Nepal Journal of Multidisciplinary Research (NJMR)
Vol. 5, No. 5, December 2022. Pages: 96-108
ISSN: 2645-8470 (Print), ISSN: 2705-4691 (Online)
DOI: https://doi.org/10.3126/njmr.v5i5.51808

Innovative monitoring mechanism: Evidence from rural drinking water sector in Nepal

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Received: November 24, 2022; Revised & Accepted: December 27, 2022

Abstract

The paper aims at determining innovative monitoring mechanism in the context of rural drinking water sector of Nepal. This study is based on both primary and secondary data. The necessary primary data were collected through telephone interview using semi-structured questionnaire while the secondary data were collected through database and publications. The collected data were analysed through simple statistical tools to derived results leading to major findings of the study. The study shows that the innovative monitoring mechanism such as, letter monitoring, hello monitoring, sensor monitoring, and toll-free monitoring are useful tools for efficient and effective monitoring of rural drinking water system in the context of developing countries like Nepal. Considering the innovative monitoring ladders and on-site monitoring, the study further concludes that a combination of two or more innovative monitoring mechanisms will make more sense for effective and efficient monitoring mechanism to keep the projects functional and sustainable. This study may be useful for development actor in the sector, academia, and policy makers. The study can be further extended by capturing learning from the implementation for these innovative monitoring mechanism in the context of rural and urban drinking water sector in Nepal.

Keywords: Innovative monitoring mechanism, letter monitoring, hello monitoring, sensor monitoring, toll-free monitoring

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Introduction

The project monitoring offers flexibility and speed for testing innovative approaches and new technologies (Lockwood, 2015). The reality in many developing countries is that government-led water, sanitation, and hygiene (WASH) monitoring systems remain weak and are often underfunded (Lockwood, 2015). Despite these dilemmas, several recent trends indicate that project monitoring and government-led systems can be mutually beneficial and contribute positively to comprehensive national sector monitoring systems. Likewise, Deroo, Walter, & Graham (2015) studied 21 organizations implementing WASH in school programs to assess monitoring and evaluation (M&E) policies and practices and found that the need to better integrate M&E into government systems that will endure post-implementation. Further, there is a need to expand the data collected and improve the quality of national monitoring systems and a need to create standard indicators to facilitate M&E activities (Deroo, Walter, & Graham, 2015).

The water sector in Nepal is currently highly non-functional and obstructing regular access to safe water for the rural communities (Adhikari, 2019). In this connection, 95 percent of the population has access to basic drinking water (UNICEF, 2019) so far but there are only 28 percent of the existing water supply schemes are functioning well (NIMP, 2019). Likewise, there are 38 percent needed minor repair while about 34 percent of the schemes have been identified needing major repair, rehabilitation, or complete reconstruction in the country (NIMP, 2019).

In addition, most of the drinking water systems have been completely or partially damaged without completing their design period due to various reasons. That is why, Nepal Water for Health (NEWAH) as a non-governmental organization (NGO) has initiated and adopted an innovative post-implementation monitoring mechanism and follow-up support to make the projects to be functional and sustainable. NEWAH is a national level NGO specialized in ensuring access to safe drinking water, sanitation, and hygiene (WASH) services in rural areas of Nepal. Founded in 1992 AD, NEWAH has provided WASH services to about 2.2 million people through more than two thousand and six hundred projects implemented in 51 districts of Nepal (NEWAH, 2022).

Along with the time, NEWAH has been adopting various innovative technology and post-project monitoring mechanism including distance monitoring mechanism. Along with on-site monitoring, the monitoring ladders having innovative initiatives comprises letter monitoring, hello monitoring, sensor monitoring, and toll-free monitoring. The above discussion shows that the studies dealing with innovative monitoring mechanism in rural drinking water sector of Nepal are of greater significance.

Materials and methods

The study comprises descriptive cum exploratory research design based on both primary and secondary data. In case of letter monitoring, the secondary data were only received and analysed in this study as this mechanism has been discontinued these days due to widespread use of mobile

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phones. Under hello monitoring, a telephone interview was conducted with 368 caretakers and the users committee office bearers from Sindhuli, Baglung, Chitwan, Dhading, and Nuwakot districts to get information about the functionality of the respective past projects. The collected data through these calls have been analysed in this study. Altogether, 825 sensors were installed in eight municipalities of Sindhuli and Baglung districts of Nepal to monitor functionality of the respective projects. The sensors' related data were collected from these municipalities and considered for the analysis under this study. In addition, there are 26 calls were received from Sindhuli, Baglung, Chitwan, and Makwanpur districts through toll-free call centre and analysed in this study to derive its effectiveness and future scope.

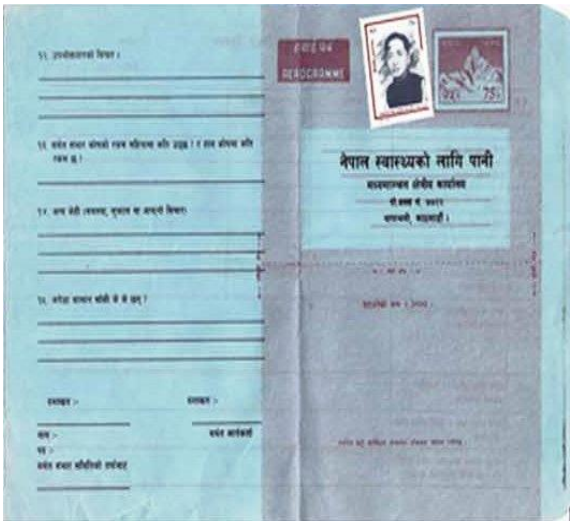
The necessary primary data were collected through telephone interview using semi-structured questionnaire while the secondary data were collected through database and publications. The collected data were analysed using simple statistical tools such as percentage, graph, table, and descriptive statistics to derived results leading to major findings of the study.

Results and major findings

An attempt made in this section to analyse innovative monitoring mechanism comprises letter monitoring followed by hello monitoring, sensor monitoring, and toll-free monitoring in the context of rural drinking water sector of Nepal.

Letter monitoring

NEWAH initially adopted a system of on-site monitoring every six months for two years after the completion of the project to keep the drinking water system functional. Later, it was changed to a system of on-site monitoring once a year for two consecutive years. As the number of projects increased over the years, a monitoring through letter system was adopted.



A sample of airmail. Photo: Bharat Adhikari Sharma

In terms of adopting timely technology and methodology, NEWAH from 1995 AD to nearly over a decade, the letter monitoring system was widely used. The letter included the name of the project and the reporting authority with list of possible problems with the entire structures and were provided to the users' committee sufficient for two years period.

The use of letter monitoring has been discontinued due to widespread use of mobile phones. In the areas where use of the mobile phones has not reached and the postal service are the only means of distance communications, letter monitoring system can still be adopted.

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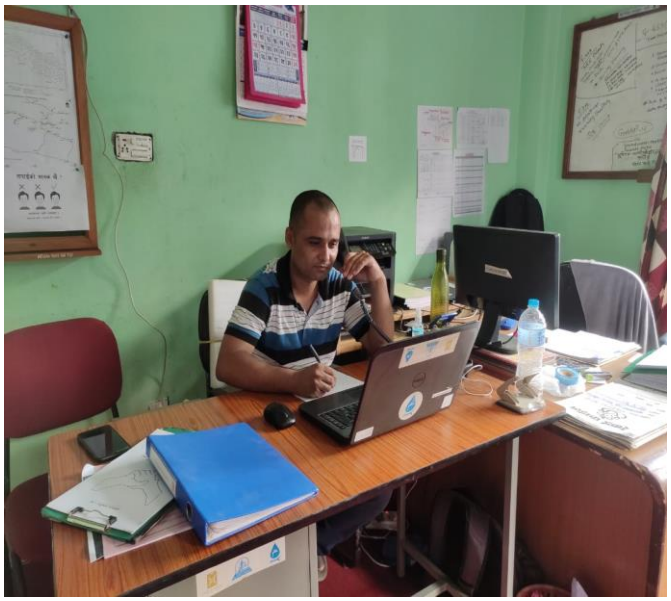
Hello monitoring

After the introduction and widespread use of mobile phones, NEWAH started hello monitoring system from September 2015 AD. Under this system, a NEWAH technician call the caretakers and the users committee office bearers once every year to get information about the functionality of the past projects.

Through hello monitoring, NEWAH technicians collect information of the recent visit by caretakers to all the tap stands, its functionality, detail information on the non-functional tap stands, expected time to repair, reason behind not repairing, record of spare parts, payment regularity to the caretakers of the reported projects.

Information is collected from the users committee about tariff collection, total maintenance fund, regularity of committee meetings, spare parts. Similarly, the other information include time spent on problem solving and by whom, replacement status of spare parts used in repairing, and availability of spare parts in the local market or district headquarters are also collected from the users' committee.

In this connection, number of projects, tap stands, households, and daily water users monitored by hello monitoring in Sindhuli, Baglung, Chitwan, Dhading, and Nuwakot districts of Nepal are given in Table-1.



NEWAH technician Bibek Prasad Dahal calling to the community for hello monitoring. Photo: Dipak Bayak

Accordingly, hello monitoring was conducted for 252 projects in Sindhuli followed by 83 projects in Baglung, 26 projects in Chitwan, two projects in Dhading, and one project in Nuwakot districts of Nepal. Altogether, only two staff within a short period can monitor 364 projects and 11,782 tap stands remotely and about 164,175 community people of 26,378 households including school students were benefited from these monitoring. Out of monitored projects, hello monitoring (2022) shows that 81% functional, 14% partial functional, and 5% non-functional projects implemented with the support of charity: water funding from 2010 to 2022 in Nepal.

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Table 1
Number of projects, tap stands, households, and daily water users monitored though hello monitoring (2022) in different districts of Nepal

SN	Districts	Number of projects	Number of tap stands	Number of households	Number of daily water users
1	Sindhuli	252	7,524	16,412	104,816
2	Baglung	83	3,564	7,158	43,479
3	Chitwan	26	628	2,651	14,963
4	Dhading	2	55	87	441
5	Nuwakot	1	11	70	476
	Total	364	11,782	26,378	164,175

Source: NEWAH 2022.

Based on the problems identified in the projects through hello monitoring, NEWAH technicians coach caretakers over the phone to fix the problems. If the solution is beyond their capacity, NEWAH technicians will provide technical assistance by visiting the project site to fix the problem. If there has been major damages and rehabilitations is required, NEWAH technicians will conduct a technical survey and prepare a project list for the project's rehabilitations.

This method can monitor many projects within a short period of time, which also reduces the cost. Because of this, the hello monitoring is useful and is being used continuously based on its effectiveness and efficiency.

Sensor monitoring

Nowadays, sensors are used for various purposes in different fields of life. While adopting up-to-date technology and methods, sensor testing has started in the water supply sector as well. With the support of charity: water, USA, the sensor technology is being tested in various countries in Asia and Africa. Accordingly, pipe sensors have been imported and installed in Nepal to make the distance monitoring more effective and to be in line with the advanced technology, NEWAH initiated sensor monitoring from April 2019 AD (NEWAH, 2019). The main purpose of

A sensor. Photo: Dr. Maheshwar Prasad Yadav

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installing sensors in water tap stands is to monitor the functionality of water systems. The functionality of the systems can be known frequently from anywhere.

Sensor is a small device with a GSM sim, battery, and a turbine, which regularly checks whether water is flowing from a tap stand as well as how much water is flowing from the respective tap stand and data shall be transmitted to the dashboard.

Sensor installation includes site selection, caretakers training, installation, sensor registration, site registration, and monitoring from installed sensors. Training on sensor installation is provided to the caretakers of the respective water supply system. Then, sensors are installed to the respective tap stands of the systems. The caretakers have been mobilized for sensor installation work. Through the installation process, the caretakers are aware about the sensors which helps in the maintenance work afterward. Furthermore, the installed sensors are registered in NEWAH MODACO (Mobile data collection, MODACO) through pre-designed 'Site Registration Survey' and 'Sensor Installation Survey'.

NEWAH technicians call to the respective users committee and caretakers if necessary while analysing the data obtained from the sensor monitoring. Before providing the service, the level of problems is analysed. According to the level of the problems, NEWAH technicians provide coaching to the caretakers by phone or on-site visits to solve the problems. According to the information received from the sensor monitoring, NEWAH technicians call daily to get more information and help solve the problem. Similarly, sensor call centre monitoring report is prepared twice every month.

A tap stands with sensor technology. Photo: Er. Sanjiv Kumar Thapa

A total of 1,444 sensors were imported in Nepal. Out of which, due to some technical reasons, only 825 sensors were installed in Baglung and Sindhuli districts of Nepal as given in Table-2.

Consequently, 402 sensors were installed in Tinpatan Rural Municipality followed by 131 sensors installed in Phikkal Rural Municipality and 68 sensors installed in Municipality of Sindhuli district. Likewise, 91 sensors were installed in Nisikhola Rural Municipality followed by 73 sensors installed in Dhorpatan Municipality, 28 sensors installed in Badigad Rural Municipality, 21 sensors installed in Jaimini Municipality, and 11 sensors installed in Tarakhola Rural Municipality of Baglung district in Nepal.

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Table 2
Number of projects, tap stands, households, and daily water users monitored by sensors installed in Sindhuli and Baglung districts of Nepal

SN	Districts	Municipality	Number of sensors installed	Number of projects monitored	Number of tap stands monitored	Number of households monitored	Number of daily water users monitored
1	Sindhuli	Tinpatan Rural Municipality	402	50	1,673	2,801	23,269
2	Sindhuli	Phikkal Rural Municipality	131	27	584	1,177	8,828
3	Sindhuli	Golanjor Rural Municipality	68	9	259	482	2,941
4	Baglung	Nisikhola Rural Municipality	91	21	843	1,637	11,470
5	Baglung	Dhorpatan Municipality	73	7	238	392	3,792
6	Baglung	Badigad Rural Municipality	28	10	318	563	4,380
7	Baglung	Jaimini Municipality	21	3	123	316	2,231
8	Baglung	Tarakhola Rural Municipality	11	2	111	132	770
Total			825	129	4,149	7,500	57,681

Source: NEWAH 2022.

Altogether, 825 sensors can monitor 129 projects and 4,149 tap stands remotely and about 57,681 community people including school students were benefited from these monitoring. Similarly, rural/municipality and development actors in the sector can monitor the water supply projects implemented in the respective municipality within a short period of time at low cost through the sensors installed in their municipalities. The sensor installed projects can be monitored from any corner of the world using internet. One can know whether a tap stand is functioning or not including how much water flowing from the respective tap stand frequently. So that the sensor monitoring method is useful in terms of effectiveness and efficiency.

According to the agreement made between NEWAH and the respective rural/municipality, the monitoring of water supply projects has been made effective by fulfilling their respective responsibilities.

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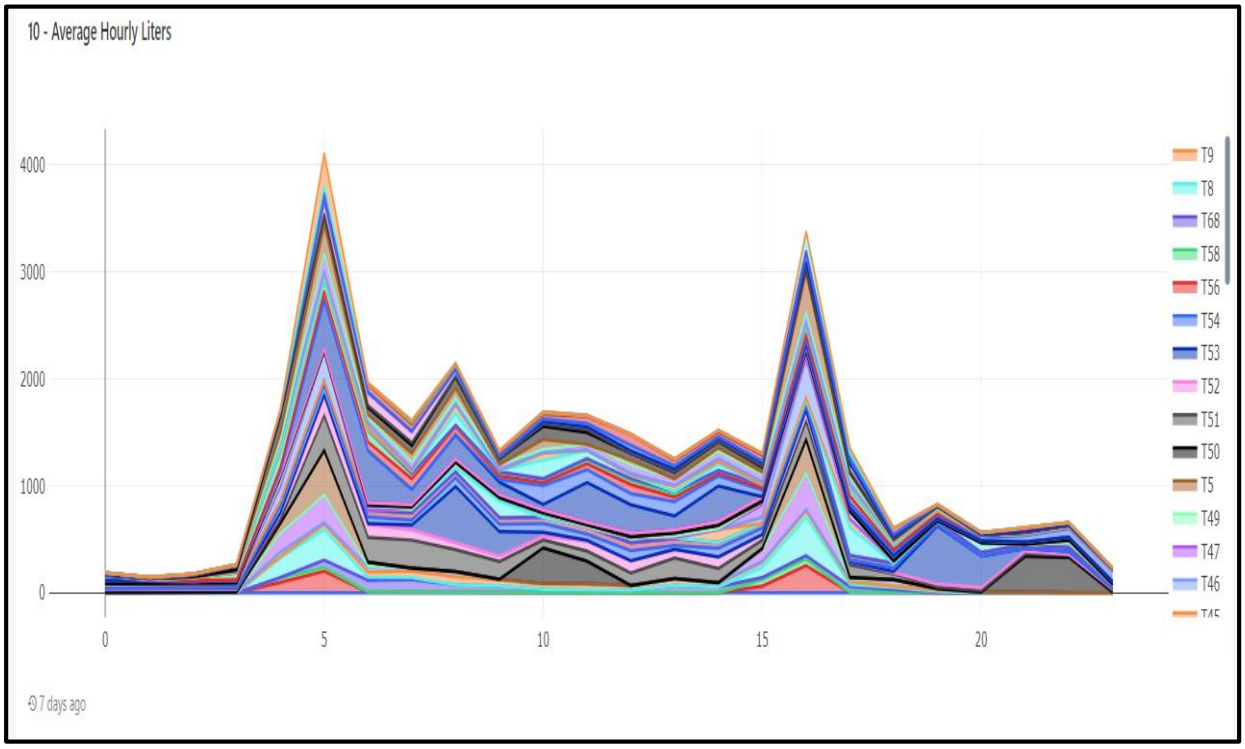

Water flow data from sensor dashboard (average in litters per hour). Photo: Dr. Maheshwar Prasad Yadav

The sensor transmits the information about the water flow from the respective tap stands to the dashboard. Similarly, the number of days with zero litre flow throughout the day in the selected month can be known. The sensor transmits the average water flow in litres based on the population. High flow, the number of hours in the selected month where the litres per hour can be found to be between 360 and 900. Abnormal flow, the number of hours in the selected month where the flow exceeds 900 litres per hour can be detected.

The information collected from sensor monitoring is analysed and an action plan is formulated and implemented accordingly. Measuring the effectiveness and efficiency of the sensor monitoring system is done by analysing monitoring reports, number of coaching and maintenance assistance by call and on-site visits, and projects identified for rehabilitation. Therefore, the sensor monitoring method is useful based on effectiveness and efficiency.

As mentioned above, many projects can be monitored in a short time using sensor monitoring and the cost of monitoring will be reduced. As this monitoring method is useful based on effectiveness and efficiency, it can be continued.

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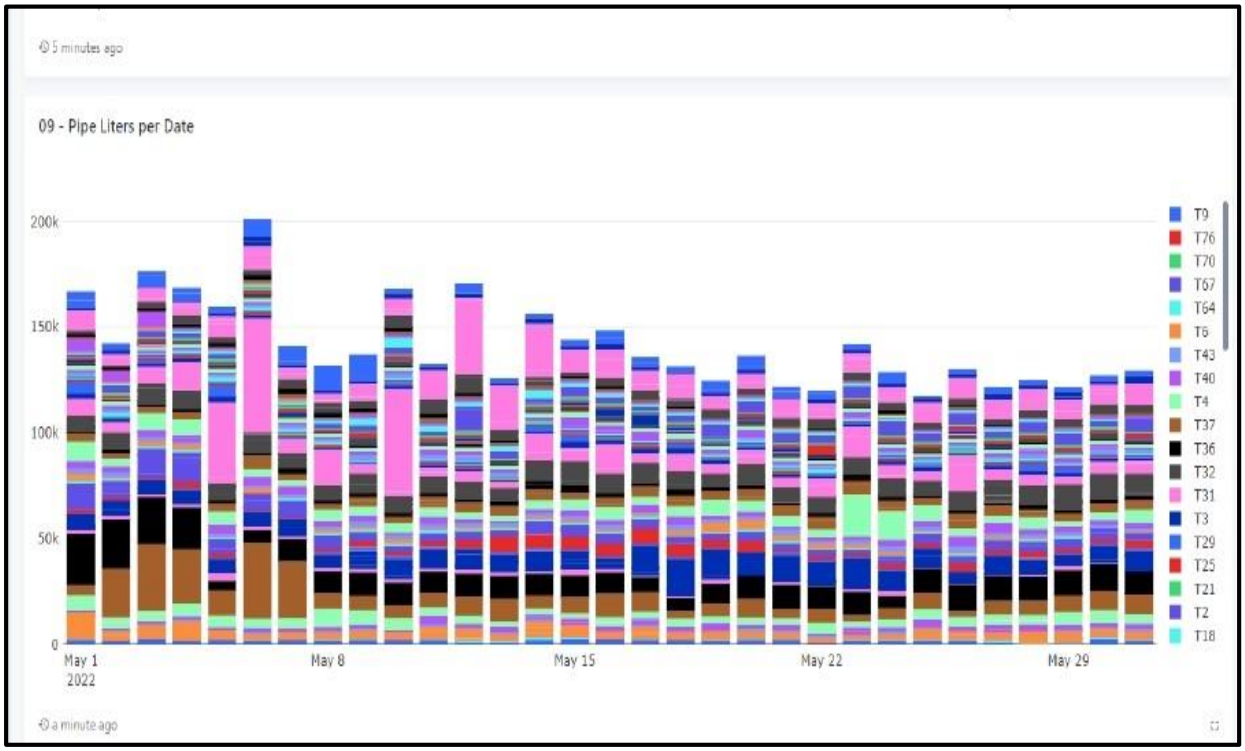

Water flow per tap stand from the sensor dashboard. Photo: Dr. Maheshwar Prasad Yadav

Based on the experience of sensor monitoring and the information obtained, technical improvement in the sensor seems necessary. It will be more fruitful to build the second-generation of sensors in Nepal by adding the feature of water meter along with other technical improvements to the sensor. The preliminary analysis shows that the sensor can be produced in Nepal having the features of a water meter can reduce the cost comparatively. The maintenance of sensors can be done as per requirements if manufactured in Nepal. In addition, it saves time and cost. Its scope of use can be extended to many areas to keep the projects functional and sustainable. If it is widely used, it will improve the quality of life of the Nepali people through sustainable access to safe drinking water, sanitation, and hygiene (WASH) services in Nepal and contribute to achieving the national goals and sustainable development goals (SDGs) related to drinking water and sanitation.

Toll-free monitoring

NEWAH, in coordination with Nepal Telecom, has established a toll-free call centre with the toll-free number of 16600123450 in March 2022 at its headquarters in Kathmandu, Nepal. Apart from public holidays, the call centre will be open from 9 am to 5 pm on Monday to Friday during office hours. A dedicated staff in the headquarters is receiving calls and keeping records into a register accordingly.

Information about the call centre has been shared with stakeholders and users through various promotional materials, group SMS and broadcasting through local FM stations in Baglung and

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Sindhuli districts of Nepal. This monitoring mechanism is the first of its kind in the water sector of Nepal. It is expected that the government will initiate and take over this role in near future.

The community people can be able to report technical issues with projects free of cost at this call centre. Based on the problems in the respective drinking water system, NEWAH technicians will provide coaching by phone or by visiting the site and get fixed their issues immediately.

Altogether, there are 26 calls were received from Sindhuli, Baglung, Chitwan, and Makwanpur districts through toll-free call centre during March to December 2022 as mentioned in Table 3.

Table 3
Number of calls received through toll-free call centre from March to December 2022

Months	*Sindhuli*	*Baglung*	*Chitwan*	*Makwanpur*	*Total*
March	3	3			6
April	4	2			6
May	1			1	2
June					0
July	2	2	1		5
August					0
September					0
October	4		1		5
November	1	1			2
December					0
Total	15	8	2	1	26

Source: NEWAH 2022.

Accordingly, 15 calls were received from Sindhuli followed by eight calls from Baglung, two calls from Chitwan, and one call from Makwanpur districts of Nepal.

Even though information about the call centre has been shared with stakeholders and users through various means, number of calls received seems very low. It indicates that dissemination of information about call centre with stakeholders is not sufficient and need to increase its frequency and provide information to the community people so that they can use this service free of cost.

A master rehabilitation plan will be prepared for each individual project identified for future restoration based on triangulation of information received from hello monitoring, sensor monitoring, and toll-free monitoring. This innovative monitoring system is first of its kind in the context of rural drinking water sector in Nepal and is expected that it will be replicated by other agencies as it moves on.

Conclusions, implications, and recommendations

The major conclusion of this study is that the innovation monitoring mechanism such as, letter monitoring, hello monitoring, sensor monitoring, and toll-free monitoring are useful tools for

efficient and effective monitoring of rural drinking water system in the context of developing countries like Nepal. The use of letter monitoring has been discontinued due to widespread use of mobile phones, however, in the areas where use of the mobile phones has not reached and the postal service are the only means of distance communications, letter monitoring system can still be adopted. Hello monitoring can be used in the context of other projects or organizations, while the effectiveness of sensor monitoring, and toll-free monitoring can only be used to determine whether it can be used in the context of other projects or organizations. In case of sensor technology, it would be more useful to manufacture and produce the second-generation sensor in Nepal by adding the features of the water meter along with technical improvements to the sensor. Under toll-free monitoring, the community people can report technical issues related to water supply projects free of cost at this call centre and get fixed their issues immediately. Considering the innovative monitoring ladders and on-site monitoring, a combination of two or more innovative monitoring mechanisms will make more sense for effective and efficient monitoring mechanism to keep the projects functional and sustainable.

This study may be useful for development actors in the sector, academia, and policy makers. The study is valuable particularly for the development actors of rural drinking water sector for more commercialization of the sector. The study aims at generating at least some new knowledge in the literature of innovative monitoring mechanism and provides avenues for future research. This study is first of its kind in the field of innovative monitoring mechanism of Nepal. Finally, it is also useful for policy makers. It would be a reference material to formulate sector-friendly policies to facilitate the rural drinking water sector in Nepal.

The first and foremost research avenue of this study is to make the study more fruitful by adding more variables and urban drinking water sector. The extension of this study can be made through conducting a detail analysis of province-wise comparison of rural drinking water sector to find out widespread results for the sector and their actors. It would be more worthwhile of incorporating the opinion and views of respondents from daily water users, regulating authorities and development actors in the sector in future studies. The study can be further extended by capturing learning from the implementation for these innovative monitoring mechanism in the context of rural and urban drinking water sector in Nepal.

Acknowledgements

The author is indebted to Nepal Water for Health (NEWAH) for providing data and information to prepare this article. Specifically, I would like to thank you Bibek Prasad Dahal, Senior Monitoring Associate, NEWAH Province Office, Sindhuli and Dhanbir Sawat, Senior Monitoring Associate, NEWAH Province Office, Baglung for conducting telephone interview with caretakers and users committee to collect data on functionality of water supply systems. Finally, I wish to express the sincerest thanks to everyone who helped me in this work in one way or another.

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