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# Assessing the Sustainability of Rural Water Supply Management Pdf in the Case of Debark Wereda, Amhara Region, Ethiopia

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**Abstract**
Management and sustainability of rural water supply is a big challenge, in water delivery service. The main objective of this study was for assessing sustainability and management of rural water supply systems in Debark Wereda Amhara region, Ethiopia. Nine sample Kebeles were chosen by cluster sampling. Survey was carried out (n=191) users and artisans (caretakers) to fill the questionnaire in fifteen purposely selected water points constructed in the last few years. Both Primary and secondary data were employed. The collected data were scored; standardized, analyzed and interpreted using project approach and performance frameworks within NUMXL1.6 software and STATA 12. Sample water points were ranked depending on the index and its values mapped with Arc GIS 10.2. Demand driven approach, users participation, committee training, choice of technology were factors which affects pre and post project implementation which results poor management and sustainability of sample projects. From the analysis 54% which was not satisfactory and good enough. 18% of sample water points categorized as ineffectiveness or non-functional and not long-lasting to deliver the anticipated service because of poor project approach and performance frameworks. From the result 23.4% of sample projects fall under effective and sustainable water points with little modification. Community managed projects have greater Effectiveness and Sustainability index results than non-community managed projects this implies Community managed projects well performed than non-community managed projects. Finally, the recommended design of spring water scheme was design by using auto cad software.
**Keywords**: Debark Wereda, Rural Water Supply, and community managed projects
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## INTRODUCTION

Drinking water supply in the context of the rural community of third world countries is quite unsatisfactory. Firstly, the needs to develop water supply systems that serve the entire human kind have not yet been bringing a solution tangibly. Secondly, constructed schemes are not operating at full capacity (**Carter et al; 1999**). To give more emphasis, the annual investment capacity of the third world countries is below the level required to cover both the new development and operation of existing system (**Seppala and Katko, 2003).Cited in (Bashan M, Bahilu,2016).**

Therefore, this paper tried diagnoses the main reason or obstacle for service failures systems and poor management system that hinders the sustainability of rural water supply systems. And proposes ways of addressing to solve problems of rural water supply thorough detail investigation of sustainability of the systems‟ in terms of social, technical, managerial aspects. By realizing the critical importance of supplying potable water both in governmental and non-governmental organization who invests large amount of capital every year in developing countries to tackle this implementation of proper water supplies is mandatory.

However, constructing water systems alone would not eliminate all problems especially in rural areas. Rather functionality and utilization of the schemes should be properly managed by those intended beneficiaries. In the study area, a number of schemes like spring, hand dug wall are failed because of lack of proper management and technical problems of the scheme. In the study area, huge investment has been incurred by different organization over the last few years. Despite the fact that, sustainability of water schemes achieved. Unless proper pre and post construction problems of the schemes properly evaluated and convenient operation and maintenance procedures followed sustainability of rural water supply schemes unattainable and a striking problem may happened. The water sector of Ethiopia, especially the rural water supply system could not ensure sustainable water supply for the rural dwellings. The concept of Community managed project (CMP) for water supplies emerged in the last three decades. During the period, water points were constructed, but government lacked to manage and maintain the schemes especially those schemes constructed by Non- CMP approaches. The solution was encouraging community ownership of water points, including their operation and maintenance (**Schouten, 2006**). The most important element identified by **Schouten (2008**) was a water committee to manage the water point as well as contribute funds to pay for its maintenance and repair. However, data reported by the rural water supply and system (RWSS) challenges the success of community managed projects. **Harvey (2007**) estimates that between 20% and 70% schemes in sub Saharan Africa don.t work at any one time. Furthermore, the RWSS identify several responses for the high failures rate, including inappropriate technology selection; poor construction and lack of quality material, lack of community participation and subsequent sense of ownership, poor community organization or cohesion; lack of spare parts and professional support (**DWWO, 2016**).

## RESEARCH METHODOLOGY

### Description of Study Area

Debark is the selected study area, which is found in North Gondar administrative zone of Amhara regional state, Ethiopia. It is one of the 105 weredas in the Amhara region. It is located 830km north of Addis Abeba as shown (Figure3.1). It lies at latitude of 13º08‟N and longitude of 37º54‟E and it has an altitudinal range of 2850m to1650m above mean sea level. The climatic condition of the area is classified as *Dega* (highland), *Weynadega* (middle altitude) and *Kola* (low land).

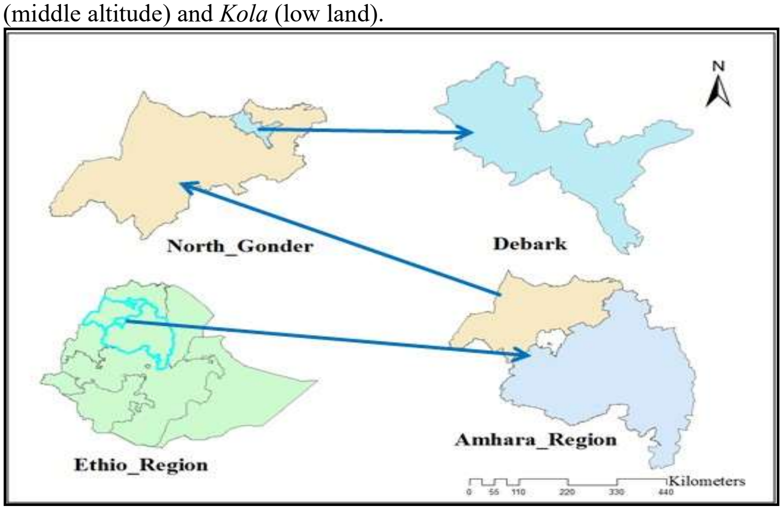


Fig 1: Location of study area

### Data Collection

The general characteristics and community was obtained as the first data used in this study. This study used the combination of both quantitative and qualitative research method. The primary data were collected by using household survey, questionnaire which covered information on the following important issues which were crucial for sustainability of the water projects focusing on the socio economic characteristics, of the respondents such as, demand responsiveness, sustainability factors of the service and type of participation how the community is involved in the overall activities of the project implementation in addition to this, four focus group discussion, observation of the physical status of the water supply scheme and by key informant interview.

Household Survey: To generate information at household level data, questionnaires and interview conducted. The variables include rural water supply, communities‟participation in the provision and managements systems, the role of water committees, factors affecting the sustainability of rural water supply schemes associated of service failures and wrong use of the schemes as well as problems related to service failures. In this study 191, households were taken as a sample for filling questionnaire and four focus group discussions from nine selected kebeles also employed.

Key-informants interview (KII): were used to collect background information about the status of rural water supply, status of communities‟ participation, in operation, maintenances, management aspect and sustainability of the water supply schemes. The conducted interviews with the selected individuals, who were believed to have good information about the area and that of the subject matter, used this frame work for the implementation and future strategy of administering in Wereda level of rural water supply projects.

### Scoring guidelines for the Parameters and Frame works

Both project approach and performance frame works of the indicators were divided into indicators, sub-indicators and information obtained from different sources such as site investigation, interviews, and questionnaires were used to fill different sub- indicators. These indicators were formulated in such a way that the presence and working out of this was supposed to have appositive effects on effectiveness and sustainability of the projects, six indicators and a number of sub indicators for project approach and three indicators and a number of sub indicators for project performance frame work were used for detail scoring.

Because of the community opinion was subjective a five point scale was used. The final result was scored with index because of index easy to understand the results and towards every sub –indicator scored between

0.01and 1.00 as presented in (table 1).The weighted average score of indicators together formed the score of indicator formed weighted average score of each indicators. The final value of effectiveness and sustainability was interpreted according to UNDP –WASH interpretation as presented in (Table 1).

Table 1: Classifications of sub indicators (**UNDP-WaSH , 1999)**

| Score% | Classification | Meaning |
|---|---|---|
| **0** | Very bad | Element is absent or very bad |
| **25** | Bad | Element is there but executed or perceived badly |
| **50** | average | Element is good but neither good nor bad |
| **75** | good | Element is good but improvements still to be made |
| **100** | Very good | Element is worked out and perceived very well |

Table 2: Indicator grading and classification (UNDP-WaSH interpretation, 1999)

| Classification | Grading of the indicator and sub indicator results |
|---|---|
| **0.00-0.25** | Unsustainable scheme because of poor application and performance |
| **0.25-0.5** | Elements of sustainability there, but not enough |
| **0.5-0.75** | Quite many elements of sustainability, but improvement can still be made |
| **0.75-1.00** | Sustainable schemes because of excellent project approach and performance |

**Numerical Analysis for Excel Software's**

Excel is a time series analysis techniques including linear and nonlinear time series modeling, statically tests and other, principal component analysis (PCA) within numerical analysis for excel (NumXL1.6) was used to standardize the data based up on the most meaning full parameters which can influence in the entire of dataset with minimum loss of original information for each sample water samples points developed by **Spider (2014).**

Computation of PCA: -Given a data matrix with p variable and n samples the data set are first centered on the means of each variable. This will ensure that the data set is entered on the origin of our principal components, but doesn"t affect the spatial relationship of the data nor the variance along our variable. The first principal components (y1) are given by the linear combination of the variables $X_1, X_2 \ldots\ldots\ldots X_P$.

$Y_1 = \alpha_1 X_1 + \alpha_2 X_2 \ldots \alpha_p X_p$---------------------------------------------------------- 1

Or in matri form notation: $Y_1 = \alpha_1 TX$

he first principal component is calculated such that it accounts for the greatest possible variance in the data set of course, one could make the variance of $y_1$ as large as possible by choosing large values for weights $\alpha^2_{11} + \alpha^2_{12} + \ldots + \alpha^2_{1p} = 1$

The second principal component is calculated in the same way, with the condition i.e. uncorrelated with (i.e. perpendicular to) the first principal component and that it accounts for the next higher variance.

$Y = \alpha_{21} X + \alpha_{22} + \alpha_{2P} Xp$ ……………………………………………….2

This continuous until a total of p principal components have been calculated equal to the original number of variables. At this point, the sum of variance of the all principal components will equal the sum of variance of the variables, i.e. all of the original

Information has been explained or accounted for collectively, all of the these transformation of the original variables to the principal component is Y=AX

Calculating these transformation or weights require NUMXL 1.6 model for all but the smallest matrices. The row of matrix A are called the egnivectors of the matrices, the variance covariance matrix of the original data. The elements in the diagonal matrix the variance covariance matrix of the principal components are known as the Eigen values **(Steven, 2008).**

**Multiple Linear Regression Models**

Multiple linear regression attempts to model the relationship between two or more explanatory variables and response variable by fitting a linear equation mentioned as below to observed data. Every value of the independent variables x is associated with a value of the dependent variable Y. The relation between the dependent variables (effectiveness and sustainability) and the independent variables (factors) was related and has been used for creating index of each of each water points and future predications.

$Y = \beta + \beta_1 X_1 + B_1 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon$ ……………………3

Where, Y=effectiveness and sustainability index of sample project water points

$\beta$ =intercept, $\beta_1 + \beta_2$ ....................... $\beta_9$ coefficient of factors, residual value of $x_1, x_2, x_3 \ldots x_9$

$X_1$=demand approach, $x_2$ =participation, $x_3$ =training, $x_4$= technology, $x_5$ =cost recovery, $x_6$=support O and M, $x_7$= operation, $x_8$, =maintenance, $x_9$=management

### Spatial Mapping in ArcGIS 10.2

Spatial mapping was done using spatial analysis technique in Arc GIS 10.2 Avery basic problem in spatial analysis is interpolating spatially continuous variables from point samples. Three commonly used interpolation method to model spatially distribution from point data are Inverse distance weighting (IDW), spline and ordinary krging.

The IDW is simple and imitative deterministic interpolation method based on principles that sample values closer to predication location have more influence on predication value than sample values further apart using higher power assigns more weight to closer points resulting in less smother surface. Major disadvantage of IDW is bull eye effect (higher a value near observed location and edgy surface spline is deterministic interpolation method which fits mathematical function through input data to create smooth surface. It works best for gently varying surface like temperature. Unlike IDW and spline kriging is method based on spatial auto correlation .It used semikarigrigarm that captures the spatial dependence between samples by plotting semi –variance against separation distances. The premise of any spatial interpolation is that close samples tend to be more similar than distant samples .The main advantage of kriging interpolation is exceeds the minimum and maximum point values to interpolate.

## RESULT AND DISSCUSSION

To emphasize the higher role of women in water related issues, the gender mix of respondents in this study area were 58.6% women and 41.4% men. The respondent age ranges from 15 to 65 year with an average of 45 year, and the majority of respondent household compositions 64% were not educated. In the wereda 15 water points has been chosen as sample purposely as explained in the methodology section for this thesis and the result was drawn based on the respondents‟ answers and through observation of the physical statues of the water schemes.

In the study area, woman and children walk up to six hours to collect water. 50.7% of the interviewed responds that the improved water sources at their community is located greater than 1.5km radius. 35.3% of the respondents also replied that the location or the distance of water points lies in the range of 1km-1.5km radius the remaining 16% responded that the distance exceeds more than 2km radius and the always encountered challenges to fetch water.

### Effectiveness and sustainability Index

Effectiveness and sustainability indicators were developed from interviews from community, wereda water office staffs and WASCHOs commutes at community administrative level.

The effectiveness and sustainability of rural water supply projects depends on the pre and post project activities. Project approach activities were scored with water supply project approach frameworks formulated by UNDEP WaSH program. Project effectiveness and sustainability indicators as presented in (Table 4) includes demand driven approach(DRA), participation(PA), training(TR), technology (TEC), cost recovery (CR), and support operation (SP) and maintenance (MT), operation(OP) and management(MG) were focused as the main factor of the analysis. The indicators were scored from 0.01(poor) to 1(excellent) and scores of indicators formed. While Creating Effectiveness and Sustainability Index the data obtained from questionnaires interviews, focus group discussion and field observation were scored, standardized and analyzed using NumXL1.6 software principal component Analyses (PCA) and the formed fitted values as presented (Table 3). As presented in (Table 3) the most critical factors that affect the sustainability of water supply schemes mentioned .

 

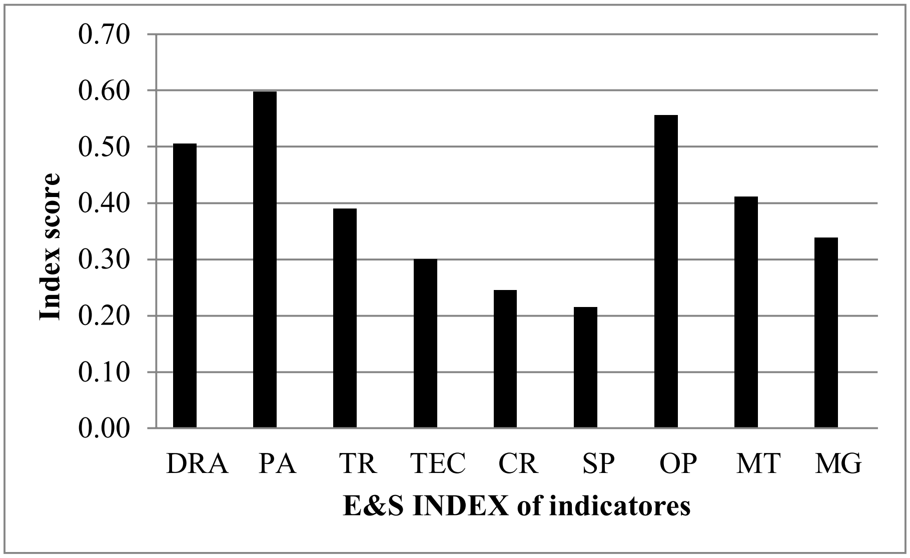


Figure 2: Statues of effectiveness and sustainability samples of the study area

Management is the most critical factor as presented in (Table 3 ) all scores of indicators in all sampling sites sores below average and it can be said that the management practices in the study area is almost absent. When we see the interpretation as mentioned in methodology section element is absent or very bad and in some sample sites element is there but executed or perceived badly and it influences the sustainability of water supply sustainability negatively and it was Avery striking problem of many water supply schemes. In this category giving attention for socio economic, legal and political aspects of water supply projects very essential to sustain water supply schemes. Hence, helping someone who understands the problems of the management aspects of sample water sites is much easier than those who have no the idea of it.

Table 3: PCA standardized and fitted factors score values of the parameters

| Sampling site | implementer | DRA | PA | TR | TEC | CR | SP | OP | MT | MG |
|---|---|---|---|---|---|---|---|---|---|---|
| **Arbatensa** | CMP | 0.68 | 0.65 | 0.7 | 0.57 | 0.47 | 0.27 | 0.79 | 0.64 | 0.45 |
| **Jagirriemidir** | Non CMP | 0.63 | 0.7 | 0.65 | 0.58 | 0.45 | 0.75 | 0.69 | 0.6 | 0.44 |
| **Terargi** | CMP | 0.74 | 0.76 | 0.64 | 0.39 | 0.34 | 0.31 | 0.68 | 0.49 | 0.2 |
| **Michibign** | CMP | 0.58 | 0.6 | 0.61 | 0.5 | 0.38 | 0.2 | 0.65 | 0.54 | 0.36 |
| **Bartahod** | CMP | 0.62 | 0.59 | 0.7 | 0.47 | 0.34 | 0.32 | 0.64 | 0.51 | 0.37 |
| **Debir** | CMP | 0.67 | 0.78 | 0.63 | 0.45 | 0.18 | 0.28 | 0.67 | 0.48 | 0.35 |
| **Afaf** | Non CMP | 0.6 | 0.57 | 0.55 | 0.41 | 0.36 | 0.06 | 0.6 | 0.49 | 0.42 |
| **Arbada** | NON CMP | 0.59 | 0.67 | 0.59 | 0.44 | 0.36 | 0.21 | 0.53 | 0.36 | 0.33 |
| **Adimahara** | CMP | 0.55 | 0.47 | 0.5 | 0.38 | 0.27 | 0.17 | 0.59 | 0.44 | 0.42 |
| **Azagie** | CMP | 0.55 | 0.56 | 0.47 | 0.34 | 0.28 | 0.7 | 0.54 | 0.45 | 0.25 |
| **Derie** | Non CMP | 0.56 | 0.58 | 0.41 | 0.22 | 0.009 | 0.24 | 0.56 | 0.38 | 0.3 |
| **Asegidie** | Non CMP | 0.55 | 0.61 | 0.25 | 0.09 | 0.37 | 0.22 | 0.51 | 0.41 | 0.33 |
| **Dokimit** | Non CMP | 0.35 | 0.52 | 0.41 | 0.45 | 0.33 | 0.21 | 0.22 | 0.51 | 0.45 |
| **Maysagila** | NON CMP | 0.48 | 0.61 | 0.31 | 0.3 | 0.18 | 0.9 | 0.2 | 0.6 | 0.5 |
| **Lastit** | CMP | 0.54 | 0.56 | 0.51 | 0.31 | 0.4 | 0.28 | 0.56 | 0.38 | 0.41 |

The project approach and project performance framework indicators presented in (Table 4) also essential to develop indexes by using in multiple liners regression formulas and resulted the combined effectiveness and sustainability values of each water sample sites as presented in (Table 3). Parameters set as factors which were identified as factors of effectiveness and sustainability management of rural water supply projects in the study area, which was constructed by different implementing organization.

The multiple linear regression models developed with data (Table 3). The „p" in the result was less than 0.05 for factor management in analysis and indicated that it was most critical factor. Annex-1 attempted to estimate the effects using multiple linear regressions equation as explained in the methodology section with a fitted line were expressed using the linear equation.

The coefficient"s can be also calculated using matrix method and resulted the same effectiveness and sustainable index values. The effectiveness and sustainability index (Table4.3) with multiple regression equation can be developed and calculated with matrix method. The samples effectiveness and sustainability was also mapped with Arc GIS 10.2 with kriging method of interpolation as shown in (Figure 4.2) to show the spatial distribution of sustainability in the study area the result of index rank showing the effectiveness over time is long-lasting service and the sustainability can be achieved.

From the index values presented in (Table 3) of the effectiveness and sustainability the highest index was recorded 0.57 for Arbatensa HDW. According to scores interpretation as given above in (Table 3.2) the highest index value lied between 0.5 and 0.75 and was interpreted as quite many elements of sustainability, but continuous improvement can still be made and sample scheme with smallest index value that was 0.2 for the water sample named Dokmit lied between 0.00 and 0.25 so could be interpreted as poor sustainability scheme and couldn"t satisfied the intended service and sustainability of the schemes is in question. In sample sites its indexes lies in the range of 0.25-0.5 elements of sustainability was present, but not enough to achieve sustainability of water supply projects as presented in (Table 3) 33.33% of the sample sites lies in this category therefore, even if the indicators present which is not satisfactory to reach sustainability of the water schemes. The results of the project approach and performance frameworks parameters and indicators are spatially mapped and illustrated in (Figure 4).

From project performance analysis only operation indicator had better index result and from project approach indicators demand response approach performed well. Cost recovery in most NGOS or donors support for operation and maintenance were almost absent. Most of other aspects were contributed for poor sustainability, so long lasting of service or sustainability wasn"t considerable aspect of many water projects in the study area. For every indicator the scores are clearly presented in (Tablen 4 and Table 3).

Table 4: Effectiveness and Sustainability Index Ranking of Samples

| Sampling site | implementer | Effectiveness and sustainability index |
|---|---|---|
| **Arbatensa** | CMP | 0.57 |
| **Jagiremidir** | Non CMP | 0.51 |
| **Terargi** | CMP | 0.52 |
| **Michibin** | CMP | 0.5 |
| **Afaf** | Non CMP | 0.5 |
| **Arbada** | Non CMP | 0.49 |
| **Adimahara** | CMP | 0.5 |
| **Azagie** | NON CMP | 0.41 |
| **Derie** | CMP | 0.38 |
| **Asegidie** | NON CMP | 0.31 |
| **Dokmit** | NON CMP | 0.2 |
| **Maysagila** | NON CMP | 0.37 |
| **Lastit** | CMP | 0.39 |

**CMP Assisted Projects**

Community managed project (CMP) approach is a way to do rural water supply differently with those conventional Wereda managed projects. It is an innovation in community managed water supply that aims to retain and strengthen some of the better aspects of community managed while addressing certain key weakness, especially a lack of local government capacity to support communities and poor sustainability. Traditionally, the development and maintenance of water schemes in study area has been seen as the government responsibility. The introduction of CMP approaches in the mid- 2000s was an attempt to enable communities to manage the scheme construction process and the overall activities of the water schemes. The challenge in bureaucracy and limited capacity of Wereda administrative structure and other stakeholders negatively affects the sustainability of rural water supply projects. The community managed project approach guideline was oriented with the user themselves so the activities were clear before and after implementation. The problem in the study area was failures of implementation efficiency during practical applications. The indicators recorded was below the average for technology, cost recovery, support for operation and maintenance and management as shown in (Figure4.5).The reason for better result was fund availability for spare parts. CMP has revolving fund collected from community and Wereda economic and finance office.

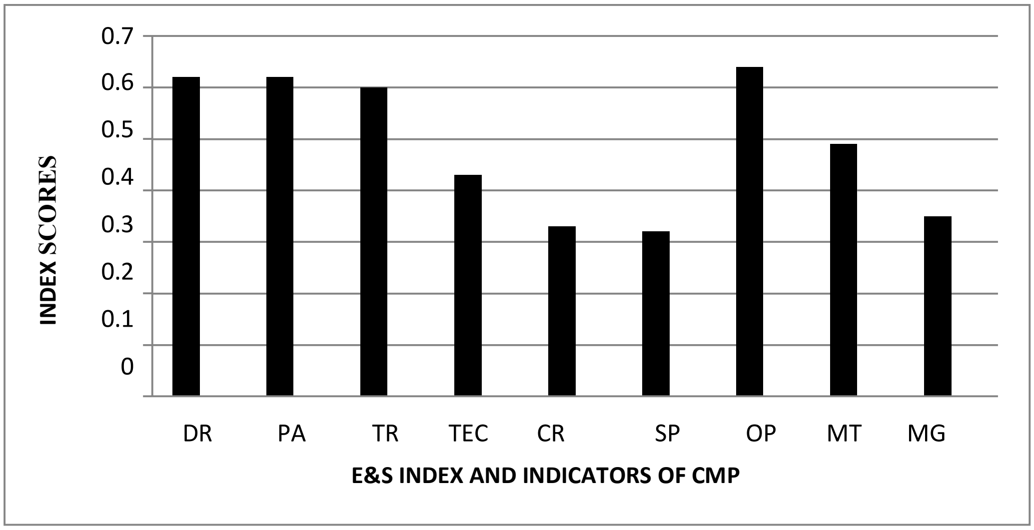


Figure 3: CMP projects effectiveness and sustainability statues (E&S)

When we see the effectiveness and sustainability of the projects as presented in (Figure4.5) and (Table4.3) we can draw the following results. For sample site of Arbatensa the (E&S) was scored as 0.57and DRA is 0.68 this implies that this sample site sustainability level is good and the demand response approach was performed very well and it plays a great role to make the sample sites sustainable was effective with little improvements. In the same analogy, for Jagire midir water points we can say that the E&S index 0.52 and it can be interpreted as quite many elements of sustainability present but, it needs improvements. Therefore, this sample site needs improvements to achieve the sustainability of schemes effectively.

Out of eight sample sites which were constructed by CMP approaches Derie water schemes performed very poorly and its E&S index scores 0.38 and it can be Saied that on the sustainability effectiveness of water schemes element of sustainability exists in small amount and it needs much improvements in the management aspects of the schemes. In general, when we summarized the indicators result and the effectiveness and sustainability indexes of community managed projects which sound good but, it needs further improvement to achieve the intended goals that supposed to be providing service for the community. According to scores interpretation all of the sample sites effectiveness and sustainability indexes lies below 0.75 this implies that the sample sites lacks sustainability elements and the scheme could not provide service for the long run and it"s a big setbacks for the study area not to achieve sustainability of the water schemes. Therefore, to put the whole story in the net shell sustainability of Debark Wereda water supply was found to be very poor and less sustainable. The physical statues of CMP assisted projects somewhat good as compared to NON CMP assisted projects as presented in (Figure 4.5) the indicators of project comparatively greater than 40% except three indicators this is because of the participation of the community was very hard, water points properly fenced and well protected projects found as shown below in (Figure 4) clearly. The result shows community managed projects (CMP) approch performed better than non-community manged projects. Especialy, in creating demand and in creating the sence of owner ship CMP perferable to Non –CMP approches in Debark Wereda water supply systems.

 

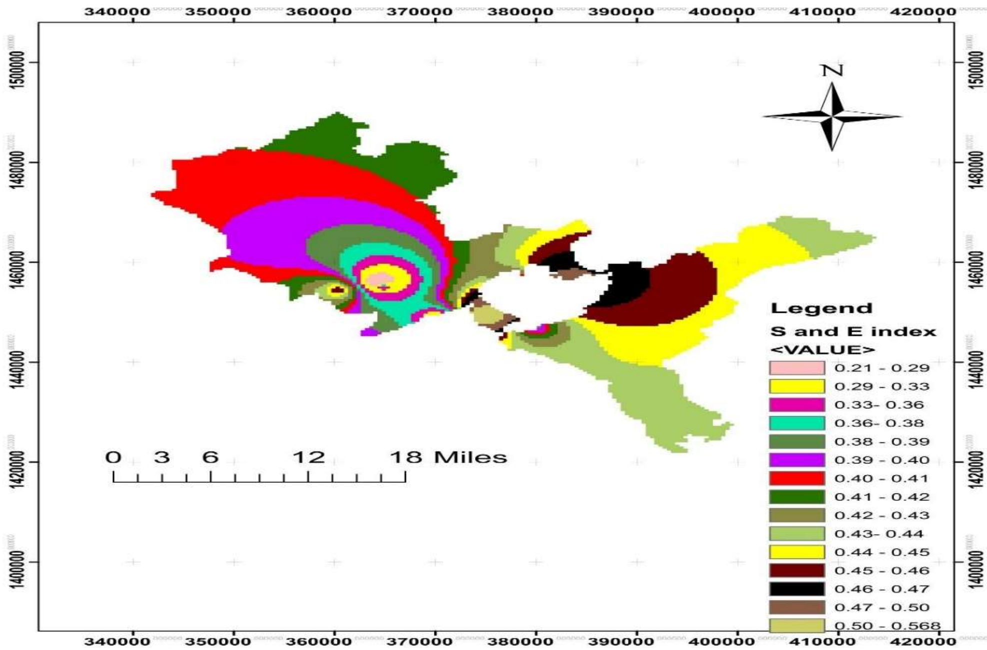

Fig 4. Spatial map of water points

This map was developed by using multiple linier equations as mentioned above based on (Table4.3) effectiveness and sustainability indexes. It shows the spatial distribution of effectiveness of sustainability within the study area.

**Non-CMP Assisted Projects**

In this section, I prefer to use Non-CMP assisted projects instead of saying the term NGOs and Wereda managed projects (WMP) because the nature of these projects follow the same procedure starting from the project planning to implementation.

In the study area, projects which were involved in the last ten years were World Bank (WB), Amhara organization for rehabilitation development (ORDA), millennium development goals (MDG), and American disjoint the rest financed by local administer (WMP).In the study area, the project initiation were demand driven theoretically by WB framework and guidelines including the political, economic, social, technical environmental legal (PESTEL) Approach as used by many literatures the result obtained was below the average (44%). The community participation was also 31% which is not enough to avoid or prevent breaking of services and failures of schemes. All the indicators and parameters identified in this paper can be sum up in two general findings those were adequate service and proper management indicators were below the expected average value of the standards (Figure 5). When we see its effectiveness and sustainability indexes and the indicators scores 71.42% scores below average meaning the sustainability of most of the schemes failed to give services for the community and it was difficult to achieve sustainability of the Debark Wereda rural water supply systems. In sample sites like Arbada, Azagie, Asegidie, Dokimit and Maysagila its effectiveness indexes are as presented clearly in (Table 3) and as illustrated in (Figure 4) and it implies that the sustainability of this schemes are not achieved and in most of the scheme‟s services are interrupted and becomesnon-functional.

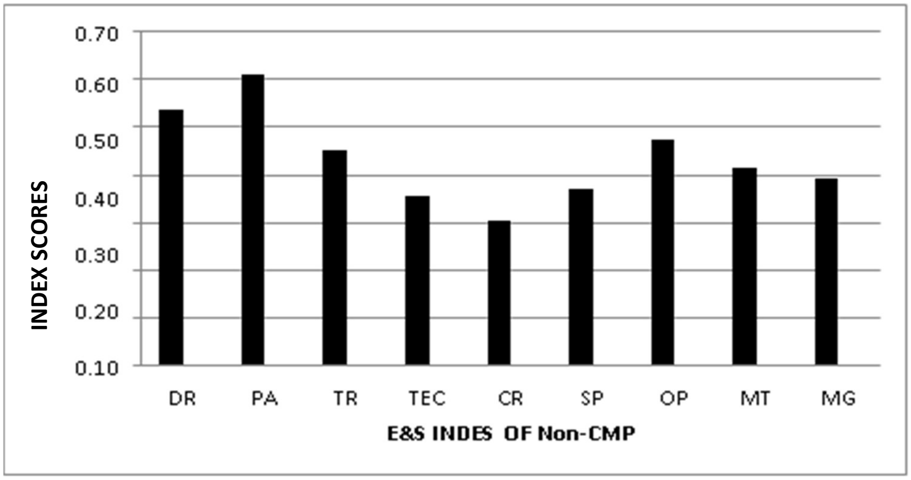


Fig 5. CMP and NON- CMP projects effectiveness and sustainability level

**CMP and NON- CMP projects effectiveness and sustainability level**

In principle, community managed project was after all more participatory, since these projects were demand were identified with beneficiaries starting from planning phase to implementation phase carried out by community members. In this section comparison of CMP and Non-CMP approaches Comparing these ideas with the hypothesis that a higher degree of participation leads to a more effective and sustainable projects, it seemed logical that CMP approach has appositive influence on sustainability as presented in data analysis result in (Figure 6) CMP assisted projects were more effective and sustainability projects than projects supported by Non- CMP assisted projects. The sense of owner ship in the CMP was highly contributed for better results. In CMP the fund obtained from the community was contributing better for operational management and good service delivery of the projects. There were some indicators of providing maintenance tools for simple operational and maintenance works to WaSHCOs caretakers and artisans weren"t enough to maintain at community levels. For all factors and other sub indicators considered. Non-CMP assisted projects with less index implies that the WB guidelines and parameters and projects cycle activities is less effective in providing adequate service and operational management to bring scheme long lasting in comparison with CMP assisted rural water supply projects.

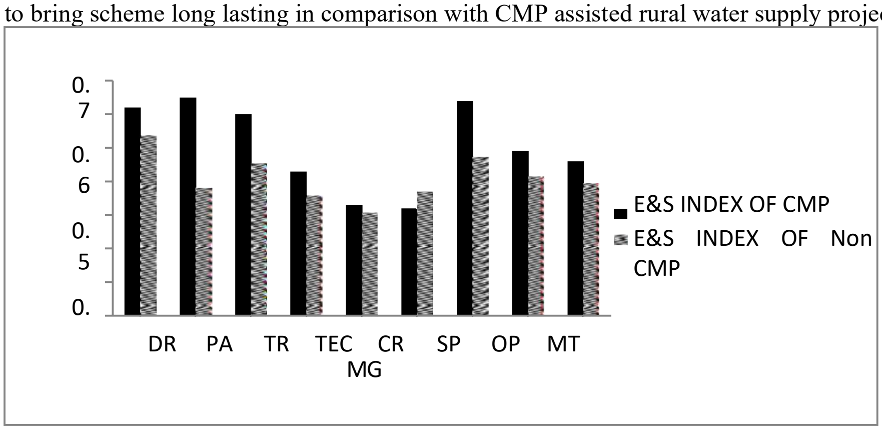


Figure 6: CMP and Non CMP comparison of E and S index

**Factors for project service failures and sustainability**

Factors considered in this study were nine indicators of project effectiveness and sustainability was determined and other indicators like PESTEL approach were also used. These main factors with their level in the study area were demand approach (50%) which was less than plan Cameron for Mbemi (55.56%) and greater than for Bamli (35.56%) participation (51%) was also less than the two projects, Mbemi (65.63%) and Bamili (59.38). Factors including training (40%), technology (30%),cost recovery (18%),support operation and maintenance(12)operation (51%) and management (35%) had less than index records for plan Cameron projects (Joannede,2005) but greater index score than Bamli (18.7%)for maintenance (30%)of the study.

Based on the result the sum of the above factors contributed for poor or excellent project. In the case of this research work 54% samples resulted as effective and sustainable projects but limited improvements 20% of the sample water points categorized as poor effective (non-functional) and not sustainable because of poor project approach and performance. The non-functionality rate was less than Amhara national region rural water supply projects implemented by government donors and local and international NGOS which was 24% (ANRS BoWRD, 2013) and one third (25%)for sub saran African countries non-functionality rate.

The 24% of sample projects fall under effective and sustainable scheme with little improvements compared to study result carried out in south Wollo zone, Amhara region Ethiopia the result was 22% (Selamawit, 2007). But, in this study it has better result as compared to south Wollo zone. Rural water supply sustainability of CMP projects have greater effectiveness and sustainability index (E&S) result than Non- CMP projects which implies water schemes constructed by CMP approach are more successful than those constructed by Non- CMP approaches projects.

**Conclusions**

This research tried to find the main factors as to why rural water supply systems become poor in its effectiveness and not long lasting without achieving the anticipated services in Debark worada rural water supply sectors. The concept idea and guideline of the Non- CMP seemed more impractical and theoretical because of the index recorded in the study area were not showed even a single water point scores in the range of 75-100% to say sustainable. When we see the performance of the water point relatively, the best scheme was registered as the effectiveness and sustainability index value which lies in the range of 0.12-0.57. In the study area the application of Non -CMP guideline was not properly or fully implemented due to the absence of the user participation. The participation and involvement practically showed that it was approximately average 51.7% for Non- CMP assisted projects. This also the result of real users demand driven approach problem (51%.) the interest of the community for the projects were not motivated by themselves but with the help of Wereda water office experts and stakeholders. Improvements needed for effectiveness and sustainability projects. In the area by improving each indicator Projects which was assisted by CMP approach were more successful and effective than the one assisted by Non-CMP approaches, because of beneficiaries participation in all steps of frameworks the technology factor including choosing and quality of construction materials were also one of poor sustainability factor. Since only the community leaders and local development agents involved with little attention and follow up of the ongoing water points which accounted 32%. Little support for O and M from Non- CMP and very little attention for cost recovery problems all in all contributed a lion share for the failures water points‟ occurrence of service break down of the water points. It was also found that the maintenance problem where influenced by the lack of awareness and les cost recovery and finance for post management and rehabilitation of the water points. The majority of water supply systems were still in charge of giving service which was constructed in the last few years. 23% of the water points of the sample schemes become nonfunctional this seemed small percentage but large sums of money has been investedand rate is high when the number of the water points become large in number. This nonfunctional rate is less as compared to regional rural water supply and sanitation which was 24% (BoWRD, 2012)and the study carried out in south well zone which was 22%(selamawit,2007) relatively projects which was assisted by CMP approach was better performed very well as compared to Non- CMP assisted projects. To put the whole story in the net shell the sustainability of rural water supply of Debark Wereda water supply system poor and sustainability couldn‟t achieved yet.

**REFERENCES**

Behailu, B. M; Suominen, A; and katko ,T. S. (2015a). Evolution of community – managed water supply projects from 1994 to the 2010s in Ethiopia. Puplic works management and policy.

Behailu, B.M; suominen,A;Katko,T, S, Mattila,H; Yayehyirad, G. (2015b). community managed projects (CMP) and other Implementation Approches in Rural water supply of Ethiopoia .waterlines .

Burea of water resource (BoWRD), (2012). Annual report on rural water supply AND sanitation ,Bahirdar ,Ethiopia.

Carter R C et al. (1999). The impact and sustainability of community water supply and sanitation programs in developing countries. Institute of Water and Environment, Cranfield University at Silsoe, Silsoe, Bedford, MK44 DT.

Harvey, Peter., & Reed, R. (2004). Rural water supply in Africa: Building blocks for hand-pump sustainability. Water, engineering and development center, Loughborough University, UK.

Jo. Smet., and Christine. W. (2002). small community water supplies. Technical paper series 40.

Joanne de k. (2005). Sustainability of rural water supply systems assessment of gravity water systems implemented by plan cameron in the North west region of cameron.

Schouten,J.(2006). Scaling up community management of rural water supply,Well resources,Loughbourouugh universty,Uk.

Stephen Comins.(2007).Community participation in service Delivery and Accountainibality.

United Nation publications, (UN). (2007). Indicators of sustainable development: Guidelines and methodologies. Department of economic Development.