

Management Practice of Constructed Rural Water Points and Its Associated Factors at Aneded District, East Gojjam, Northwest Ethiopia, 2015

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Abstract

Introduction: Rural water point management refers to the ability of coordinating the efforts of people to accomplish desired goals and objectives by using available resources efficiently. Management of water points comprises planning, organizing, implementing, leading, controlling and evaluating of the rural water points to meet the needs of the community.

Objective: To assess management practice of constructed rural water points and its associated factors at Aneded district, northwest Ethiopia, 2015.

Method: Community based cross sectional study design was conducted from March 1-30/2015 G.C. Multistage sampling method was used. A total of 635 household heads from 38 water points were included in the study. Data was collected by trained data collectors using semi-structured questionnaires. Data was entered using Epi data version 3.1 and exported to SPSS version 20 for analysis. Odds ratio at 95% confidence level was used to express the observed associations at 5% significant level.

Result: The magnitude of good management practice in the study area was 379 (59.7%). Study participants had different roles in management practice of water points, 337 (53.1%) participated in planning, 369 (58.1%) participated in implementation, 356 (56.1%) participated in evaluation activities. The variables, male of respondents, adequate knowledge, haven't alternative water source, distance far from 1000 meters to water points and adequate water consumption (AOR=2.7 [1.719, 4.185]), (AOR=2.6 [1.788, 3.835]), (AOR=1.6 [1.085, 2.314]), (AOR=0.3 [0.208, 0.441]) and (AOR=1.6 [1.054, 2.316]) were significantly associated to management practice of rural water points respectively.

Conclusion and recommendation: The rural water point management practice of the study subjects was good. The associated factors which affect management practice of rural water point were, sex, knowledge, alternative water source, distance from water points and per-capita water consumptions. Therefore management practice of rural water points in the district were continued without any slackening and the district water and energy office should work better to raise awareness of the community.

Keywords: Rural water; Water supply; Hygiene; Sanitation

Introduction

The Millennium Development Goals created by the United Nations in the year 2000, hope to generate an international effort to fight poverty and disease. Since the adoption of the Millennium Development Goals, the world health organization/united nation children fund (WHO/UNICEF) Joint Monitoring Program for Water Supply and Sanitation has reported on progress towards achieving Target 7c: Reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015 [1].

There are over one billion people worldwide without access to potable water; the majority live in Africa and Asia. The deficiency of economic wealth is one cause of this devastating fact, and, poor management of the rural water supply schemes also contributes [2,3].

Management refers to using expertise in coordinating the efforts of people to accomplish desired goals and objectives using available resources efficiently and effectively. It comprises planning, organizing, staffing, leading and controlling of the rural water supply schemes to meet the needs of its community and embraces the concept of doing this beyond the expected time [4].

Management of water points involves increasing the alignment of development schemes with host community priorities and coordinating aid efforts at all levels (local, national, and international) to increase ownership and efficient delivery of services. It is therefore basically offering leadership to achieve certain laid objectives, and good management ensures that sufficient local resources and capacity exist to continue the water points in the absence of outside resources [5].

Community based projects are complex and require multifaceted management skills. the rural water supply schemes management

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activities include but are not limited to defining the schemes scope, managing resources and relevant training issues within a project, identifying specific and general water points management practices and escalation procedures, estimating the water schemes schedule and budget, ascertaining and managing risks within the water points and preparing risk mitigation [6].

Water is one of the basic needs of human beings. Still, achieving sustainable water supply remains one of the milestones of third world countries. In Africa, the best way to get clean water is by using boreholes, but there is a big question mark on their functionality as the non-functionality rate of these boreholes is very high [7-15].

In developing countries seventy five percent of all diseases arise from polluted drinking water. The lack of access to water also limits sanitation and hygiene practices in many households because of the priority given for drinking and cooking purposes [16].

Despite Ethiopia's goal of achieving full coverage Water Supply and Hygiene (WASH) through its Universal Action Plan, there is a long way ahead to get a fully functional water service system. In 2008, only 26% of the total rural population has access to improved drinking water sources [17].

Objectives

- To determine the magnitude of management practice of constructed rural water points.
- To identify associated factors related to management practice of constructed rural water points.

Materials and Methods

Study area: The study was conducted in Aneded district of rural area. Aneded district is one of the 18th zonal district with a total population of catchment area is estimated to be 104704 (52662 female and 52042 male). The district is located 20 km from Debre Markos, 290 km from Bahir Dar and 280 KM from Addis Ababa and the district had one urban and 19 rural kebeles, four health centers, two high schools and one preparatory school. Study was conducted from March 1-30/2015 G.C.

Study design: Community based cross sectional study design was conducted.

Source population: All people who were using constructed rural water points in Aneded district.

Study population: All people who are living in randomly selected kebeles.

Inclusion criteria: People, who are above 18 years old, lived above one year in selected kebeles and used constructed waters sources.

Exclusion criteria: Seriously sick individual.

Sample size determination: The required sample size was calculated using single population proportion formula with assumption $P=50\%$, the margin of error=0.05 and design effect 1.5 (homogeneity of study participants in the study area was high). Considering 10% non-response rate the final sample size was 635.

Sampling procedure: Multistage sampling method was used. First six kebeles were selected by using lottery methods and also 38 water points also selected by lottery method from selected kebeles. Finally household were selected by using lottery method from beneficiaries and then 635 household heads were participated

Variables: Management practice of constructed rural water points is dependent variable while socio-demographic variables (age, sex, educational status, income), environmental factors (community participation, training of community, per capita water consumption, turbidity of the water, distance of water point, use of other alternative water sources, water point breakage frequencies) and personal characteristics (knowledge and attitude) are independent variables.

Data collection tools: The data was collected through interviewer administered questionnaire.

Data processing and analysis: Data was entered in to Epi data version 3.1 and exported to SPSS version 20 for analysis purpose. Binary logistic regression analysis was used to determine statistical associations between dependent and independent variables, variables with p-value <0.2 were entered into multivariate analyses. The strength of statistical associations was measured by adjusted odds ratio and 95% confidence intervals. Statistical significance was declared at $P<0.05$.

Ethical consideration: Ethical clearance was obtained from Debre Markos University Health Science College Ethical Review Committee. Supporting letters was also obtained from East Gojjam Zone water Department and the respective Woreda water office administrations. After the purpose and objective of the study was informed, verbal consent was obtained from each study participants.

Results

Socio-demographic characteristics

From the total study participants 506 (79.7%) were males with a mean (+SD) age of 43.92 (± 13.12). Only 8 (1.3%) study participants were in the age range 20-24, while 192 (30.2%) were in the age of ≥ 50 years. Around two third of the respondents 383(60.3%) could not read and write. Out of the total study subjects 401(63.1%) of study participants earned an average monthly income of less than 500 birr, and 43 (6.8%) earn more than 1000 birr (Table 1).

Variables	Number	Percent
Age		
20-24	8	1.3
25-29	59	9.3
30-34	103	16.2
35-39	121	19.1
40-44	74	11.7
45-49	78	12.3
>50	192	30.2
Total	635	100%
Sex		
Males	506	79.7
Females	129	20.3
Total	635	100%
Average monthly income		
<500	401	63.1
500-1000	191	30.1
>1000	43	6.8
Total	635	100%
Educational statuses		
Cannot read and write	383	60.3
Can read and write	252	39.7
Total	635	100%

Table 1: Socio-demographic characteristics of respondents who participate in management practice of constructed rural water points in Aneded woreda northwest Ethiopia 2015.

Management practice of study participants about rural water points

From 635 study participants, about 379 (59.7%) respondents had good management practice. Three hundred ninety six participants (62.4%) participated in water point committee selection, 337 (53.1%) participated in planning activities, 369 (58.1%) participated in implementation 454 (71.5%) participated in different meeting, 356 (56.1%) participated in evaluation program, 309 (48.7%) participated in documented guideline preparation and 477 (75.1) were participated in maintenance activities of the water points (Table 2).

Knowledge of the study participants about water points

Among 635 study participants, about 544 (85.7) respondents had good knowledge about management practice of rural water points. From the total participants less than half 279 (43.9%) of the individuals knew the owner of the water point. On the other hand 594 (93.5%) of the participants knew the necessary things to be fulfill for rural water points for long period of functionality. All most all 632 (99.5%) of the study participants knew that their water points are easily broken unless they used properly. In addition, 609 (95.9%) of the study participant knew the maintenance cost of the water point are covered by them. Study participant of 620 (97.6%) knew water points committee were elected by them. Five hundred thirty one (83.6%) of the household knew they could get maintenance service from woreda water office (Table 3).

Attitudes of study participants about rural water points

Among 635 study participants, about 401 (63.1) respondents had

Variables	Numbers	Percent
Participation in water point committee selection		
Yes	396	62.4
No	239	37.6
Total	635	100
Participation in planning		
Yes	337	53.1
No	298	46.9
Total	635	100
Participation in implementation		
Yes	369	58.1
No	266	41.9
Total	635	100
Participation in attending in different meeting		
Yes	454	71.5
No	181	28.5
Total	635	100
Participation in evaluation		
Yes	356	56.1
No	279	43.9
Total	635	100
Participation in documented guideline preparation		
Yes	309	48.7
No	326	51.3
Total	635	100
Participation in maintenance activities		
Yes	477	75.1
No	158	24.9
Total	635	100

Table 2: Management practice of study participants, about rural water points, in Aneded woreda, northwest Ethiopia, 2015.

favorable attitude about management practice of rural water points. Respondents who were using water from constructed water sources, 397 (62.5%) and 231 (36.4%), agreed and strongly agreed with the building of water point in their village are important, respectively. From the total participants, 564 (88.8%) believed that the collection of money after construction of water point is important for creation of sense of ownership. Five hundred twenty two (82.2%) of the participants believed that their individual participation were important to manage their Owen constructed water points. Including of females in the water committee members are important for better water points management system as agreed by 539 (84.9%) of the respondents. About 318 (50.1%) of the participant were not satisfied with the water amount they got from water point. And in this study there was no neutral respondent (Table 4).

Factors affecting management practice of rural water points

From the total participant only 218 (34.3%) respondent were get training. Among the respondents, 289 (45.5%) got adequate water which are 20 and above liters of per capita water from constructed water points. Only 331 (52.1%) of the respondent had another alternative water sources in addition to constructed water point, of which 38 (6%) have rivers followed by 89 (14%) and 204 (32.1%) having springs and traditional hand dug well nearby their house, respectively.

Four hundred twelve (64.9%) participants got their water points within 1000 meters and 631 (99.4) were pay money for water point maintenance. Five hundred fifty (86.6%) study participant water was not turbid at any time. Three hundred seventy five 375 (59.1%) respondents water point did not broke, while the respondents of 260 (40.9%) constructed water point broke 1-4 in the last one year [18]. Finally about 250 (39.4%) and 401 (63.1%) study participants had good knowledge and favorable attitude about their constructed water point respectively (Table 5).

Factors affect management practice of constructed rural water point

Multivariate analysis showed that, sex was found significant association with management practice of rural water points. So, males were 2.7 times more likely good management practice than females (AOR=2.7 [95% CI=1.719, 4.185]). Knowledge of the respondents was significantly associated with management practice. Participants who had good knowledge were 2.6 times more likely good practice than those respondents had poor knowledge (AOR=2.6 [95% CI=1.788, 3.835]). Alternative water sources have an association with management practice. The study participants who haven't any alternative water source have 1.6 times more good management practice than those persons who have alternative water sources (AOR=1.6 [95% CI=1.085, 2.314]). Distance from the water points also has significantly association with that of management practice. Respondents who were living far from 1000 meters from water points have less likely good management practice than those respondents who were living within 1000 meters to their water points (AOR=0.3 [95% CI=0.208, 0.441]). Per-capita water consumption of the beneficiaries' also has significant association with that of management practices. Respondents who got adequate water from water points has 1.6 times more likely good management practice than who got inadequate water (AOR=1.6 [95% CI=1.054, 2.316]) (Table 6) [19-22].

Discussion

In this study, 59.7% of the study participants had good management practice of their rural water points. From the total study participants

Knowledge about water points	Number	Percent
Knowing owner of water points		
Yes	279	43.9
No	356	56.1
Total	635	100
Necessary thing for water point to be functional for long time		
Yes	594	93.5
No	41	6.3
Total	635	100
Water point easily damaged unless properly used		
Yes	632	99.5
No	3	0.5
Total	635	100
Maintenance cost of water points are covered by beneficiaries		
Yes	609	95.9
No	26	4.1
Total	635	100
Water point committee were elected by the community		
Yes	620	97.6
No	15	2.4
Total	635	100
Woreda water office give maintenance support		
Yes	531	83.6
No	104	16.4
Total	635	100

Table 3: Knowledge of study participant about constructed rural water points in Aneded woreda northwest Ethiopia, 2015.

75.1% of respondents were participate in water points maintenance activities either through cash, labor, local materials or combined which is higher than the study conducted Mecha Woreda, Amhara region [23] (47.5%) in 2012, Ghana [24] (35%) in 2010, and Kenya, Kibwezi sub-county [25-31], (47.8%) in 2013. This due to that, communities understand reasons for their participation, building a sense of ownership and capacity building for purpose of sustainability or time gap between the studies.

Using additional alternative water sources were another major factor which affects community's management practice of rural water points. In this study the prevalence of additional alternative water sources (52.1%) contributed to poor management practice (48%) of study participant to their water points. This finding was higher compared to the study conducted in Achefer woreda Amhara region (30%) in 2009 [32] and Mecha Woreda Amhara region (51%) in 2012 [23]. This difference may be due to the seasonal fluctuation of water amount, long distance between users and the constructed water points and small yield of water.

In the other cases the use of alternative water sources in this study was 52.1% which is less than the study conducted in Ofla woreda, in Tigray region (94%) in 2006 [31] and Simada Amhara Region 65% in 2012 [33]. The possible reasons for this differences is the time gap between studies, relatively increment of per capita water of the respondents in this study, construction of rural water points were highly increased in each year, drinking water coverage is increasing at national, regional and district levels.

Distance to water point was one of the major factors which affect management practice of communities. Buildings of water points near to the community were positively associated with community management practice of water points. In this study, 64.9% of the study participant got their water points within 1000 meters, of which 72% were good management practice. This finding was higher when compared to the

study conducted in North Gondar zone (18.8%) in 2002 [18], in Ofla Woreda in Tigray Region 25% in 2006 [31], and Adama (62.9%) in 2012 [29]. The possible reasons for this difference are: the time gap between studies, topography difference of the study area and many water points were constructed in each year nearest to the communities.

Knowledge is one of the determinate factors that affect communities' water point management practice. Respondent's knowledge were positively association with good management practices of rural water points. In this study, the study participants who had good knowledge were 2.6 more likely participate in water point management system, while the communities who had poor knowledge were less participation in management practices. In this study, from the total study participants, who had good knowledge about rural water points, about, 76% of the respondents were good management practice. According to this study, some respondents didn't know the responsible persons for managing, directing, controlling of their water points, and they were not aware about water point management system and water points utilizations.

Per capita water consumption was another determinant factor for community management practice of water points. Adequate per capita water consumptions of individuals were positively associated good management practice of water points. An individual who got adequate per capita water from water points were 1.6 more likely good management practice than that of individual who were get inadequate waters. In this study, only 45.5% respondents had adequate water consumptions. This finding was higher than when compared to the study conducted in Mecha woreda (19%) in 2012 [23], north Gondar zone (2.3%) in 2002 [18] and Nepal (10%) in 2009 [30]. The possible explanations for this difference are; the time gap between the studies, contraction of water points each year and increment of water coverage at each level.

In this study, from all female participants, 64.3% women were poor management practice of water points. Males were 2.7 times more likely

Attitude of respondents	Numbers	Percent
Building of water point around their village is important		
Strongly disagree	3	0.5
Disagree	4	0.6
Agree	397	62.5
Strongly agree	231	36.4
Money Collection after building of water points create ownership		
Strongly disagree	1	0.2
Disagree	32	5
Agree	564	88.8
Strongly agree	38	6
User participants are important for water point management system		
Strongly disagree	0	0
Disagree	45	7.1
Agree	522	82.2
Strongly agree	68	10.7
Females water point committee are important for management		
Strongly disagree	2	0.3
Disagree	31	4.9
Agree	539	84.9
Strongly agree	63	9.9
Getting enough water from the water point		
Strongly disagree	9	1.4
Disagree	309	48.7
Agree	289	45.5
Strongly agree	28	4.4

Table 4: Attitudes of respondents in constructed rural water points in Aneded woreda northwest Ethiopia, 2015.

good management practice than that of females. The possible reasons are: males were participated in different meeting and training, more information access. According to this study majority of women were not fully participated in, planning, implementation, and evaluation of water points management activities as compared to males [34].

Women had a solid role in decision making in water point management and have the support of their fellow local society. Women did not only participate in decision making and management of the water points, but also in take part water point protection, sanitation and hygiene [17].

A number of reports on water points from Asia and Africa by UNICEF suggest that, the inclusion of women as participants and decision-makers increase water point's life time and their water access. Report from Pakistan, Nepal, India, South Africa, Kenya, Tanzania and several other nations, and concludes that placing women at the center of water point management and sanitation decisions can lead to more households with access to water, more cost effective service delivery, better placement and maintenance of water points, better community health and hygiene. In other words, the failure of many water points were a result of the exclusion of women at all levels of the water point management system and activities [35,36].

Possible factors that affect water point management	Frequency	Percent
Getting training		
Yes	218	34.3
No	417	65.7
Total	635	100
Per capita household water consumption (in liters)		
Adequate	289	45.5
Inadequate	346	54.5
Total	635	100
Use of alternative water source		
Yes	331	52.1
No	304	47.9
Total	635	100
Types of alternative water source use		
Springs	89	14
Traditional hand dug well	204	32.1
Reveres	38	6
Only constructed hand dug well	304	47.9
Total	635	100
Distance to constructed water points (in meters)		
≤1000	412	64.9
>1000	223	35.1
Total	635	100
Payment for maintenance (in birr)		
Yes	631	99.4
No	4	0.6
Total	635	100
Turbidity of water		
Yes	85	13.4
No	550	86.6
Total	635	100
Water point breakage		
Yes	260	40.9
No	375	59.1
Total	635	100
Frequencies of water breakage		
No	375	59.1
Once	91	14.3
Two times	138	21.7
Three times	18	2.9
Four times	13	2
Total	635	100

Table 5: Factors that affect management practice of constructed rural water points in Aneded woreda northwest Ethiopia, 2015.

Conclusion and Recommendation

Conclusion

In this study, the community management practices of rural water points were good. The associated factors which affect management practice of rural water point were sex, knowledge, alternative water source, distance from water points and per-capita water consumptions.

The per capita water consumption of majority respondents was below the standard of WHO which is less than 20 liters. Under such a situation, people had tendency to look for alternative water sources in order cover their household basic needs. This would have far reaching effect on the health status of household members as they are exposed to unsafe water sources with high risk of being affected by water borne diseases.

The poor participation in management practice of water points

Factors affect management practice	Good management practice n=379 No (%)	Poor management practice n=256 No (%)	AOR[95%CI]	COR[95%CI]
Sex of respondents				
Male	326(64%)	180(36%)	2.6[1.749,3.856]**	2.7[1.719,4.185]*
Female	53(41%)	76(59)	1	1
Knowledge of respondents				
Good knowledge	190(76%)	60(24%)	3.3[2.309,4.71]**	2.6[1.788,3.835]*
Poor knowledge	189(49%)	196(51)	1	1
Distance of water point				
>1000	84(38%)	139(62%)	0.24[0.17,0.339]**	0.3[0.208,0.441]*
≤1000	295(72%)	117(28%)	1	1
Having alternative water source				
No	207(68%)	97(32%)	2[1.427,2.726]**	1.6[1.085,2.314]*
Yes	172(52%)	159(48%)	1	1
Per-capita water consumption				
Adequate	198(69%)	91(31%)	2[1.432,2.747]**	1.6[1.054,2.316]*
Inadequate	181(52%)	165(48)	1	1
Getting training				
No	234(56%)	183(44%)	0.64[0.458,906]	0.86[0.588,1.267]
Yes	145(67%)	73(33%)	1	1
Respondent attitude				
Favorable attitude	254(63%)	147(37%)	1.4[1.018,1.924]	1.1[0.741,1.649]
Unfavorable attitude	125(53%)	109(47%)	1	1

Table 6: Factors that affects management practice of constructed rural water points in Aneded woreda northwest Ethiopia, 2015.

leads to the failure of water points, less access water, less cost effective service delivery, less maintenance activities of water points, less community health and hygiene.

The presence of additional alternative water sources and long distance of constructed water points contribute to poor management practice water points.

Recommendation

Water and energy office: (1) Even if management practice of rural water points good it should be encouraged, and continued without slackening for better improvements; (2) Since study showed that females have poor management practice of water points as compared to males empowering women in management practice, in order to promote high participation in water point management activities is need; (3) Community sensitization to increase community's knowledge on water point management systems and water source utilization practice; and (4) Should construct additional water points near to the community in order to increase per capita water consumption of the community and decrease the distance of water points.

For researchers: Further research is needed to identify other variables that have effect on management practice of rural water points.

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References

1. The United Nations Children's Fund (UNICEF), World Health Organization (WHO) (2012) Progress on Drinking Water and Sanitation. United Nations Plaza, NY, USA.
2. Adams A (2012) Financial Sustainability of Rural Water Supplies in Western Kenya. Master thesis of Science in Civil Engineering, Delft University of Technology, Kenya.

3. Richard D (2005) Decision Support System for Rural Water Supply in the Nilgiris District of South India. McMaster University, India.
4. Carter R, Tyrrel S, Howsam P (2009) The impact of sustainability of community water supply and sanitation programs in developing countries. *Journal of Chartered Institute of Water and Environment Management* 13: 292.
5. Mc Dade S (2007) Gender and Energy for Sustainable Development: A Toolkit and Resource Guide. United Nations Development Program, NY, USA.
6. Weinberg (2008) Improving Leadership Effectiveness (2nd edn.). The Leader Match Concept, NY, USA.
7. World Health Organization (WHO) (2012) Water Supply and Sanitation collaborative council, rural water supply system.
8. Tesfaye YA (2012) Comparative study on Woreda managed and community managed rural water supply project with respect to their planning, implementation, functionality and utilization in the case of Amhara National regional state. St Marry's University College, Ethiopia.
9. Water and Sanitation Program (WSP) (2010) Water and Sanitation Program report in Africa, especial emphasis in Ethiopia.
10. Rural Water Supply Network (RWSN) (2009) Myths of the Rural Water Supply Sector, Perspectives, RWSN Executive Steering Committee, St Gallen Rural Water Supply Network.
11. African Development Fund (ADF) (2005) Ethiopia, Rural Water Supply and Sanitation Program appraisal report, African Development Fund, infrastructure department, north, east and south.
12. Niyi G, Felix O (2007) Assessment of Rural Water Supply Management in Selected Rural Areas of Oyo State, Nigeria. ATPS Working Paper, African Technology Policy Studies Nigeria p: 49.
13. Jansz S (2011) Study into rural water supply sustainability in Niassa province, Water Aid in Mozambique.
14. Dawit K (2007) Water Supply and Access in Rural Africa. Churches for Water in Africa Botanical Beach Hotel Intebbe, Uganda.
15. Pruss-Ustun A, Bos R, Gore F, Bartram J (2008) Safer water better health, cost benefits and sustainability of Interventions to Protect and Promote health. World Health Organization. Geneva.
16. United Nations Children's Fund (UNICEF) (2010) Progress on sanitation and drinking water. New York.

17. Abdi A (2013) Sustainability of the rural water services implemented using community-managed project approach in Amhara region of Ethiopia, Construction Engineering, Visamäki Campus spring, British.
18. Admassu M, Kumie A, Fantahun M (2003) Sustainability of drinking water supply projects in rural of North Gondar, Ethiopia, AAU Ethiopian. *J Health Dev* 3: 221-229.
19. Kleemeier E (2005) The impact of participation on sustainability, an analysis of the Malawi rural piped scheme program. *World Dev* 28: 929-944.
20. Rural Water Supply Network (RWSN) Myths of the rural water supply sector, perspectives RWSN executive steering committee, St Gallen rural water supply Network.
21. Harvey A, Reed A (2007) Community-managed water supplies in Africa, sustainable or dispensable. *Commun Dev J* 42: 365-378.
22. Mbata J (2006) Estimating household willingness for water services in rural economy, the case of Kanye in Southern Botswana. *Development of Southern Africa* 23: 29-43.
23. Addis H (2012) Factors affecting the sustainability of rural water supply systems in Mecha Woreda Amhara region Ethiopia. Cornell University, Ithaca, NY, USA.
24. Sun Y (2010) International Food Policy Research Institute, on opportunities and challenges of community-based rural drinking water supplies, an analysis of water and sanitation committees, in environment and production technology division. Ghana.
25. Chanasa A (2013) Factors influencing sustainability of rural community based water projects. In: Mtiito and Kibwezi sub-county. University of Nairobi, Kenya.
26. Tesfaye T (2008) A review of Ethiopia's water sector policy, strategy and program, in digest of Ethiopia's national policies, strategies and programs, forum for social studies. Ethiopia.
27. Awoke Z (2012) Assessment of challenges sustainable rural water supply in the case of Quarit woreda Amhara region, Ethiopia, Cornell University, Ithaca, NY, USA.
28. Getachew Z (2005) Determinants of sustainable rural water supply system in Ethiopia, The case of two rural water supply systems, Amuyee Serra and Habru Seftu Schemes, Regional and local development studies, Ethiopia.
29. Tadesse A (2013) Rural water supply management and sustainability in Ethiopia with special emphasis on water supply schemes in Adama area, Ethiopia Swedish University, Swedish. *Journal of Water Resource and Protection* 5: 208-221.
30. Final Report End Line (2009) KAP Survey (Knowledge, Attitudes and Practices) conducted in the frame of an ECHO funded project clean water, improved sanitation and hygiene promotion in rural villages of Humla and Mugu. Mid-West, Nepal.
31. Gebrehiwot M (2006) An assessment of challenges of sustainable rural water supply, the case of Ofla woreda in Tigray Region. Msc thesis, on regional and local development study (RLDS). A.A.U. Ethiopia.
32. Demeke A (2009) Determinants of household participation in water resource management, Achefer woreda, Amhara region, Ethiopia, Master's thesis integrated agriculture and rural development, Cornell University, Ithaca, NY, USA.
33. Belachew M (2012) Assessment of drinking water quality and determinants of household potable water consumption in Simada District, Amhara region, Cornell University, Ithaca, NY, USA.
34. Kassa T (2014) Assessment of Sustainability of community managed potable rural water supply schemes/points in Saharti-Samre Woreda Tigray region Mekelle University, A.A, Ethiopia.
35. Kasongamulilo H (2013) Gender and water management, it's implications on women empowerment, integrated water resource management. University of Zambia, Zambia.
36. World Health Organization (WHO) (1995) Catalogue of WHO indicators for Health monitoring.