

Advancing Sustainability in Rural Water Management: Insight from Chaurjahari Municipality, Nepal

Yagya Bahadur Karki^{1*}, Bishal Adhikari², Surendra Bahadur Shahi³

¹Engineer, Birendranagar Municipality, Surkhet, Nepal

²Engineer, Ministry of Urban Development, Government of Nepal, Nepal

³Faculty, Graduate School of Engineering, Mid-West University, Surkhet, Nepal

*Corresponding Author: bibasyagya@gmail.com

Received Date: December 23, 2024; Published Date: January 22, 2025

Abstract

This study delves into the major problems affecting the sustainability of community water supply schemes in Chaurjahari Municipality, Rukum (West) District, Nepal. Employing a combination of explanatory, descriptive, and qualitative research designs, the study utilized primary data collected via structured questionnaires from field observations and secondary data sourced from local government offices and existing publications. The selected study area included five water supply schemes representative of the municipality's diverse demographic and environmental contexts. The research uncovered several critical sustainability challenges such as management inefficiencies, inadequate community engagement, and insufficient maintenance practices. It also examined the functionality of water supply systems through various indicators, evaluated sustainability issues at different project phases (pre-construction, construction, and post-construction), and analyzed the socio-demographic profiles of the respondents. Ethical considerations focused on respecting local customs and maximizing participant benefits were strictly followed. The findings emphasize the need for robust community involvement, enhanced capacity building, and improved management practices to ensure the sustainability of water supply projects. By addressing these key issues, the study contributes to the broader discourse on sustainable development in rural water management and offers actionable recommendations for policymakers and stakeholders in similar contexts.

Keywords- Community water schemes, Rural Nepal, Sustainability assessment, Stakeholder engagement, Water supply management

INTRODUCTION

Clean water and hygienic sanitation are essential for a dignified, healthy life, economic development, and a functioning global ecosystem. According to World Health Organizations (WHO), drinking water services encompass the accessibility, availability, and quality of water used by households for various needs (World Health Organization (WHO), 2022) [1]. The right to water and sanitation is vital for improving these conditions. However, providing safe

water and improved sanitation to rural areas remains a significant challenge, especially in developing regions.

Sustainable rural water supply projects rely on naturally replenished sources and maintained systems that ensure reliable and adequate water supply (Harvey & Reed, 2003) [2]. Key factors influencing sustainability include government funding, staff management, modern technology, social-cultural factors, institutional arrangements, technological advancements, natural environment, community aspects,

financing, maintenance, training, and capacity building. Researchers have highlighted the importance of integrating these factors for sustainability. For instance, (Spaling, Geoffrey , & Njoka, 2014) [3] emphasized the role of economic factors, financing, and legal frameworks, while (Abrha, 2006) [4] explored various interpretations of sustainability, including economic self-sufficiency and institutional support.

Local participation and management are crucial for sustainable water resources, but participatory approaches alone do not guarantee sustainable solutions [5]-[7]. Effective sustainability requires meaningful participation at all project stages and ongoing external support [8]. The sustainability of water projects can be threatened by changing initial conditions, such as reduced water supply due to over-extraction or climate change, and evolving water policies.

Aligned with national policies and sustainable development goals, local governments in Nepal are tasked with formulating strategic plans that enhance prosperity and socio-economic development, crucially incorporating environmental considerations and effective water management systems to ensure sustainable water supply [9].

In Nepal, significant investments in rural water supply projects have been made, but inadequate management and maintenance have led to inefficiencies and project failures. Despite infrastructural development, lifestyle changes, and socio-economic growth, sustainable water supply remains a challenge in rural areas like Chaurjahari Municipality. Sustainable Development Goal (SDG) aims to ensure access to water and sanitation for all by 2030 ((UN), 2024) [10].

As of 2020, according to the report of National Planning Commission (NPC) more than 90% of Nepal's population had access to basic drinking water services, but challenges remain (National Planning Commission, 2022) [11].

STATEMENT OF THE PROBLEM

Despite the widespread acceptance of sustainable development, a coherent, quantifiable definition of sustainability in community water supply systems remains elusive. Current practices often lack evaluation of sustainability, leading to resource wastage and frustration among stakeholders. Stakeholders' varying backgrounds and priorities, combined with population growth, lifestyle changes, and climate impacts, complicate sustainable water supply efforts. A framework to evaluate sustainability and improve stakeholder communication is needed.

OBJECTIVES OF THE STUDY

To assess the sustainability of the water supply system in Chaurjahari Municipality, Rukum (West), Nepal.

SIGNIFICANCE OF THE STUDY

This study addresses the sustainability concerns of rural water supply schemes, emphasizing the need for periodic maintenance and investment. It provides recommendations for policymakers, stakeholders, and beneficiaries to achieve sustainable development.

SCOPE AND LIMITATIONS OF THE STUDY

Scope

Focus on the sustainability of water supply projects in Chaurjahari Municipality, Rukum (West), Nepal. Identify problems related to pre-construction stage, construction stage and post construction stage of respective water supply projects.

Limitations

- Study limited to three water supply schemes in Chaurjahari Municipality, Nepal.

- Results may not represent the sustainability conditions of community water projects across the entire country.

MATERIAL AND METHODS

Research Design

This research had attempted to find the major problem associated with community water schemes in Rukum (West) District, Nepal. Both explanatory research designs were employed in this research with the use of both primary and secondary data for analysis. Qualitative data were collected from questionnaire survey. Collected data are analyzed in tabulated, graphical and descriptive mode. Explanatory methods are used to interpret the data.

Study Area

Chaurjahari Municipality located in Rukum (West) of Karnali Province, spans 107 square kilometers and had a population of 27,438 as of the 2011 Nepal census. Established on 18 September 2015, it merged Kotjahri and Bijeshori VDCs, later incorporating parts of Kholagaun, Nuwakot, and Purtimkanda. The municipality is divided into 14 wards and is bordered by Tribeni Rural Municipality to the east, Jajarkot district to the west, Sani Bheri Rural Municipality to the north, and Salyan district to the south.

Based on area sample technique, three numbers of community Water Supply Schemes (WSS) were selected from Chaurjahari Municipality ward no. 12 Panekhola, Chaurjahari Water Supply Scheme and Ratamata Water Supply Scheme Ward No. 13, to represent the whole municipality.

Panekhola Scheme: Panekhola scheme is in the ward no. 12 of Chaurjahari Municipality. It was constructed by the funding of Nepal

Government. It serves more than 110 HH and about 550 people are benefited from this scheme. The tariff is not collected till now. The fund is collected from people during the interruption of water flow and renew of water source. They have not recruited a village maintenance worker for the regular flow of water supply and maintenance as well.

Ratamata Scheme: Ratamata scheme is in the ward no. 13 of Chaurjahari Municipality. It was constructed by the funding of Local Government. It serves more than 105 HH and about 525 people are benefited from this scheme. The tariff is collected from the users and used in salary of Village Maintenance Worker (VMW).

Chaurjahari Water Supply Scheme: Chaurjahari water supply scheme is in ward no. 3 of Chaurjahari Municipality which serves the ward no. 1, 2, 3. It is funded by Nepal Government. It serves more than 910 houses hold of municipality. The tariff is collected from the users and used in operation and maintenance of water supply project by water management committee.

Data and Its Collection

For the study of major problem associated with community water supply schemes in Rukum (West) district of Nepal, both of primary and secondary are the two kinds of nature of data.

Primary data is collected from the field visit using qualitative method based on questionnaire survey with structured questions.

Secondary data is collected from respected municipality office, respective ward offices, Water Supply and Sanitation Divisional Office (WSSDO), I/NGOs and different publication and magazine as much as possible.

Sample Size and Sampling Techniques

The random and convenient selection techniques were applied for the sample size selection. From the national census of the year 2021, 14 wards in Chaurjahari Municipality (CSM) have total population of 29956. Among total population of the municipality, 6055 populations of 1211 households are benefitting from selected three water supply schemes presented on Table 1. Using qualitative versus and quantitative study of study area using

stratified random sampling method (representation from all cluster, wards and ethnicity) 200 households was interviewed. For the household survey, the sample size for the given universe of 1211 HHs was estimated based on the following assumptions. Confidence level or the measure of reliability as 95% or the significance level 5%. Degree of accuracy as 91.5% or the margin of error as 8.5% variability as moderate. The sample size of 175 was derived for the above condition by using Slovin’s formula.

Table 1: Selected study area and sample size of water supply schemes.

S. No.	Name of Water Scheme	Completion Year	No. of HH	Population	Sample Size	Representing Area
1	Panekhola Scheme	2019	185	925	27	Sanakhola
2	Ratamata Water Supply Scheme	2019	116	580	17	Ratamata
3	Chaurjahari Water Supply Scheme	2020	910	4550	131	Chaurjahari
	Total:		1211	6055	175	

(Source: Chaurjahari Municipality)

Ethical Consideration

Ethics in research refers to the standards distinguishing right from wrong behavior, guiding acceptable versus unacceptable actions. They ensure the researcher's compliance with laws, human rights, animal welfare, safety, and health standards. Ethical considerations are crucial across all research types.

The current study addresses issues in community water supply schemes in Chaurjahari Municipality, Rukum (West), Nepal. Ethical data collection involves engaging respectfully with participants of all ages, genders, castes, and rituals, aiming to benefit them and adhere to the principle of "do no harm." Key ethical principles in qualitative research include respect for

persons, beneficence, justice, and respect for communities.

RESULTS AND DISCUSSIONS

Respondents Demographics and Details

Respondents Profile: The respondents were of two different categories among them one category is respondents from the household member/user and other is professional personnel who were involved in survey design and implementation of water schemes.

Respondents by Age Group: Among total respondents, 47.5% respondents were under the category of 18-45 years, 33.3% of the respondents falls on 46-60 years, 8.5% of the respondent falls under the category of below 18 years, 10.7% of the respondents

falls on fall in category of above 60.

Household's Respondent's Gender Profile:

Equal opportunity was given to participation household survey during this study, however among the total respondents, 63.3% of were male and remaining 36.7% were female had given response.

Respondents by Service Group: Among total respondents, 88.7% were from community members and users, 6.2% were consultant engineer and 2.8% were contractor, 0.6% was wash engineer, 1.7% was engineer and sub engineer.

Family Size of Household's Respondents:

Among total respondents, 72% respondents have family size of 2 to 5 members, 5% have family size of less than 2 members, 20% have family size of 5-8 persons, and 2% have family size of more than 8 members. This result shows that maximum percentage of water consumers have 2 to 5 numbers of family size.

Respondents by Ethnicity: Among total respondents, 27% respondents were in the category of Bhramin, 27% were Chhetri, 21% were Adibashi/Janajati, and 24% were from Dalit as deprived ethnicity. The result shows that in the selected study area, there was presence of all ethnicity people as users of water supply schemes

Respondents by Level of Education: Among total respondents, 21% respondents have qualification of primary level, 26% have secondary level, 28% have qualification of college level and 21% have university level qualification.

Respondents by Occupation: 61.6% of the total respondents were involved in agriculture sector, 21.5% respondents were in service oriented sector, 14.7% were involved in the different business and

remaining 2.3% were involved in different occupations like study, trekking, tourism and some were unemployed. Around 61.6% of family were depend upon traditional agriculture, so they can manage only day to day life and income generation is low. Similarly, as majority of population were dependent on agricultural activity, there was high demand of water for drinking and domestic use.

Respondent's Reply on Completion Date of Water Schemes:

78% respondent replied that water schemes were completed 1-3 years before, 8% respondent replied that water schemes were completed 1 year ago, and 14% respondent replied that water schemes were completed above 3 years ago.

FUNCTIONALITY OF WATER SUPPLY PROJECTS

Functionality of water scheme has been studied in basically two categories i.e. by analyzing functionality of user committee as institutional performance and condition of operation and maintenance status. Table 1 presented hereunder is summary of functionality status of each water supply schemes. Functionality status has been depicted in two different headings first operation and maintenance mechanism and institutional mechanism.

Operation and Maintenance Mechanism

Eleven different indicators collected from various literatures and have been tailored to the context for the measurement of the functionality status of the water supply projects from the lens of operation and maintenance mechanism.

Table 2: Operation and maintenance mechanism.

Indicators	Weightage	PM	Panekhola Scheme		Ratamata Water Supply Scheme		Chaurjahari Water Supply Project	
			Condition	Weightage	Condition	Weightage	Condition	Weightage
Financial Management (F&M) Fund	Very Good (10), Good (7), Satisfactory (5), Poor (2), Very Poor (1)	10	Very poor	1	Very poor	2	Good	7
Availability of spare parts, tools and fittings with user's committee		10	Very poor	1	Very poor	1	Satisfactory	5
Efficient Tariff Collection		10	Very poor	1	Very Poor	1	Good	7
Availability Operation and Maintenance (O&M) fund:		10	Very poor	1	Very poor	1	Satisfactory	5
Water safety plan functional		10	Very poor	1	Very Poor	1	Poor	2
Regularity on operation and maintenance		10	Very poor	1	Very poor	2	Satisfactory	5
Regularity on record keeping		10	Very poor	1	Very Poor	1	Poor	2
Regularity on Annual General Meeting (AGM), audit of water user committee		10	Very Poor	1	Very poor	1	Good	7
Community feedback mechanism		10	Very poor	1	Very Poor	1	Poor	2
Coordination of user committee with concerned government bodies in local level and I/NGOs		10	Very poor	2	Very poor	2	Satisfactory	5
Condition of technical support getting from local government / water supply divisional office/ NGOs	10	Very poor	5	Very poor	5	Satisfactory	5	
Sub Total		110		16		18		52
Percentage				14.54		16.36		47.27

Note: VP: Very poor, P: Poor, S: Satisfactory, G: Good, and VG: Very good.

Table 2 shows that operation and maintenance mechanism Panekhola water supply project have lowest value of functionality index 14.54%, Ratamata Water Supply Scheme have 16.36% and Chaurjahari water supply project have 47.27%.

Institutional Mechanism

Six different indicators collected from various literatures and have been tailored to the context for the measurement of the functionality status of the water supply projects from the lens of institutional mechanism.

Table 3: Institutional mechanism.

Indicator	Weightage	Weightage Obtained %	
		Yes	No
Is there water user committee in the project?	Yes, No (100%)	35.6	64.6
Has own staff with maintenance worker?	Yes, No (100%)	29.4	70.6
Regularity on WUSC meeting?	Yes, No (100%)	24.9	75.1
Regularity and maintaining every meeting minute of WUSC?	Yes, No (100%)	19.2	80.8
Regularity on capacity building training to user committee and technicians?	Yes, No (100%)	20.9	79.1
Regularity on monitoring and management of water scheme?	Yes, No (100%)	22.6	77.4

Table 3 Functionality of water supply project based on institutional mechanism shows that only 35.6% of respondents agreed with there is water user committee in the project, 29.4% respondent agreed with the management of own staff for operation and maintenance. 24.9% respondents agreed with the water user committee meeting and 19.2% respondents agreed with the maintaining of minute of meeting. Similarly, only 20.9% respondents agreed with the regularity on capacity building training to user and 22.6% agreed with regularity on monitoring and management of water scheme.

in preconstruction phase, construction phase and post construction phase. Each phase has been studied through various sustainability related factors which has been collected and tailored for the study.

Sustainability Related Problems in Pre-Construction Stage

Sustainability related problems in pre-construction stage of water supply projects have been studied considering survey phase and technical design phase separately. The responses on sustainability related problems in a survey phase are presented Fig. 1 below.

Sustainability Related Problems

The sustainability has been assessed

Sustainability Related Problems in Pre-Construction Stage- Survey Phase

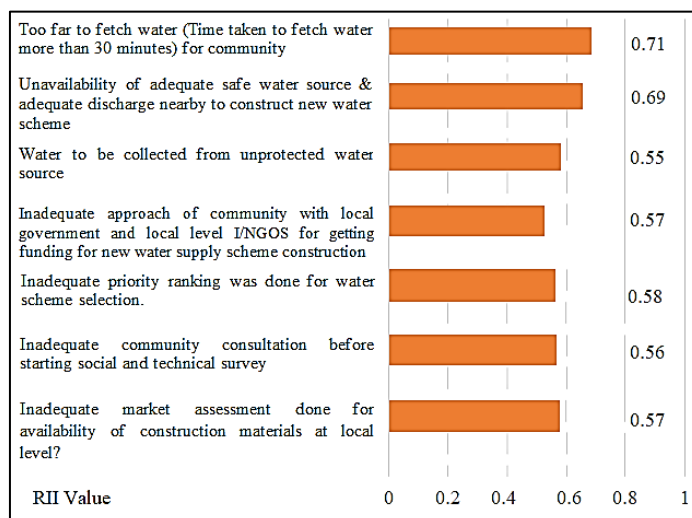


Figure 1: RII value of the responses on Sustainability related problems during pre-construction stage- survey phase.

As presented on Fig. 1 with RII value 0.71 respondents replied that there was problem to fetch water which required more than 30 minutes round trip time. Similarly, RII value 0.69 respondents agreed that there was unavailability of adequate safe water source and enough discharge to construct new water scheme nearby their community.

RII value 0.58 respondents agreed on there was problem of water to be collected from unprotected water source.

RII value 0.55 respondent agreed on there was problem on Inadequate approach of community with local government and

local level I/NGOS for getting funding for new water supply scheme construction, RII value 0.57 respondent agreed on there was problem of inadequate priority ranking for water scheme selection, so that they were facing problems before construction of water scheme.

RII value 0.56 respondents agreed on there was problem due to inadequate community consultation before starting social and technical survey, RII value 0.57 respondent agreed that there was market assessment done for availability of construction materials at local level.

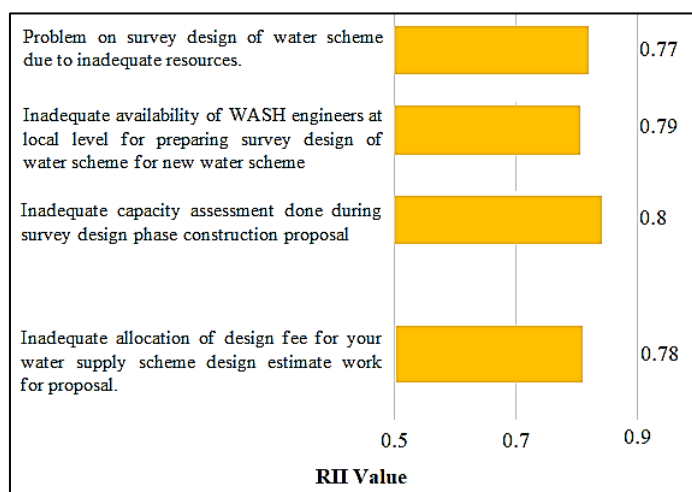


Figure 2: RII value of the responses on Sustainability related problems during pre-construction stage- design phase.

As presented on Fig. 2 among total respondents, RII value 0.77 agreed that problem on survey design of water scheme due to inadequate resources, RII value 0.79 agreed that there was problem due to inadequate availability of WASH engineers at local level for preparing survey design of water scheme for new water scheme proposal, RII value 0.8 respondent agreed that there was problem related to inadequate capacity assessment during survey design of water scheme pre construction, Similarly RII value 0.78 Inadequate allocation of design

fee for your water supply scheme design estimate work for proposal.

Sustainability Related Problems Associated During Construction of Water Supply Schemes

Various sustainability related problems during the construction stage of the water supply schemes have been collected from literature review and was tailored for the study. The response of this has been tabulated in the Table 4 below.

Table 4: RII of each problem on during construction stage.

Sustainability Related Problems- During Construction Stage	RII
Community engagement/contribution & community consultation.	0.75
Conflict management on water source, structural location.	0.62
Accuracy in pipeline alignment & pipe fittings in comparison with original design construction materials in local level.	0.68
Following original design of scheme during construction.	0.67
Accuracy on selected location of structures as per design pipeline alignment & pipe fittings.	0.72
Unavailability of skilled workers local level for construction.	0.71
Unavailability of unskilled workers local level for construction.	0.67
Unavailability of construction materials in local level for construction.	0.69
Transportation of construction materials on time	0.66
Storage of construction materials at site.	0.67
Construction material management.	0.66
Damages of construction materials.	0.7

As presented on Table 4, regarding questionnaires during construction stage of water scheme, RII 0.75 of respondents agreed on there was problem on community engagement and community contribution and community consultation,

RII 0.62 of respondents agreed on there was problem on conflict management on water source, structural location (e.g. Formal paid or unpaid agreement with landowner, water distribution, right to water for community of surrounding water source etc.).

RII 0.68 of respondents agreed on there was problem on accuracy in pipeline alignment and pipe fittings in comparison with original design, similarly, RII 0.67 of respondents agreed on there was problem on following original design of scheme during construction, RII 0.72 of respondents agreed on there was problem of accuracy on

selected location of structures as per design, RII 0.71 of respondents agreed on there was problem of availability of skilled workers local level for construction, RII 0.67 of respondents agreed on there was problem of availability of unskilled workers local level for construction.

RII 0.69 of respondents agreed on there was problem of availability of construction materials in local level for construction, RII 0.66 of respondents agreed on there was problem of transportation of construction materials on time, RII 0.67 of respondents agreed on there was problem of storage of construction materials at construction site, RII 0.66 of respondents agreed on there was problem of construction material management (store keeping, material inventory, damage register etc.), RII 0.70 of respondents agreed on problem due to damages of construction materials.

Sustainability Related Problems Associated with Post Construction of Water Supply Scheme

Various sustainability related

problems during the post-construction stage of the water supply schemes have been collected from literature review and was tailored for the study. The responses of this have been tabulated in the Table 5 below.

Table 5: RII value of each problem related to post construction stage.

Problems	RII
Inadequate operation and maintenance.	0.7
Operation and maintenance skilled technician at community level.	0.69
Donor funding / funding source for O & M.	0.68
Community willingness to pay monthly tariff/revenue/fee for O & M fund.	0.65
Spare parts & linkage of user community with market.	0.7
Increasing water demand with time spent after construction.	0.6
Water source depletion/water source availability & conflict on water source.	0.67
Water contamination, Leakage, and impact on structures due to natural disaster, human & animal activity.	0.7
Regularity on water quality testing.	0.65
Regularity on centralized water treatment before distribution.	0.67
Inadequate O & M guidelines.	0.68
Waste water management.	0.66

As presented on Table 5 regarding questionnaires post construction stage of water scheme, RII 0.70 of respondents agreed on there was problem of inadequate operation and maintenance, RII 0.69 of respondents agreed on there was problem of operation and maintenance skilled technician at community level, RII 0.68 of respondents agreed on there was problem due to inadequate donor funding / funding source for O & M, RII 0.65 of respondents agreed on there was problem due community willingness to pay monthly tariff/revenue/fee for O & M fund. RII 0.70 of respondents agreed on there was problem due spare parts and linkage of user community with market. RII 0.60 of respondents agreed on there was problem due Increasing water demand with time spent after construction, RII 0.67 of respondents agreed on there was problem due to water source depletion/water source availability and conflict on water source, RII 0.70 of respondents agreed on there was problem due to water contamination, leakage, and impact on structures due to natural disaster, human and animal activity. RII 0.67 of respondents agreed on there was

problem due to irregularity on water quality testing, RII 0.65 of respondents agreed on there was problem on regularity of centralized water treatment before distribution, RII 0.68 of respondents agreed on there was problem of inadequate O & M guidelines, RII 0.69 of respondents agreed on there was problem of waste water management, RII 0.66 of respondents agreed on there was problem of inadequate legislation, policies and political support for O & M.

Causes of Sustainability Related Problems Associated with Community Water Supply Schemes

After studying the major problems associated with the sustainability of the water supply schemes at various stages, causes behind the sustainability related problems were studied. For this, nine different root causes triggering behind the problems collected from literature review and tailored for the context was done. The responses are depicted in table 6 below.

Table 6: RII value of each causes of sustainability related problems.

Causes of Problems	Code	RII
Inefficient water management committee & quality of leadership (institutional) support.	CP1	0.71
Inadequate O & M fund & donor/funding source (Financial).	CP2	0.73
Passive repair and maintenance work & lack of spare parts for O & M.	CP3	0.73
Inadequate community engagement/people’s participation to project.	CP4	0.72
Inappropriate design & construction techniques of the community water scheme (Technical)	CP5	0.75
Low.	CP6	0.73
Lack of capacity building training for water user committee.	CP7	0.69
Water source deplete on/ water source availability & confliction water source.	CP8	0.76
Inadequate legislation, policies & political support.	CP9	0.75

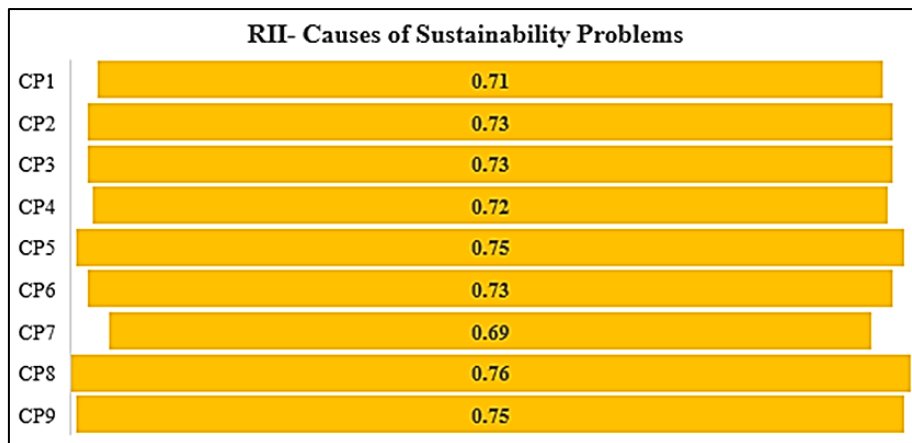


Figure 3: Causes of problems of community water supply schemes.

As presented on the Table 6 and Fig. 3 regarding questionnaires causes of problems on community water scheme, RII 0.71 of respondents agreed on there was causes of problem of inefficient water management committee and quality of leadership which is institutional problem, RII 0.73 of respondents agreed on there was causes of problem of inadequate O & M fund and donor/funding source financial problem, RII 0.73 of respondents agreed on there was causes of problem of passive repair and maintenance work and lack of spare parts for O & M.

RII 0.72 of respondents agreed on there was causes of problem of community engagement/peoples participation to project, community willingness and ability to pay for O & M. RII 0.75 of respondents agreed on there was causes of problem of inappropriate design and construction techniques of the community water scheme, RII 0.73 of respondents agreed on causes of problem due to low-level consumer's satisfaction with the service of portable water in terms of

quality accessibility reliability quality.

RII 0.69 of respondents agreed on causes of problem due to lack of capacity building training for water user committee, maintenance technicians and inadequate numbers of skilled village maintenance worker /technicians, RII 0.76 of respondents agreed on causes of problem due to water source depletion/water source availability and conflict on the water source, RII 0.75 of respondents agreed on causes of problem due to inadequate legislation, policies and political support.

Impact of Sustainability Related Problems Associated with Community Water Schemes

Impact of the sustainability related problems were studied using possible impacts that may arise from the existing problems. The impacts were collected from the literature review and have been tailored for the study. The details have been depicted in Fig. 4 below.

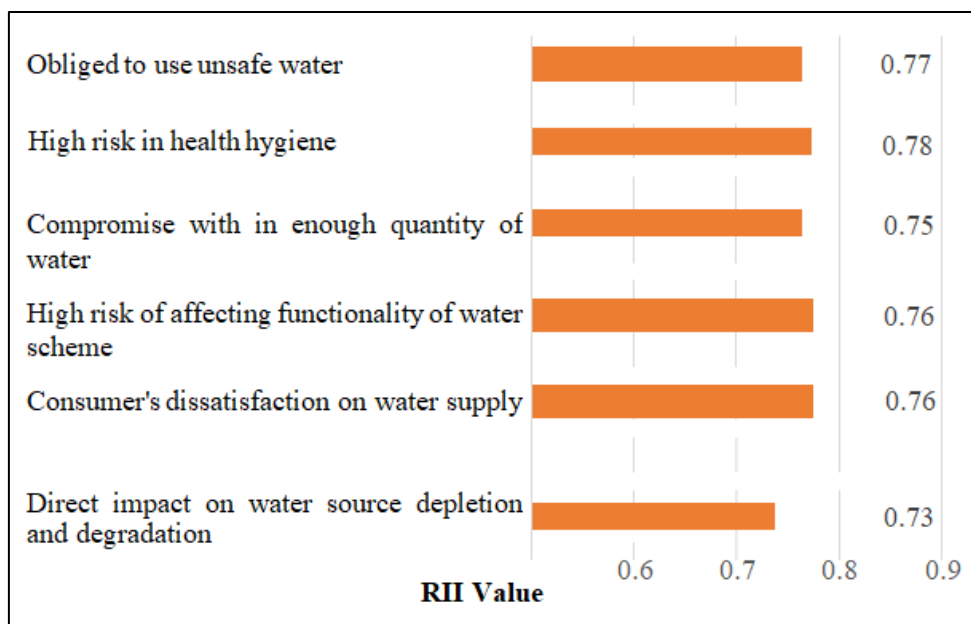


Figure 4: Impact of problems in community water schemes.

As presented on Fig. 4, regarding questionnaires on impact of problems on community water scheme, RII value 0.77 of respondents agreed on impact of problem is community people obliged to use unsafe water, RII value 0.78 impact is high risk in health and hygiene, RII value 0.75 compromise with insufficient quantity of water for drinking and basic sanitation and hygiene, RII value 0.76 respondents agreed on high risk on affecting functionality of water scheme, RII value 0.76 agreed on consumer dissatisfaction on water supply, and with RII value 0.73 respondents agreed on direct impact on water source depletion and degradation.

Solution of Problems Related to Sustainability of Community Water Schemes

Finally, after measuring the factors behind the sustainability related problems, its causes and possible impacts that may arise from the sustainability related problems of the water supply schemes; the probable solutions are laid down. Twelve probable solutions collected from literature review and tailored for the study has been asked for the respondents to rank. The responses are depicted in the Table 7 below.

Table 7: RII value of each proposed solution related to sustainability related problems.

Probable Solutions	Code
Follow priority ranking, precise feasibility study & survey of scheme selection.	PS1
Appropriate design, technology and implementation as per design.	PS2
Formation of active & responsive water user committee (WUSC).	PS3
Management of adequate Operation and Maintenance (O & M) funds.	PS4
Management of adequate spare parts for O & M.	PS5
Management of regular capacity building training to water user committee.	PS6
Increasing community engagement & consultation.	PS7
Environmental consideration such as source protection, water recharge.	PS8
Establishment coordination & linkage between water user's committee.	PS9
Active water safety plan, water safety members.	PS10
Integrating gender equity and social inclusion.	PS11
Developing & providing operation and maintenance manual.	PS12

The responses of the ranks given by the respondents are depicted in the Table 8 and Fig. 5 below.

Table 8: Rank of the RII value each proposed solution related to sustainability related problems.

Probable Solutions	Code	RII	Rank
Management of adequate Operation And Maintenance (O&M) funds.	PS4	0.79	1
Appropriate design, technology and implementation as per design.	PS2	0.77	2
Formation of active & responsive water user committee (WUSC).	PS3	0.77	3
Management of regular capacity building training to water user committee.	PS6	0.77	4
Follow priority ranking, precise feasibility study & survey of scheme selection.	PS1	0.72	5
Increasing community engagement & consultation.	PS7	0.72	6
Establishment coordination & linkage between water user's committee.	PS9	0.71	7
Active water safety plan, water safety members.	PS10	0.71	8
Developing & Providing operation and maintenance manual.	PS12	0.71	9
Management of adequate spare parts for O&M.	PS5	0.69	10
Integrating gender equity and social inclusion.	PS11	0.69	11
Environmental consideration such as source protection, water recharge.	PS8	0.68	12

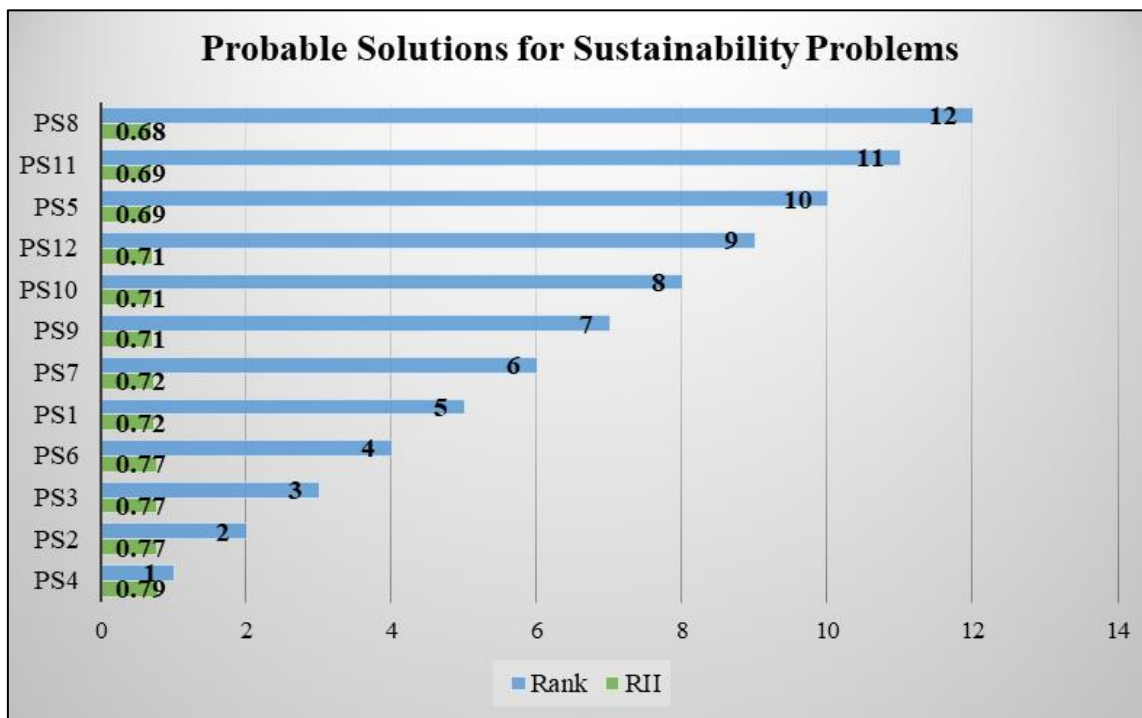


Figure 5: Rank of proposed solution.

Table 8 and Fig. 5 shows that RII value of each proposed solution of problems in community water scheme of study area. Regarding questionnaires proposed solution of problems on community water scheme, respondents agreed on proposed solution of problem to follow priority ranking precise feasibility study and survey of scheme selection with RII value 0.72, respondents agreed on proposed solution of problem as

to follow appropriate design, technology and implementation as per design with RII value 0.77.

Similarly, with RII value 0.77, respondents agreed on proposed solution of problem as formation of active and responsive Water User Committee (WUSC) by Institutional set up, RII value 0.79 respondents agreed on proposed solution of problem as management of adequate

Operation and Maintenance (O & M) funds and funding sources (Financial), RII value 0.69 agreed on proposed solution of problem as management of adequate spare parts for O & M for the proper functioning of the physical condition of structures and water supply scheme.

Likewise, RII value 0.77 of respondents agreed on proposed solution of problem as management of regular capacity building training to water user committee and maintenance technicians.

Similarly, RII value 0.68 of respondents agreed on proposed solution of problem as environmental consideration such as source protection, water recharge, protecting from contamination, environmental assessment,

RII value 0.71 of respondents agreed on proposed solution of problem as establishment coordination and linkage between water users committee with local government, I/NGOs, and related water and sanitation body government authority, market supply chain for spare parts, and water quality testing, RII value 0.72 of respondents agreed on proposed solution of problem as Increasing community engagement and consultation, responding to community feedback to improve service level for consumer satisfaction, RII value 0.62 of respondents agreed on proposed solution of problem as integrating Gender Equity and Social Inclusion (GESI), User friendly (Child, elderly people, women, and disability-friendly) structures in water schemes, RII value 0.71 weightage mean of respondents agreed on proposed solution of problem as Providing operation and maintenance manual, standard operating procedure, as-built design drawing of water scheme and related training to user committee.

CONCLUSION

The study on community water supply schemes provides critical insights into the demographic composition,

institutional mechanisms, functionality, and sustainability-related challenges faced by these projects. The findings reveal that most respondents are from agricultural households, indicating a significant dependence on water for both domestic and agricultural purposes. Despite some progress, the operational and institutional performance of water user committee's remains weak, characterized by low engagement in regular meetings, limited capacity-building efforts, and insufficient monitoring activities. Sustainability-related challenges arise in all project phases, including inadequate technical design and survey preparation, lack of skilled manpower, community engagement issues, and insufficient funding for Operation and Maintenance (O & M).

Similar challenges were identified in the implementation of the Integrated Urban Development Plan (IUDP) in Godawari Municipality, where key barriers included inadequate institutional capacity, limited technical support, financial constraints, transparency issues, and a lack of community ownership [12]. Both studies emphasize the importance of robust institutional frameworks, clear project prioritization, enhanced technical capacity, and formalized community engagement as critical factors for successful and sustainable project implementation. Drawing on the IUDP's proposed solutions, addressing sustainability in community water supply schemes could similarly benefit from better feasibility studies, improved design practices, strengthened management committees, adequate O & M funding, and enhanced coordination among institutions.

By integrating lessons from IUDP implementation such as strengthened financial accountability, use of cost-effective technical consultants, and community-driven approaches water management projects can improve their operational sustainability. A participatory model involving all relevant stakeholders and a clear legislative framework can promote long-term

functionality and resilience, contributing to holistic regional and community development.

RECOMMENDATIONS

To ensure sustainable water supply management, it is recommended to strengthen institutional mechanisms by empowering responsive and accountable Water User Committees (WUSCs) with clear roles, regular meetings, capacity-building training, and transparent decision-making processes. Technical design and construction practices should prioritize feasibility studies, community needs, and sustainable design standards with expert supervision. Enhancing community participation through active engagement during all project phases and implementing Gender Equity and Social Inclusion (GESI) strategies is essential. Sustainable operation and maintenance (O & M) models must incorporate diversified funding mechanisms, community tariffs, and reliable market linkages for spare parts and technical support. Policy support should focus on clear legislative frameworks, environmental conservation measures, and regular water quality testing. Finally, continuous capacity building and the establishment of knowledge-sharing platforms will enhance technical and managerial expertise while promoting best practices in water supply project management.

REFERENCES

1. World Health Organization, "Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda," *World Health Organization*, Mar. 21, 2022. <https://www.who.int/publications/i/item/9789240045064>
2. T. Dube, "Emerging Issues on the Sustainability of the Community Based Rural Water Resources Management Approach in Zimbabwe: A Case Study of Gwanda District," *SSRN Electronic Journal*, vol. 1, no. 3, 2013, <https://doi.org/10.2139/ssrn.2346802>.
3. H. Spaling, G. Brouwer, and J. Njoka, "Factors affecting the sustainability of a community water supply project in Kenya," *Development in Practice*, vol. 24, no. 7, pp. 797–811, Sep. 2014, <https://doi.org/10.1080/09614524.2014.944485>.
4. Abrha M., "An Assessment of Challenges of Sustainable Rural Water Supply: The Case of Ofla Woreda in Tigray Region," *Irrigation and Water Management*, Jun. 01, 2006. https://www.researchgate.net/publication/320335657_An_Assessment_of_Challenges_of_Sustainable_Rural_Water_Supply_The_Case_of_Ofla_Woreda_in_Tigray
5. T. Dube, "Emerging Issues on the Sustainability of the Community Based Rural Water Resources Management Approach in Zimbabwe: A Case Study of Gwanda District," *SSRN Electronic Journal*, vol. 1, no. 3, 2013, <https://doi.org/10.2139/ssrn.2346802>.
6. P. A. Harvey and R. A. Reed, "Sustainable supply chains for rural water supplies in Africa," *Proceedings of the Institution of Civil Engineers - Engineering Sustainability*, vol. 159, no. 1, pp. 31–39, Mar. 2006, <https://doi.org/10.1680/ensu.2006.159.1.31>.
7. A. K. M. Kamruzzaman, I. Said, and O. Osman, "Overview on Management Patterns in Community, Private and Hybrid Management in Rural Water Supply," *Journal of Sustainable Development*, vol. 6, no. 5, Apr. 2013, <https://doi.org/10.5539/jsd.v6n5p26>.
8. D. Whittington, J. Davis, L. Prokopy, "How well is the demand-driven, community management model for rural water supply systems doing? Evidence from Bolivia, Peru and Ghana," *Water Policy*, vol. 11, no. 6, pp. 696–718, Oct. 2009, <https://doi.org/10.2166/wp.2009.310>.
9. S. K. Bhattarai P. Bhanadari, P. Luitel,

- “Towards Sustainable Local Development: Comparative Analysis of Periodic Plans in Nepalese Municipalities,” *Journal of Interior Designing and Regional Planning*, vol. 9, no. 1, pp. 58–72, Jun. 2024, <https://doi.org/10.46610/joidrp.2024.v09i01.005>
10. United Nations, “The Sustainable Development Goals Report 2022,” *unstats.un.org*, Jul. 07, 2022. <https://unstats.un.org/sdgs/report/2022/>
11. “The Fifteenth Plan National Planning Commission Singhadurbar, Kathmandu.” Available: https://npc.gov.np/images/category/15th_plan_English_Version.pdf
12. U. Poudel, A. C. Lal, S. K. Bhattarai, and Sudeep Sharma Paudyal, “IUDP: Prospects and Challenges for Implementation in Nepal: A Case Study of Godawari Municipality,” *Journal of Recent Activities in Architectural Sciences*, pp. 38–62, 2024, Accessed: Jan. 18, 2025. [Online]. Available: <https://matjournals.net/engineering/index.php/JoRAAS/article/view/609>

CITE THIS ARTICLE

Y. B. Karki, B. Adhikari and S. B. Shahi, “Advancing Sustainability in Rural Water Management: Insight from Chaurjahari Municipality, Nepal”, *International Journal of Environmental Management and Renewable Energy System*, vol. 1, no. 1, pp. 19-34, Jan. 2025.