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Impact Evaluation Study of a Rural Water Supply & Sanitation Project

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Abstract : Provision of safe drinking water and sanitation facilities is cited as the highest social priority to communities. The Government of Sri Lanka is committed to improve the quality of life of the people by providing access to safe drinking water and adequate sanitation facilities. The main objective of the project is to assess the positive and negative impacts of a newly constructed water supply project in Warakagoda, Kalutara. The data samples were collected through questionnaires and then analyzed. The results based on the analysis are discussed in this article.

1. Introduction

1.1. Background

It is difficult to imagine any clean and sanitary environment without water.

The objectives of water supply systems are:

- To supply safe and wholesome water to the users, whether these constitute a family, a group of families, or a community;
- To supply an adequate quantity of water;
- To make water readily available to the users, in order to achieve personal and household hygiene.

The positive and the negative impacts of water supply and sanitation projects are assessed to ascertain whether the project objectives are being met. In measuring the effects, care would be taken to identify impacts derived only from the project interventions, since other interventions can also occur simultaneously in the project area. Only then will it be possible to clearly attribute observed impacts to project interventions. Some parameters, which are used to monitor the impact of water supply and sanitation facilities, are listed below.

- Comparison of the number of facilities before and after the commencement of the project, using the information from continuous progress monitoring.
- Number of occurrences of water borne diseases before and after the project.
- Number of people with unsatisfactory sanitation facilities before and after the project.
- Change in property values due to improved water and sanitation facilities.
- Knowledge of sanitation and health habits and practices and behavior

Under the Asian Development Bank (ADB) funding several rural water supply & sanitation systems are implemented, through the NWSDB as executive agency from the year of 1999.

One of the Grama Nilathari Division's (GND's) in Kalutara district under this project was selected for the study.

1.2. Study Area

The Kalutara district is located in the Western province of Sri Lanka. It is situated in the wet zone of Sri Lanka with a mean annual rainfall ranging from 1900 mm to 2500 mm. The mean minimum temperature and the mean maximum temperature are 26^0 C & 30^0 C respectively.

The project area falls under Warakagoda (East) GND. This GN division comprises 08 clusters and is under the Bulathsinhala Pradeshasabha, Madurawela Divisional Secretariat Division, and Kalutara District Secretariat.

The population of the project area is estimated as 1319 with 361 households. There are about 198 families from the Sinhala community and

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the balance from the Tamil community. The Average family size of a household is between 4 and 5. The source of income in most of the households is from rubber tapping, and the monthly income of a household is in the range of Rs 2000 - 4000/=. This area can be considered as a low-income area according to the poverty lines established by the Department of Census and Statistics.

Majority of the people in this area received only primary education, while a few people have completed secondary education. Two thirds of the adult target population in this area can read well and this was beneficial to the public awareness campaigns during project implementation.

Before implementing the project the people from Warakagoda east were using common and individually used dug wells to meet their day-to-day water needs. The project includes rainwater harvesting, gravity yard tap, common dug well, individual dug well, common hand pump and individual hand pump water supply. The total number of households covered by the project is 237 households. The community contribution for this project is approximately 45% of the total cost. And the operation and maintenance is done by appointed Community Based Organizations (CBOs) after implementing the project.

1.3. Objective & Scope of the study

- To assess the positive and the negative impacts of the newly constructed water supply and sanitation project.
- To identify causes of the negative impacts, and to propose mitigatory measures.

2. Study Methodology

Since the study involved the collection of data before and after the implementation of the Project, a questionnaire survey had to be carried out. Due to lack of time and resources, only a sample of the population was covered in the survey. A desk study, discussions with stakeholders and laboratory analysis of water samples were carried out to gather the necessary data.

The activities of the study are described below:

2.1. Desk study

The team studied the necessary documents available in the Rural Water Supply (RWS) section of the National Water Supply & Drainage Board (NWS & DB) relevant to the project and collected necessary data from the Kalutara District Office. Discussions were held with the Chief Sociologist, Community Development Specialist and the Engineering Assistant of the Bulathsinhalapura division.

2.2. Field visits

The team visited the project area and inspected the different types of facilities constructed under the project. The different types of technology used were discussed with the Engineering Assistant. Later, interviews were held with the local officials such as Grama Nilathari, CBO chairman, NWS & DB Engineering Assistant and beneficiaries and non-beneficiaries of 31 and 5 numbers of households respectively from the different type of WSS facilities.

2.3. Sampling

A representative sample of 10% was selected with the advice of the Sociologist's team in the Rural Water Supply (RWS) section, NWS & DB Head Quarters. Since the resources and time available were limited, only 36 households were drawn on based on a stratified random sampling with the following four criteria.

- In and Out of the project.
- Different types of facilities available in the project.
- Different type of ethnic group.
- Income levels.

The details of the samples are given in Figure 1.

2.4 Questionnaire

A draft questionnaire was prepared first, field tested and then revised. The final questionnaire was then prepared. The research team filled these questionnaires by interviewing an adult member of each selected household sample.

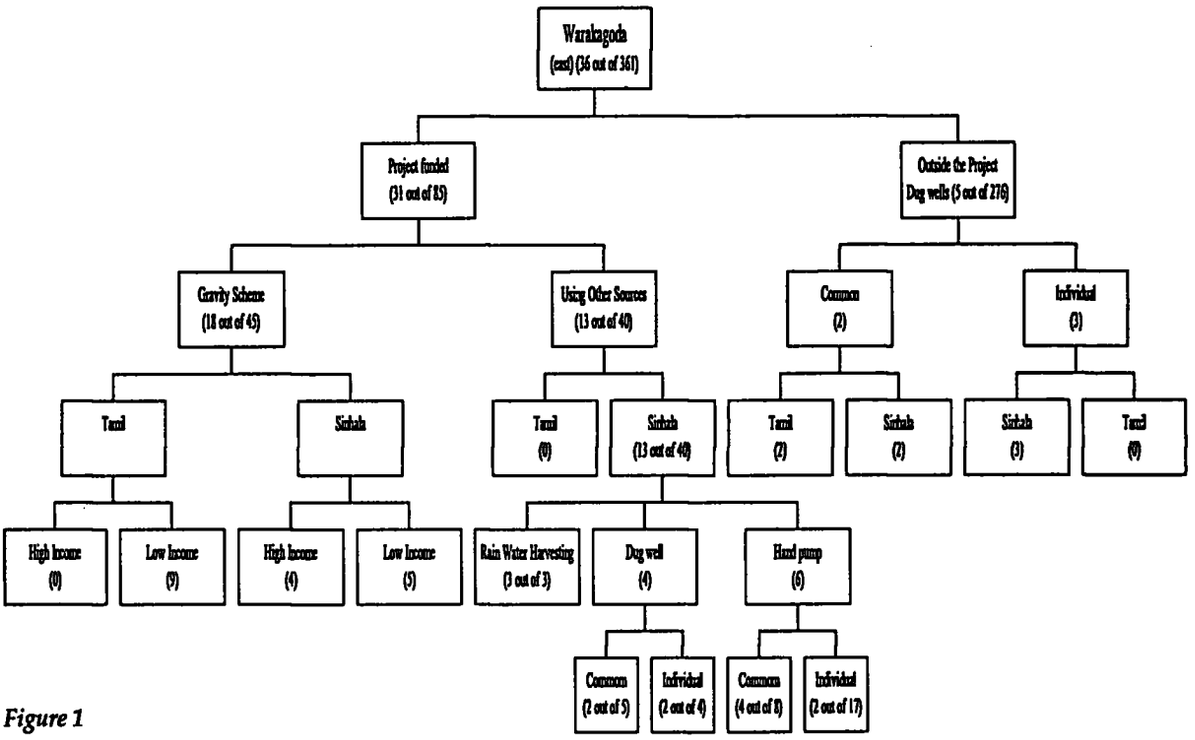

Figure 1

Table 1

Source	pH	Conductivity (us/cm)	Temp (deg C)	Turbidity (NTU)	Colour (Hazen)	Total coli forms at 37deg C (MPN)/ 100 ml	E.Coli at 44 deg C (MPN)/ 100 ml	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Fluoride (mg/l)
Rainwater harvesting	9.45	50.2	26.6	0.37	10	4	<2	0.0132	0.1939	0.0591	0
Gravity source	4.81	30.4	26.6	0.36	5	13	4	0.0005	1.0379	0	2.308
Gravity yard tap	5.14	37.7	26.7	0.33	5	90	30	0	0.6322	0	2.146
Dug well common outside the project	4.97	35	26.8	0.37	5	8	4	0	0.3369	0.1301	1.708
Dug well individual outside the project	4.8	63.8	23.1	0.24	5	7	4	0	1.4225	0	2.184
Hand pump common	4.75	22.6	26.4	0.63	5	6	<2	0.0022	0.1543	0.0079	1.428
Hand pump individual	4.8	87.2	23	0.53	5	27	9	0.0113	1.8345	0	2.334
Dug well common inside the project	5.47	43.2	23.2	0.36	5	170	14	0	1.8675	0	2.237
Dug well individual inside the project	5.22	35.3	22.8	0.3	5	8	8	0.0008	0.2508	0	2.019
Sri Lankan Standards (permissible)	6.5 to 9.0	3500		8	30	10	0	0.01	10	0.06	1.5

2.5. Water sample collection

Water samples were collected from each category of the water source such as rainwater harvesting, gravity source, gravity yard tap, dug well (common) - inside the project, dug well (individual) - inside the project, dug well (common) - outside the project, dug well (individual) - outside the project, hand pump (common) and hand pump (individual).

Then these samples were tested for their physical, chemical, microbiological characteristics.

Under the physical characteristics, pH value, colour, turbidity, conductivity & temperature of water sample were measured and for chemical characteristics, nitrate, nitrite, free ammonia and fluoride levels were measured.

Finally, the microbiological test was done and the E.Coli and total coli form values were measured. Details of the sample results were tabulated in Table 1. The Microbiological and the chemical tests were done within 24 hours of sample collection.

2.6. Data Entry and Analysis

The collected data were tabulated in the Excel spread sheet and these data were analyzed with regard to aspects of technical, social, financial, quality, quantity, affordability, service level, etc. and the results were also tabulated.

3. Observations and Results

To ensure the rural water supply systems and sanitation facilities are operating efficiently and the target groups are realizing anticipated benefits, an impact evaluation study has to be established. It will monitor the delivery, use and benefits of the water supply and sanitation improvements. The study has to be undertaken at intervals after the new and upgraded infrastructure has been operating for some time. Such a study assists in incorporating valuable lessons of experience into the ongoing and future activities.

From this study many lessons have been learnt. If the complete pre project conditions in social, economic and environmental aspects are available, the results in this study could have been compared and the study would have been better and more effective. So it is desirable to carry out the benchmark surveys of the social, economical and environmental conditions of the project area prior to the project implementation.

As per the information collected from the sub project office at Warakagoda (East) the total cost of the project is around SL Rs. 1,279,652.00 for the listed water supply facilities together with the toilets. The cost of different water supply options together with the sanitation on a household basis is summarized below and compared with the average household income per month. From Table 2, it is observed that except in the case of Rain water harvesting, the community had contributed more than 50% of the cost of the facilities.

3.1. Reduction in travel time and travel Distance.

Around 23 numbers of households (out of a total number of 36 households) had to walk long distances (2 - 3 km) to fetch drinking water before the implementation of the project. After the implementation of the project, the travel distance of 21 numbers of households (out of 31 households) was reduced considerably. The average travel time has reduced by 20 minutes. The burden on the women of carrying heavy loads has been reduced a lot. The women highlighted this during the interviews. The people were participating in recreational activities to spend the time saved above. This will lead to the improvement of the relationships between people and to better health and fitness.

Table 2

Source	Total Cost	Total Cost/ household	Project Contribution / household	Community Contribution / household	Avg. Household income
Rain water harvesting	44,280.00	14,760.00	10,185.00	4,575.00	10,500.00
Gravity Yard tap	194,949.00	4,332.20	2,221.89	2,110.31	4,500.00
Dug well common	63,093.00	12,618.60	3,826.60	8,792.00	6,000.00
Dug well individual	80,660.00	20,165.00	8,917.50	11,247.50	4,500.00
Hand pump common	100,220.00	12,527.50	6,500.00	6,027.50	4,400.00
Hand pump individual	296,450.00	17,438.24	7,770.59	9,667.65	5,250.00
Toilets (project Contribution)	500,000.00	10,000.00	3,000.00	7,000.00	5,800.00
	1,279,652.00				

3.2. Improved behavior in hygiene

The results from the questionnaire show that, after the project, the households are taking baths and washing clothes etc. daily whereas before the project, it was done every other day. This shows an improved behavior in hygiene. It also suggests improved sanitation in the households. Hence, spreading of infection will reduce. Life without disease will lead to a pleasant existence.

3.3. Improved sanitation facilities.

With regard to sanitation, 94% of the households were having private toilets at the time of the survey. Before the project implementation estate workers especially were having common toilets where five toilets were grouped together in a line discharging sewage to a single soakage pit. During the project, around fifty water sealed latrines were constructed for this community. A subsidy of Rs. 3000/= was given to the beneficiaries to purchase materials. The labour required for construction was provided by the communities. The locations of the toilets were approved by Public Health Inspector (PHI) and a minimum distance of 30 ft. was maintained between the drinking water source and the latrine. At the interview conducted, the women showed their pride about the privacy they had experienced after the toilets were constructed. If there is no proper sanitation facilities the environment will get polluted further this causing health hazards.

3.4. Improved social status of the households.

When an household in the project area is compared with one outside the project area, it is clearly seen that the social status of the household has increased considerably and this is remarkable. This is because these households get more recognition in society as they have the basic needs of life. For example a grown up girl who has a property with these basic facilities, waiting to get a life-partner has a better chance of getting married soon. The people expressed this statement during the interviews.

3.5. Project planning

It was noticed that the pumping scheme constructed at Geekiyana Kanda Estate for 152 households with common taps was not in operation for more than one year due to unavailability of electricity. This was revealed by the project officials and it was informed that a special type of cable is required for the power supply and the Ceylon Electricity Board (CEB) is taking a long time to purchase this cable, as the correct power requirement was not identified at the planning stage of the project. This shows the importance of identification of critical activities at the planning stage.

3.7. Unsatisfactory water quality

3.7.1. Dug wells

Nine numbers of households (out of 36 households) using dug wells complained that there are floating and settled particles of dead leaves and other organic matter, which leads to bad odour and color in the water. The reason for this is the non-availability or inadequacy of covers. An awareness programme regarding the need of a cover has to be given to the households. Further, the fluoride levels are higher than the permissible levels.

3.7.2 Gravity piped scheme

When the water quality of a yard tap of a gravity scheme was tested it was found that it was more contaminated than the gravity source. This may be due to the pipe connection from the source to the yard tap not being properly sealed. This must have arisen from technical defects in the system and needs further investigation. It was found that chlorination is not practiced in the pipe scheme. At the interview conducted, the households indicated that they do not like the chlorinated water which has a special taste and odour. It is evident from this statement that the households are unaware of the health hazards caused by contaminated water. The importance of chlorination has to be conveyed to the households by awareness programmes.

3.7.3 Dug well with individual hand pump

The bacterial quality tests of this facility indicates contamination. However, this quality is much better than the dug well without hand pumps. This proves that contamination occurs during drawing water from the well. Further, the fluoride levels in these wells too were higher than the standard.

3.7.4 Rainwater harvesting

As per the test conducted during the study, rainwater harvesting showed good quality water on physical, chemical and bacteriological parameters. This is the only perfect facility in the study area.

As per the above study, it has been observed that all the facilities except the rainwater harvesting indicated high fluoride content. High concentration of fluoride will lead to dental fluorosis and skeletal fluorosis. The Fluoride removal techniques have to be introduced in these community water supply schemes where the fluoride levels are higher than acceptable limits.

A major draw back in the project is that the water quality in the constructed facilities has not been tested once. The microbiological test conducted showed high content of contamination of E.Coli and coli form bacteria in all facilities except rainwater harvesting. It is found that the chlorination is not practiced even in piped schemes. Further, most of the households indicated that they do not know whether boiling is necessary before drinking. Therefore even at this stage an educational program has to be conducted among these households regarding the water quality and the effect of bacteria.

3.8. Operation and maintenance

Even though CBOs have been organized to do the operation and maintenance, the participation of the CBO members in some of the facilities is not adequate. When repairs arise in a piped scheme, it takes a long time to rectify the defect. This shows that the operation and maintenance is not organized well and the CBO's lack of preliminary technical knowledge. They are unaware of whom to contact for the repair. An overall knowledge on preventive maintenance and O&M has to be transferred to the CBOs at least now.

Further, they do not have a proper coordination with other stakeholders in the area. For example, replantation of rubber was done and the pipeline was removed for a long time. The residents revealed that even though they have made several complaints it was not reinstated immediately and they did not have water for more than two months. The CBO's should have had cordial contacts with other stakeholders in the project, so that they could arrange this kind of job without delay. This could be developed only at the social gatherings held in the village.

3.9. Solid waste management

It is found that no solid waste disposal program is implemented in parallel with the water supply and sanitation program. In spite of the vast open space available, some of the residents have dumped the waste by the side of the wells and this has caused the quality problems mentioned above. This should have been taught to the households through the awareness program, which was conducted during the project.

4. Conclusions and Recommendations

4.1. Conclusions

The results obtained from the study reveal that the project has achieved some of the set targets and goals.

The beneficiaries have achieved the following benefits.

- Improved social status
- Improved sanitary behavior
- Satisfactory sanitation facilities
- Time saving in collection of water.

When, the projects are properly planned and implemented, most of these impacts are likely to be the ones that were anticipated during the planning process. However, there can be unexpected impacts, since it is impossible to predict all potential impacts for any development project.

The following causes of negative impacts were identified in this project.

- Inadequate planning
- Unsatisfactory water quality
- Unorganized solid waste disposal
- Inadequate operation and maintenance arrangements
- Lack of follow up on overall situation by the Executive Agency after the completion of the project

The study also showed that the questionnaire survey was very effective in identifying the

positive and negative impacts of the project, and identifying the causes of the negative impacts, as well as enhancement of the positive impacts. The questionnaire may have to be modified to suit the specific location and type of scheme, but can be used as a basis for any future study.

4.2. Recommendations

1) For similar projects in future, the requirements of other resources such as electricity, land clearance, road reservations, etc. have to be identified in advance at the planning stage and negotiations have to be held at the design stage so that the above resources are available at the construction stage. A good relationship with the stakeholders should be maintained from the beginning of the project, through regular meetings/ workshops. Certain problems encountered cannot be resolved unless the stakeholders are committed to provide a service to the community, especially in the rural projects.

2) The water supplied from each and every facility except rainwater harvesting constructed in the project has quality problems. Since, fluoride levels in most of the facilities (80%) are very much higher than the allowable levels, it is recommended that fluoride removal plants be installed. Chlorination has to be done as the water is contaminated with bacteria.

3) The CBO's or any authority maintaining the project has to arrange water quality tests on a monthly basis. For future projects it is recommended that the Executing Agency conduct routine quality checks at least for one year after completion of construction.

4) An awareness about the water quality be created in the households through educational programs.

5) The households have to be educated on safe solid waste disposal techniques.

6) The project should make necessary operation and maintenance arrangements and train the CBO's during the latter part of construction.

7) The operation and maintenance (O&M) staff of the executive agency of Warakagoda area should have participated during planning and construction stages so that the O&M staff could track what is happening to the project after construction works are over so that advice on technical matters/quality problems be given if required.

8) For future projects the project unit should build infrastructure facilities such as community centers where social gatherings could be held. The mixing of communities in such places will build up unity and there by resolve problems in the village.

9) The questionnaire developed in this study may be used to assess the impacts from rural water supply and sanitation projects, after modification to suit specific project sites, where necessary.

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