of the items are above 0.70 and considered acceptable for this study. Essentially, all of the coefficients obtained for all questions examined under the Likert Scale are reliable. Further results shows that, when the households apply to get the piped water supply (Improved water), they consider the initial cost as an important factor as it is considerably high. The least important factor is the seasonal reliability.

Table 5 Reliability Statistics

| Item | Cronbach's Alpha if Item Deleted |
|----------------------|----------------------------------|
| Initial cost | 0.96 |
| Water quality | 0.71 |
| Seasonal reliability | 0.75 |

Figure 4 reports the attitudes of women towards the benefits of improved water supply. Most of the women in the study area are housewives. Their main role is to carry out their day to day activities. Because of this reason, their main benefit they get through improved water supply is that it is easy to access. At the same time, they emphasised that, when they have an improved water supply, they get more time to spend with their family members and dedicate for their requirements than before.

Figure 4 Benefits of improved Water Supply



This suggests that there is no direct impact on the productivity level of the women despite some indirect benefits through the improved water supply. The majority of the women have agreed that they can spend more time on children care and education. In addition to that, they believe that, when the quality of the water is high, it prevents water borne diseases too. Most of the housewives expect to devote their time to start a small business and generate an income. Therefore, it is obvious that an improved water supply creates positive effects on the welfare and the health of the family units. The next section presents the results of in-depth interviews of three families in the research area.

Case Study 1: Gayani is a housewife with two children. She is a self-employer. She made hand bags especially for women. The family has a private well and collects water from it for drinking purposes. Few families close to their home also collect water from their well for drinking purpose. They face huge problem in the dry season because of limited water resource. According to her view they get benefits from piped water in numerous ways. After receiving the piped water supply, she is able to dedicate more time on her household works, self-employment and children's education. Now she made additional two bags per day than before and selling price of the bag is Rs. 350.00 (Exchange rate 1 US\$= Rs. 1.27 in 2015). The family use piped water for all purposes such as cleaning, bathing, cooking, etc... Because of that, she is able to save her time and she can spend that time for productive purposes as she is the main responsible person for household works in their family. Her husband is a mason bass. If they can find market for their products they can enhance their business and able to improve their living conditions.

Case Study 2: Kamala's family consist five members. Her mother also lives with their family. Both her mother and Kamala engage with a part-time job. They collect certain kind of flowers and tight up as a ten bundle and provide it to the collection centers. They also received piped water connection. Though initial cost of getting piped water supply is expensive, they applied for it because of easy for their household works. Kamala engages with some agricultural activities too. They also faced very difficult situation when dry season is started. After getting piped water supply, they feel that more comfortable than previous. They are able to get more

harvest from their farming. According to their views they felt that life is more comfortable and their income levels also better than previous.

Case Study 3: Wimala and Sunil both are farmers. Especially they grow different types of vegetables and fruits in their home garden. For their activities water is very important resource. They said that during the dry seasons their family income is very low due to low harvest from their farming. Before receiving the piped water they collect water from common well for drinking and especially for other purposes they collected water from boreholes. Both sources are not enough in dry season. They pointed out that after getting piped water supply it helps them in numerous ways to improve their living conditions. Especially they are able to continue their farming without trouble. At the same time, Wimala is the responsible person to collect water. Now she is able to devote more time for their family works, such as children's education, more time on farming and their health cost also lower than before because of clean water. Sunil reflects they can vastly improve their productivity, income and living conditions in their home garden, if they receive some level of guidance from the government or any other organization. Though they do farming, they have had no training on handling hazardous substances.

V. Conclusions And Recommendations

4.1 Conclusions

This is a special investigation into the benefits of the improved water supply of households in North Central Province. As, there seems to be less number of empirical analysis in this research area, in our observation, this study essentially contributes to the existing literature providing an empirical analysis of the benefits of improved water supply in Sri Lanka with special reference to the north-central province. A total of 53 households that covers the four sections of the study area were used for the research through focus group discussions, in-depth interviews and questionnaire survey. Benefits of the improved supply of water were measured using the additional income received by the productive use of time savings when such saved time is used as an opportunity for the economic use. A closer look at the benefits of the improved water supply shows that the reduction in workloads and time spent to fetch water is a remarkable advantage that in turn to be readily transformed into enhanced economic opportunities. Case studies carried at the global level reveal that water is used for productive activities such as agriculture, gardening, horticulture, livestock-raising, car-washing, arts, ice-making, brick-making, pottery and other small-scale commercial activities (Van Koppen et al., 2006)[32]. However, it is noted that there is a possibility of making the inhabitants of the households victims when the water collected for drinking from the open wells may reduce the cost incurred for health, and this again emphasizes the use of the improved water supply. Notably, there are some households who consider that the use of water from the tap line is an additional burden justifying the water from the pump is excessively chlorinated and "expensive". When household activities are concerned, women bear a greater responsibility with respect to all domestic chores and the welfare of the family. This is evident even from the study area in which collection of water has been an essential duty of woman and children. This result agrees with a previous work that women and children play dominant role in water collection globally (WBWDRT 1993[33]; Briscoe and DeFerranti, 1988)[34]. In most of the cases, it is women who income generate an additional income from different activities, control financial activities and, they are responsible for household expenditure. This clearly shows that an appropriate institutional support was given with an easy access to resources; rural women have the ability to sustain their household economy participating at productive activities. What is implied here is that, if they were provided by an improved water supply, it not only saves their time previously spent to collect water, reduces women's workload, but helps to generate an additional household income.

4.2 Recommendations

The paper recommends the need for the establishment of more public water points in the local government area in order to improve easy access to water supply which saves an extra time for productive activities in the community. Furthermore, it is recommended that government authorities are expected to take further measures towards the expansion of water supply system in the rural areas through various approaches such as the increase the number of stand pipes, boreholes etc. In this attempt, development of alternative sources of water should be encouraged. One such example is the popularization of rain water harvesting techniques as an extra source to fight against drought conditions. At the same time, it is expected that the government authorities to conduct awareness programs in the community to attract women direct for economic activities and get their maximum participation.

Acknowledgement

This study has been undertaken with the financial support of the University of Sri Jayewardenepura, Sri Lanka under the Research Grant ASP/06/RE/MGT/2014/03.

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