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SUSTAINABILITY AND FUNCTIONALITY OF RURAL WATER SUPPLY, A CASE STUDY OF BHUTIYA KHOLA DRINKING WATER SUPPLY SYSTEM, SALYANTRA, NEPAL

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***Abstract*—Being finite natural resource, water has high value as both economic as well as social good and basic for the survival of living beings. The availability of fresh (drinkable water) water on the earth surface is limited, also enhancement in development activities has pressurized water resource resulting water scarcity. On the other hand, the case of rural water supply system in Nepal is in poor condition in terms of sustainability and functionality for long term services. This paper tries to explain the different aspects of rural water supply system's sustainability and functionality in relation with water tariff and its importance. A case study in Bhutiya Khola Drinking Water Supply System (BKDWSS), Salyantra, Nepal has been carried out.**

Water tariff has been basic source for operation and maintenance (O&M), mobilization fund of BKDWSS from the date of establishment 2047 B.S. Water tariff of NRs. 200 per public tap per month to NRs. 50 per household (HH) per month has been charged in BKDWSS with its service population of 5436 at 1136 HHs. 41.23% of the respondent believes that sustainability of water supply depends on Institutional Sustainability whereas 39.27% believes on Economic Sustainability out of four major parameters of sustainability as Economic Sustainability, Institutional Sustainability, Natural Resource and Physical Infrastructure Sustainability.

Keywords— Rural Water Supply System, Sustainability, Functionality, Water Tariff, Village Maintenance Worker (VMW)

I. INTRODUCTION

United Nation general Assembly on 2010 A.D., through Resolution 64/292, has recognized the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realization of all human rights. Through this Resolution, UN calls international organizations and concern state to provide financial resource, capacity building and technology transfer in particular country to provide safe, clean, accessible and affordable drinking water and sanitation[1].

TABLE I. WATER SUPPLY COVERAGE BY SOURCE

Source	Year	Water Supply Coverage (%)
DHS	1996	69.8
CEN	2001	84.5
DHS	2001	77.1
DHS	2006	81.8
NMIP	2008	80.5
CEN	2011	86.5
DHS	2011	91.7
NMIP	2010	80.4
NMIP	2012	79.6
NMIP	2014	84.0
DWSS	2015	86.4
DWSS	2016	87.0

(Source: Published Report on Different Time)

Article I.1 of United Nation Committee on Economic, Social and Cultural Rights adopts the right to water, with General Comment No. 15 defining the right to water as, "the right of everyone to sufficient, safe, acceptable and physically accessible and affordable water for personal and domestic uses [1].

Also The Constitution of Nepal 2072, guarantees the fundamental right of water through its article 35 stating, "Access to safe drinking water and improved sanitation is a basic right of the people" [2].

Water Supply and Sanitation Projects has been the priority of Government Programs from 1990's during the international water supply and sanitation decade (1981-90) and continued in investment and receive aids from the mid of 1990's [3].

Data from Demographic Health Survey (DHS), National Census (CEN), National Management Information Project

(NMIP) and Department of Water Supply and Sewerage (DWSS) on different period of time shows the coverage of water supply as (Also showed in Table I):

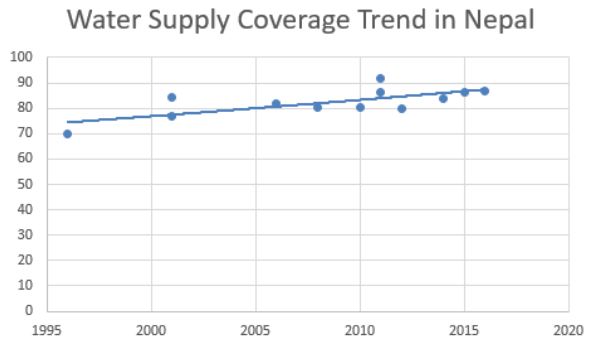

Fig. 1. Water Supply Coverage Trend in Nepal (based on Table 1)

Data indicates that there is general increase in water supply coverage by 0.86% on average since 1996 A.D.

II. Status of Water Supply in Nepal

Remarkable change has been seen in access to water supply since 2001 A.D. 85% to total population has access to affordable water as suggested below [4] :

TABLE II. Water Supply Coverage (CBS2011)

Area	Population	% of Population in Access of Water Supply	No. of Population not in access of Water Supply
Urban	4523820	87	585382
Rural	21970684	85	3295603
Total	**26494504**	**86**	**3880985**

(Source: CBS 2011)

III. Functionality of Water Supply System

A sustainable water supply system must be economically viable, socially acceptable and technically and institutionally appropriate [3]. Rural Water Supply systems are managed by Drinking Water and Sanitation Users Committee (DWSUC), an acting committee formed by the general assembly of water users. The rate for the tariff collection would be fixed by the meeting of DWSUC for the Operation & Management (O&M) of scheme and salary of care taker.

About 41,205 rural water supply systems operated by DWSUC have been registered in District Water Resource Collaboration Committee (DWRCC) which serves 52.3% of rural population [5]. Only 68.2% of water supply systems are capable of providing year round water to all taps. Functionality of water supply in Nepal has been the great challenge with only 25.4% of water supply systems are well-functioning [5]. Following table explains the status of rural water supply system in term of functionality:

TABLE III. Functional Status of Rural Water Supply (NMIP 2014)

Status	% of Water Supply
Well-Functioning	25.4
Needs Minor Repair with in the capacity of DWSUC	36.1
Needs Major Repair beyond the capacity of DWSUC	9.2
Needs Rehabilitation to meet present demand	19.8
Needs Reconstruction	19.8
Cannot be Recovered	0.9

(Source NMIP 2014)

This Table seriously undermines functional access and sustainable use to safe water services with 49.7% of water supply requiring support from outer agencies for their rehabilitation and repair.

IV. Sustainability of Water Supply System

Water sustainability could be defined as supply of clean water as the continual system for human uses and for other living things [6].

For the Sustainability of Water Supply System following parameters shall be checked as:

A. *Economy*

Water Supply System shall be economically sustainable. Tariff collected from the Water Users shall be sufficient for O&M works and salary of Village Maintenance Worker (VMW).

B. *Natural Resource*

Sufficient Quantity and Quality as per National Drinking Water Quality Standard (NDWQS, 2005) of freshwater shall be supplied to the water users.

C. *Institution*

Drinking Water Supply and Sanitary Users Committee (DWSSUC) is the prime institution for the sustainability of rural water supply. DWSSUC shall be capable in resolving the dispute arose between water users, tariff fixation, and legislation of water supply.

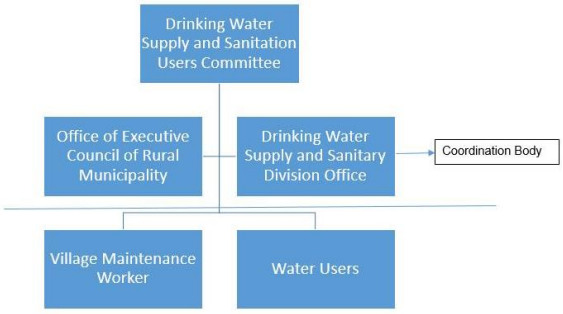

Fig. 2. Coordinating instution for proper functioning DWSSUC

DWSSUC needs coordination from Office of Executive Council of Rural Municipality and Drinking Water Supply

and Sanitary Division Office for its proper functioning so that they can provide service to water users and, in the meantime, develop employment opportunity for maintenance works.

D. Physical Infrastructure

Physical Infrastructure such as Storage Tank, Intake, Tap Stand, Transmission Line and Distribution Line shall be sustainable for the long term service of water supply project.

V. WATER TARIFF IN RURAL WATER SUPPLY SYSTEM

Drinking Water and Sanitation Users committee is responsible for tariff fixation in rural water supply system. With the aim of sustainable and functional water supply system, Government of Nepal has acknowledged the normal practice of fixing adequate tariff for water supply and sanitation services [7].

Thus collected tariff shall be used for the salary of care taker and operation and maintenance works.

VI. BHUTIYA KHOLA DRINKING WATER SUPPLY SYSTEM, SALYANTAR, NEPAL

From its establishment 2047 B.S., BKDWSS has been serving the water users of former Salyantar VDC- ward number 1 (Currently Tripurasundari Rural Municipality, Ward number-1)

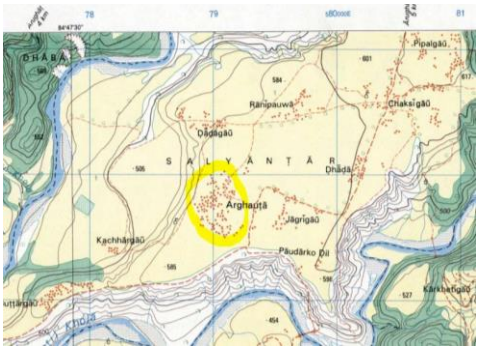

Fig. 3. Highlighted section represent study influence area

A. Physical Description of scheme:

TABLE IV. PHYSICAL INFRASTRUCTURE IN BKDWSS

Storage Tank	
Capacity	***Location***
3*20 m^3 ferro-cement	Belgau, Salyantar
3*20 m^3 ferro-cement	Panitanki, Salyantar
Service HHs	
Belgau Distribution	560 HHs
Panitank Distribution	576 HHs
Total HHs	1136
Intake	
Bhutiya Khola	2.1 m^3/s discharge
Type	Spring Intake
Tap Stand	
2047 B.S.	25 Public Tap
2060 B.S.	43 Public Tap
2075 B.S.	54 Public Tap

(Source: Field Survey 2018)

The project has two water tanks, namely at Belgau and Panitanki, providing its service to 1136 HHs with a total 54 water taps for the residents by 2075 BS.

B. Drinking Water Supply and Sanitation User Committee:

Drinking water Supply and Sanitation User Committee of 9 member has been formed at the time of signing MoU with Drinking Water Supply and Sanitation Division Office (DWSSDO), Dhading at 2047 B.S. At present this DWSSUC has been functioning under the Chairperson-ship of Mr. Bhoj Bahadur Rijal from 2067 B.S. Out of total member, 3 are female participants with 33% representation.

This participation also meets the requirement of Drinking Water Supply and Sanitary Users Committee formulation Guideline 2068 and Constitution of Nepal 2072, "as at least 33% of the member shall be female participants". This committee is gender equitable with one female member in signatory position (Treasurer).

C. Water Tariff in BKDWSS

From its established date, water tariff has been collected in BKDWSS. During course of time, the rate of tariff has been changed to fulfill the cost O&M and VMW Salary. Water tariff rate at different time:

TABLE V. WATER TARIFF IN BKDWSS

Date	**Water Tariff**	**Number of VMW**
2047 B.S.	NRs. 200 per tap per Month	3 (1 non-Trained + 2 Trained)
2060 B.S.	NRs. 15 Per HHs per Month	3 (1 non-Trained + 2 Trained)
2067 B.S.	NRs. 50 Per HHs per Month	3 (1 non-Trained + 2 Trained)
2070 B.S.	NRs. 50 Per HHs per Month	4 (2 non-Trained + 2 Trained)

Salary of VMW at different period of time

TABLE VI. SALARY SCALE OF VMW IN BKDWSS

Date	**Type of VMW**	**Salary (NRs.)/Month**
2047 B.S.	Non-Trained	500.00
	Trained	1000.00
2060 B.S.	Non-Trained	1500.00
	Trained	2500.00
2070 B.S.	Non-Trained	4000.00
	Trained	8750.00

D. Functionality of BKDWSS

Bhutiya Khola Drinking Water Supply System has been in user's service from 2047 B.S. After a landslide in 2067 B.S. destroyed the water transmission line, this DWSS has been disrupted for short period of time. After Rehabilitation of Scheme, this system is functioning till the date of survey.

E. Sustainability of BKDWSS

To understand the sustainability of BKDWSS questionnaire survey was done in between the water users committee. In total 300 HHs took part in the survey with the major question as, "What is the basic reason behind the Sustainability and Functionality this Water Supply System?" the choice as institutional sustainability, economic sustainability (water tariff), natural sustainability (water source) and physical sustainability.

Participants in the survey concluded with following results:

TABLE VII. SUSTAINABILITY PARAMETER IN BKDWSS

Sustainability Parameter	Weightage (%)
Institution	41.23
Economic	39.27
Natural Resource	15.23
Physical Infrastructure	4.27

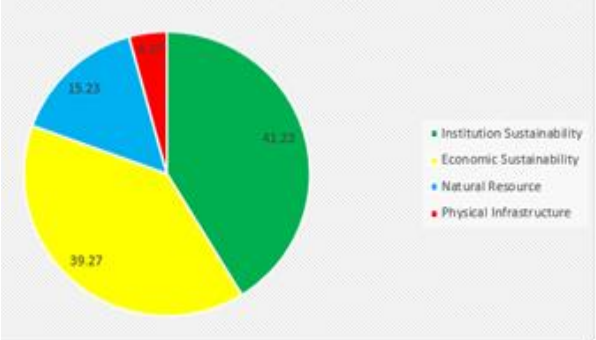

Fig. 4. Sustainability of BKDWSS

This data suggest that, for the sustainability of rural water supply system, Institutional Sustainability and Economic Sustainability is most required. During this survey, 41.23% of respondent think, BKDWSS is sustainable because of its management institution, Drinking Water Supply and Sanitary Users Committee (DWSSUC). Also DWSSUC is responsible for all kind of activities involving the Natural Resource Sustainable and Physical Infrastructure Sustainable.

Economic Sustainability is another important parameter for rural water supply sustainability. 39.27% of respondent believe that BKDWSS is sustainability because of water tariff collection.

CONCLUSION

For the functionality and sustainability of water supply system all of the different parameters are equally important. Though during the study, Institutional Sustainability and Economical Sustainability were sought (by water users) more important than other two aspects because these two parameters are the governing one for other two as well.

Institutional Sustainability (DWSSUC) and Economic Sustainability (Water Tariff) weight 80.5% of total weightage suggesting the importance of Water Users Committee and Water Tariff in rural areas for water supply system.

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