

Performance Evaluation of Organizational Arrangement in Irrigation Water Management at Serenta Irrigation Scheme, Northern Ethiopia

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Abstract

This study was conducted to evaluate the performance of organizational arrangement for irrigation water management in Serenta irrigation scheme. The different indicators considered were Water Users Association (WUA) structure, water allocation and distribution systems, water distribution fairness status, conflict management mechanisms in water use, canals cleaning and maintenance performance and organizational support service on irrigation water management. To evaluate the performance of organizational arrangement of the irrigation water management practices, questionnaire survey data collection method was used. The data generated through the household survey were analyzed using SPSS software. Eighty nine per cent of the respondents responded that the organizational performance of the current water users association in the irrigation scheme was poor. This attributed for unfair water distribution system and conflict on water use. To distribute the water fairly among users and to minimize the water loss, water users association should be strengthened and training on irrigation water management need to be arranged for the farmers. This implies that, presence of strong water users association in particular and presence of well organizational arrangement in irrigation water management is corner stone to build an effective irrigation development.

Keywords: Organizational arrangement • Performance • Water management • Water users association

Introduction

Irrigation Water Management is defined as management of irrigation water on farm with the objectives of delivering water in the right amount, at the right place, and at the right moment, in a way that will satisfy the water requirement of the crop [1]. Inadequate management of available water for irrigation at system level has led to a range of problems and has reduced the benefits of irrigation investments [2]. Irrigation systems cannot match their intended objectives without appropriate organizations to manage, preserve and control the system [3]. Building a strong irrigation organization is one of the major aspects of a successful and sustainable irrigation management [4]. As a result, the performance evaluation of organizational arrangement of irrigation water management has got the highest priority in irrigation research among other researches needed to resolve the problems of irrigation management, and equity of water distribution between irrigation users [5]. The performance of organizational arrangement can be simply defined as the level of achievement of the operating decisions to deliver irrigation water from a water sources to the crop [6]. The performance evaluation is based on certain qualitative indicators of descriptions, comparisons and responses from stakeholders, including farmers and key informants to manage the annual flow of irrigation water from the main feeding canal, coordinate the sharing of irrigation water among different farming units, and responsibility for the maintenance and repair of the on-farm infrastructure [7]. In Ethiopia, although organizations for irrigation management existed in different forms, they are neither generally well recognized nor endorsed by the public sector. More emphasis is given to technical aspects and less emphasis to the managerial and organizational issues. The organizations for irrigation management generally lacked appropriate regulation and legal basis to function properly [4]. This study was conducted to evaluate the of organizational arrangement performance of irrigation water management;

in terms of Water Users Association (WUA) structure, water allocation and distribution systems, water distribution fairness status, conflict management mechanisms in water use, canals cleaning and maintenance performance and organizational support service on irrigation water management at Serenta irrigation scheme, Northern Ethiopia. Serenta irrigation scheme is one of the biggest newly constructed dams in Northern Ethiopia. The investment in this scheme is expected to bring significant impact on livelihoods of many of the farmers' as well as the regional economy. To attain this, farmers are supposed to apply water in equity manner and practice sustainability using well organized arrangement. But, water losses and unequal water distribution between users are commonly observed. However, so far, there was no research done on the performance evaluation of organizational arrangement of the irrigation scheme. The evaluation of the performance of organizational arrangement performance of the irrigation scheme is needed in order to put appropriate measures for water management of the scheme and to enhance farmers' water use, organizational arrangement for irrigation water management. It is believed that this study will help the farmers at the irrigation scheme, researchers; local and regional decision makers in developing appropriate strategies for enhance water use of irrigation schemes.

Materials and Methods

Description of the study area

Serenta irrigation scheme is located in Tselemti district, North Western zone of Tigray regional State, Ethiopia. It lies between latitude of 13°36' 29" - 13° 34' 18" N and 38° 09'45"- 38° 10'44" E longitude. The elevation of the area ranges from 1315 m (downstream end of the command) to 1388 m (highest point in the catchment) above sea level (Figure 1).

According to the ten years (2008 – 2017) climatic data from May-tsebri station (meteorological station nearest to the irrigation scheme), the study area is mainly hot semi-arid, with mean maximum and minimum temperature equal to 33.3°C and 18.4°C respectively [8]. The annual average rainfall is 811.81mm [8]. Serenta dam is earthen embankment type, which has 32.82m height, 814.15m length, two manually controlled gates and 8,435, 983.81m³ reservoir volume capacities [9]. The scheme has a total command area of 520 ha with total beneficiary of 800(420 adults, 231 young and 150 females), out of which only 382 ha in 2016/17 and 394 ha in 2017/18 were irrigated [8]. Almost all

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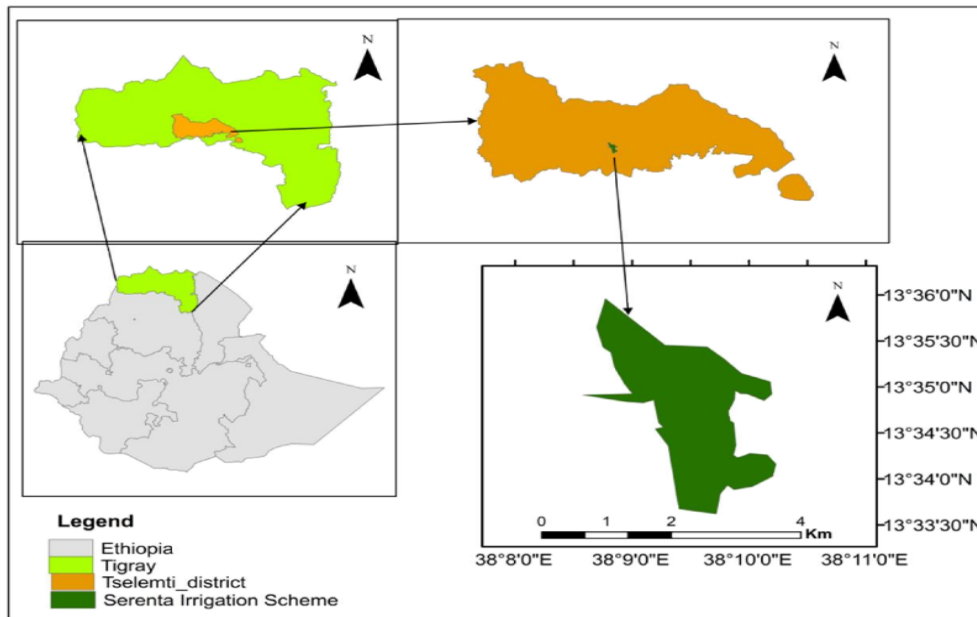


Figure 1: Location of the study area.

of the farmers in the irrigation scheme irrigate vegetable crops (onion and tomato), and maize and pepper as major irrigated crops (Figure 1).

Sampling procedure and techniques

To evaluate the organizational arrangement performance of the irrigation water management practices, a stratified random sampling technique was done. The farmers were stratified based on their location in the command area at head, middle and tail-end users of the water source. This include respondents from all parts of the irrigation scheme to compare water distribution fairness between the locations (as head, middle and tail-end users). The simple random sampling was followed from each location (head, middle and tail-end user). The totals of 73 respondents were interviewed using the sample size determination Equation (1).

Sample size determination

$$n = \frac{Z^2 * P * Q * N}{p^2 * (N-1)} \tag{1}$$

Where:

n=Sample size

N=number of households=800

P=Level of precision.....5% =0.05

Q= is expressed as 1-P

For P= 0.05; Q=1-0.05=0.95

Z= Confident interval 95%, 1.96 from Z – table [10].

Data collection methods

The data required for organizational arrangement performance evaluation of the irrigation water management practices were collected through interview household heads, key informant and focus group discussions. The questions in this survey were related to the water allocation and distribution systems, cleaning and maintenance conditions of canals, causes of conflicts and conflict management mechanisms, roles and functions of Water Users Association (WUA), and support service on irrigation water management.

Household heads survey

The data required for this study were collected from the 73 beneficiaries of Serenta irrigation scheme using semi structured questionnaire. Before conducting the actual interview, the questionnaire was pre-tested. Based on

the pretested result, the questionnaire was redesigned. The respondents were from all parts of water user locations (head, middle and tail-end) and included male and femalewater users

Key informant interview

The key informant interview was conducted to generate general understanding ofirrigation system,including the major managerial problems in the irrigation scheme and others, which are more relevant to irrigation water management. The selected key informants were, thechair and vice chair man of the WUA, the districtirrigation experts and kebele development agents.

Focus group discussion

The data collected from households survey were also further enriched with additional information gathered through focus group discussion with the beneficiary (by considering male and female irrigators) and coordinators of the irrigation scheme. It was held with 12 irrigators, who were selected purposively based on the postion of their plots (head to tail-end users), and WUA committee members.

Data analysis techniques

The data generated through the household questionnaire survey were analyzed by employing the Statistical Package for Social Science (SPSS Vs. 20.0) computer Software.The descriptive statistical methods such as frequency, percentage, and Pearson'schi-square(χ^2) comparisons were used. The data collected from keyinformant interviews, group discussions and observations were assessed qualitatively.

Results and Discussion

Performance of organizational structure of Water Users Association (WUA) of the irrigation scheme

Water Users Association (WUA) are the most frequently recommended organizational form for management of irrigation scheme. The WUA are supposed to have full control over the irrigation infrastructures in irrigation scheme [4]. The Water Users Association (WUA) in Serenta Irrigation Scheme was established in January, 2017 with 72 members. The organization has its own bylaw (internal rule). Under this association there are five committees with different responsibilities (Figure 2).

According to the household survey, 89% of the respondents responded that the organizational performance of the current WUA in this irrigation scheme

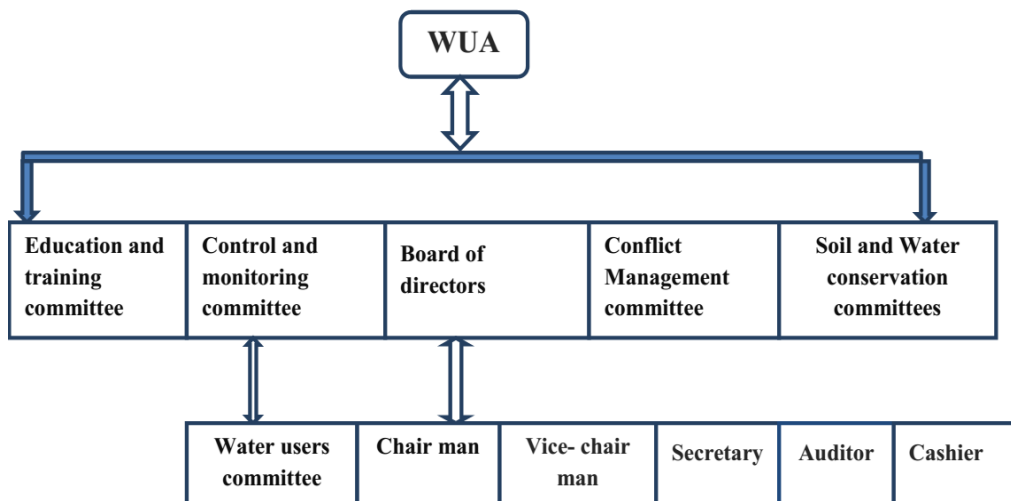


Figure 2: WUA organizational structure of the Serenta irrigation scheme.

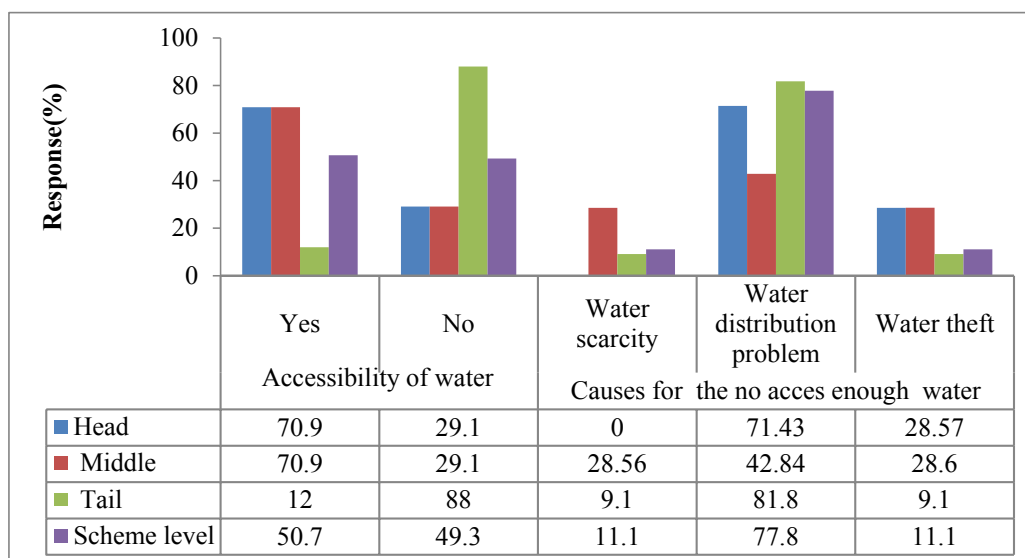


Figure 3: Farmers' response to enough irrigation water access and their causes.

was regarded as poor. This was also supported by the result revealed from the key informant interview and group discussants; they described it as simply a symbolic structural organization, which needs reorganization (rearrangement) for proper performance. Haileslassie et al. [4] also observed that, the functioning of organizations for irrigation water management in Ethiopia not well developed.

Water allocation and distribution systems

Since, the irrigation scheme had weak organization of water users association, there were no water users' group leaders (the persons responsible for water management within their block or location). It was partially managed by the individuals responsible to opening and closing of the gate and fully managed by the users themselves. Due to poor organizational setup of the WUA the water allocation and rotational distribution system was not implemented on the ground (practically) though it was stated as rule and regulation for the irrigation scheme. The result from the household survey revealed that, there was a problem in accessing to irrigation water when needed in the irrigation scheme in general and this get sever across the location from head to tail end (Figure 3). About 50.7% of the sampled beneficiaries of the irrigation scheme revealed that they get enough water when needed for their irrigation activities. Figure 6 also clearly shows that, a significant number of beneficiaries (49.3%) complained that they have faced problem of water shortage in the irrigation scheme; not getting enough water for irrigation activities when needed.

The problem was worse across the location from head to tail end. Eighty eight per cent of the tail-end water users and 29.1% both head and middle users complained that they faced problem of water shortage in the irrigation scheme. The chi-square comparison also indicated that there was significant difference to water access when needed, at 1% significance level ($\chi^2=22.8$, DF =2, p= 0.000) between the locations (head, middle and tail-end). The result from the focus group discussant with beneficiaries also revealed that due to absence of well-organized water committee (water user association) and low coordination of the users, water allocation was implemented based on guess. Beneficiaries do not know when to irrigate their farm and the communication that inform who irrigate next was not known. Ghazouani et al. [11] stated that, equal water distribution system requires coordination of users and enforcing rotation rules. Thiruchelvam [12] also reported that, proper water distribution system in irrigation scheme needs capacity building and strength of WUA. About 49.3% of irrigation beneficiaries complained about not getting enough water at scheme level, 77.8% said that the shortage was due to water distribution problem, and the water scarcity and water theft problems accounts 11.1% for each (Figure 3). Consequently, unfair water distribution and conflicts on water uses were common. Yohannes et al. [12] also reported that, the absence of water users group leaders in Gumselassa irrigation scheme lead to deterioration of water distribution and allocation system, and this reflects presence of weak WUA organization (Figure 3). Farmers' opinion on water distribution fairness status in the irrigation scheme Fairness refers to equity of water distribution among various users in an irrigation scheme. Fair distribution

of water to the farmers is major concern in management of irrigation scheme [13]. Due to the water distribution problem presented in the irrigation scheme responded by farmers; they were requested to respond on the fairness status of irrigation water distribution system. Accordingly, 53.4% of the farmers at scheme level responded as unfair water distribution (Figure 4). The water distribution fairness status response was different across the location (head, middle and tail-end users). The tail-end and middle users did not agree with very fair distribution and only 12% of the tail-end users responded that there was fair distribution. While, 88% of the tail-end and 41.7% of the middle users responded that there were unfair water distribution in the irrigation scheme (Figure 4). The chi-square comparison also indicated that there was significant difference at 1% significance level ($\chi^2=26.6$, DF =4, p = 0.000) on farmers opinion in the fairness status of water distribution system across the three locations (head, middle and tail-end). Fifty one per cent of the respondents said that the unfair water distribution was due to the reason that rotations were not strictly implemented, and 25.6% and 23.1% respondents responded that the causes for unfair distributions were poor coordination of water distribution by water users committee and due to illegal water users respectively in the scheme level. Due to the unfair water distribution system, farmers in the irrigation scheme receive different amount of water across the irrigation position and within groups. Accordingly, 82% of the respondents responded that, the head users in the irrigation scheme received more irrigation water than others. Because, they were near to the water source and they enforced to the persons who open and close the gate when they need, as well as they did not transfer to the next irrigator at a time (they use as they want). These unfair water distribution practices lead to conflict in water use in the irrigation system every time in the irrigation season of the scheme (Figure 4).

Conflict and conflict resolution mechanism in irrigation water use

Conflicts arising from water allocation and distribution problems were a common phenomenon in the scheme level in general, and across the location difference in particular. At scheme level, 67.1% of the respondents responded that they faced conflicts within groups and between groups of the water users. The severity degree of the conflict was high across the positions and it was sever in the tail-end users. It may be observed from Figure 5, that 88% of the tail-end water users responded that they faced conflict with each other and the other groups. While, the middle and head users accounted for 70.8% and 41.7%, respectively.

The chi-square result ($\chi^2=12.1$, DF=2, p = 0.002) also revealed that conflict over irrigation water use and the location difference from the water source

has a significant relationship at 1% significance level. According to the result explained in Figure 5, about the presence of conflict on water use in irrigation scheme, respondents put the major causes for the conflicts on water use. At scheme level 71.4% of the respondents said that the major cause for the conflict was due to lack of proper water distribution system, and 18.4% and 10.2% respondents responded that the causes for the conflict were water theft and water scarcity respectively in the scheme level (Figure 5). Haileslassie et al. [4] also argued that, conflicts in irrigation water use can happen between farmers at different position (between groups) of the scheme or farmers within the same position (within groups). A conflict between positions (location) is mainly due to irrigation flow cut-off by the upper locations, and conflicts between farmers within the same irrigation location (position) were due to water sharing problem and water theft (Figure 5). According to the households’ survey, 59.2% of the respondents responded that the conflicts in the irrigation scheme have been were addressed by elders .This implies that the water users try to solve the conflict themselves through self-agreement, and it indicated that there were weaknesses within the WUA.

Canals cleaning and maintenance performance

Canals cleaning and maintenance performance indicators of irrigation scheme provide an indicator to the future improvements of scheme structures. These indicators take much time and labor, but useful to enable wise use of irrigation water [14]. In the present study, the status of broken and damaged structures, sedimentation, and weed growth on canals indicators were taken to evaluate the cleaning and maintenance performance canals of the irrigation scheme. These indicators are important to prevent the obstacles in water deliveries and maximize the life of the system’s facilities [14,15]. In Serenta irrigation scheme farmers did not participate on cleaning and maintain canals, and there was no clear time schedule for canals cleaning and maintenance activities. Farmers were interested only to clean the canals near to their plots. According to the questionnaire based data analysis, 46.6% of the respondents responded that the cleaning and maintenance of the irrigation scheme were in a poor condition. This was due to poor organization of the WUA. The respondents, who responded that the canals have poor cleaning and maintenance condition, put the causes for that poor performance (Figure 6). Accordingly, 50% of the respondent stated that the major cause for the poor conditions of the canals was, breaking by illegal water users, and 35.3%, 8.8% and 5.9% of the respondents were responded as siltation, animal damage and poor coordination of water users’ committee problems. In the time of field data collection and visiting, these phenomena were observed, and that were sever in secondary and tertiary canals those were more damaged and broken, and weeds and sediments (siltation) were common. Due to those factors, off farm

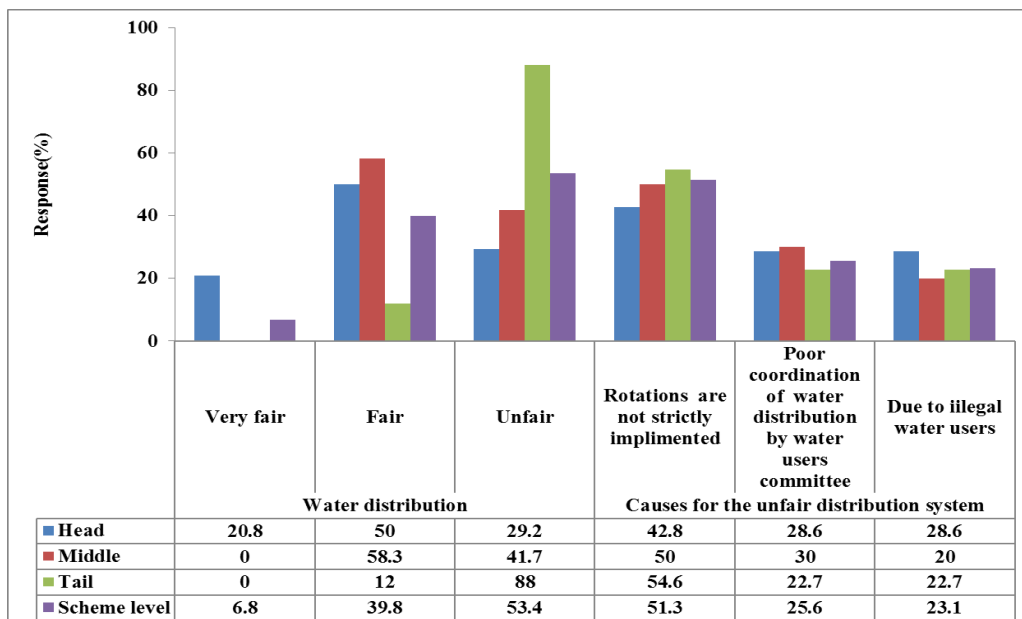


Figure 4: Farmers response to water distribution fairness status and causes for unfair.

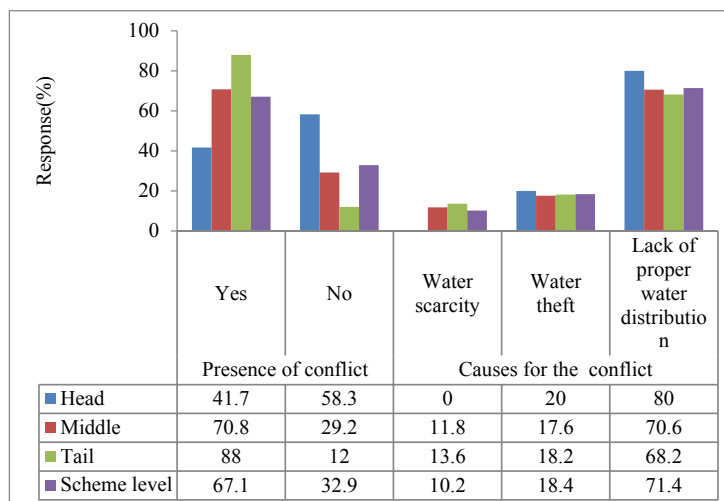


Figure 5: Farmers' response to the presence of conflict on water use and causes for conflict.

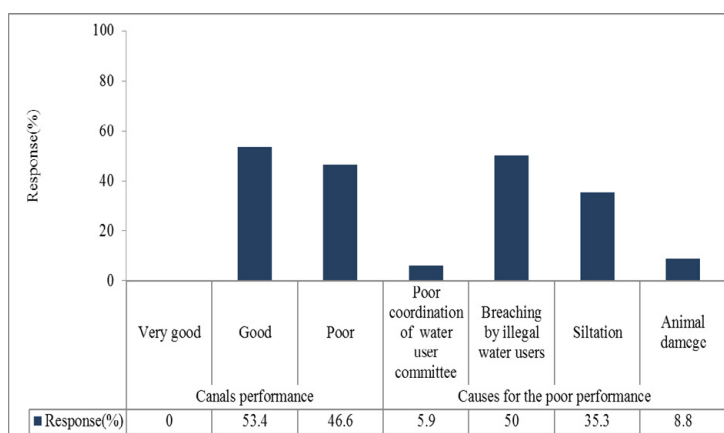


Figure 6: Farmers' opinion on canals cleaning and maintenance performance and causes for poor performance.

water loss and seepage loss were common from the secondary and tertiary canals. Similarly, Kassa and Ayana [15] and Haileslassie et al [4] reported that, a lot of structures were damaged, and have high seepage losses due to poor maintenance of the canals in Tahtay Tsalit and May Nigus irrigation schemes (Northern Ethiopia) (Figure 6).

Organizational support service on irrigation water management

Organizational support towards irrigation water management through advice and training to farmers would play a great role in achieving sustainable water use in irrigation scheme. This could be done using qualified development agents and irrigation experts [16]. In the present study, farmers were not getting full advice and training from the responsible bodies. This was due to the weak organization committees in the WUA, and the responsible bodies. The WUA structure in the irrigation scheme has the committees, which were responsible for education and training support (Education and Training committee), however these were not functional and no change was made in the farmers. As indicated in Figure 7, only 26% of the respondents agreed with presence of organizational support on irrigation water management in the irrigation scheme. Those farmers who agreed with the presence in support expressed that the support was only in terms of advice on water use informally by the experts and development agents who assigned in the irrigation scheme. However, they never had any formal training on the water management, except some training on insect and pest management, and production and productivity. Similarly, the research conducted by Yohannes et al. [12] in Gumselassa irrigation scheme (Tigray) revealed that, the support service by organizations to farmers was only focused on supply of fertilizer, seeds and chemicals, but it was poor on water management (Figure 7).

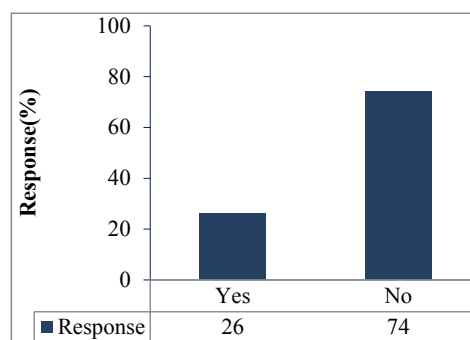


Figure 7: Farmers' response to the presence of support service.

Conclusions

The frequent performance evaluation is very important for improvement of irrigation scheme and the irrigation practices. The WUA organization function and legal enforcement of bylaws in Serenta irrigation scheme was very weak. This attributed to unfair water distribution system and conflict on water use in the scheme level in general, and at different locations (head, middle and tail-end) of water users in particular. To distribute the water fairly among users and to minimize the water loss, water users association should be strengthened and training on irrigation water management need to be arranged for the farmers. This implies that, presence of strong water users association in particular and presence of well organizational arrangement in irrigation water management is corner stone to build an effective irrigation development.

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