

Efficient Utilization of River Water: Constraints and Effects; Case of Alewuha Sub-basin in Raya Kobo-woreda for Irrigation Purposes

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Abstract

This research describes the findings of efficient utilization of river water; constraints and effects; case of Alewuha sub-basin in Raya-kobo-woreda. With simple random particularly lottery method, 50 samples drawn out of 3500 in proportionate representatives. Based on this, the collected data through structured interview questionnaire was analyzed with descriptive statistics analysis. It describes; land fragmentation, lack of technology, management problem, nature of channel constructed, disease and lack of skilled man power, lack of budget to maintain the channel system and repair the damaged channel, lack of interaction among the farmers, bad seed bed preparation and types of irrigation they use as a major constraints and their effects on yield reduction (-) and households emigration (+). Farmers in that river basin should convert rain fed land in to irrigable land by making a channel and they should utilize the river wisely.

Keywords: River; Water; Effects; Irrigation

Introduction

Back ground of the study

In the ancient time human population's activity on agriculture was dependent on the rain fed since rain fall scarcity was undoubted. Due to environmental problem (deforestation) the rainfall becomes erratic so that farmers tried to shift their water utilization towards both surface and ground water.

As agricultural river water use is generally accepted as the largest user of river water resource with in a given river basin, and therefore contributes at large to depletion and degradation of resource. Special attention, in the context of river water use for agriculture will be attributed to efficient use of river water at the basin level; rather than considering in the inefficiencies.

River water, once considered a free good and abundantly available resource has now become scarce and draw the attention of planners and policy makers for its optimal development and utilization.

Knuse stated that Indian farmers were preparing a plan on river water utilization in 1980 [1]. They started to construct bio-dams, reservoirs and canal networks. However, the river water resources sectors have been subjected to scathing criticism for its poor performance in increasing agricultural productivity and generating revenue from sale of water services.

As Swain stated on his research paper, Indian farmers delivered river water inefficiently and inequitably to their farms. He recognized that even if the marginal and small holdings endowed of river water resource, most of the water they take from the main canal is waste and lost.

According to Gary reported on his book, if the cultivation method (tillage and irrigation) is faulty and less efficient, resulting in the wastage of water, the duty of water will naturally be less. On many farmers, three fourth of the total irrigation water is wasted and lost [2].

Man's dependent up on irrigation can be traced to earliest biblical reference in a manner of wastage and lost. Irrigation in very early time was practiced by the Egyptians, Asians and the Indian of North American. Everyone knows that ancient Mesopotamia and Egypt were flourished on river Euphrates and Tigris, Nile respectively on irrigation activities. But, their perception towards utilization of river water efficiency was a grass-root level.

Turning to irrigation development in Ethiopia, it has a long history. Small scale irrigation started before 2000 years. It is fact that Ethiopia is the "Water Tower" of north East Africa. Although we are endowed by many big and small rivers, their economic contribution is not as such.

According to Relief Society of Tigray the major perennial rivers that pass through central Tigray such as Giba, Werie, Mereb and Tekeze are presently not utilized for agriculture efficiently. The river water distribution system in Raya-kobo woreda in general and Alewuha sub-basin in particular consists of structure built traditionally with inefficient capacity to deliver the required water reaching to the field is minimum, resulting high irrigation interval and right irrigation practices to irrigate more land area is the common experience of the farmers [3].

Conceptual frame work

Efficiency results when no resources are unemployed and no resources are misallocated. Economic efficiency is explained as equating marginal benefits obtained from the productive use of the resource to its marginal cost in water resource managements the simultaneous fulfilment of optimality conditions over space and time. Efficient utilization requires efficient water distribution and the choice of on farm irrigation technology. Efficiency means the production of any particular mix of goods and services in the least costly way. In another way efficiency is the result of full employment of the resource in this case water.

Graphically efficiency can be illustrated as follows:-

- All points on the curve are efficient i.e. no idle resource;
- At point "A" production is attainable but inefficient i.e. there is idle resource; here there is resource lost to produce the two goods.

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- At point “D” production is unattainable; because our resources are scarce;

Efficiency depends on full employment Figure 1. So, efficiency is dependent variable but full employment is independent variable. Mathematically the concept is illustrated as follow:

$$\text{Irrigation efficiency (\%)} = \frac{\text{water stored in the soil for crop growth/}}{\text{Water applied to the land}}$$

Justification of the study

As Kay stated basin irrigation can be very inefficiency method when it is not managed well [4]. In Alewuha sub-basin the peasants use the river unwisely, they use only small amount of its part. Even the water they distribute to their farm land is lost in different ways before reaching the irrigation land. This intern hinders agricultural production particularly crop production.

Prior to the present study, no economic study is carried out in Alewuha sub-basin. So, the problem still exists. Because of this problem; the researcher initiated to assess the constraints and their effects for efficient utilization of river water to be a solution.

The local society will benefit both economic and social aspects after accomplishing this task. This will be true if and only if different natural resource experts participate from various NGOs and governmental organization to curve or mould the behaviour of the society by reading and applying this research. If this is so, the society will become at least food secure and create employment opportunities to themselves as well as the rest of the society by handling the river water wisely.

Statement of the problem

We know that Ethiopia is the “Water Tower” of north east Africa for irrigation, drinking water and supply and development fishery. Despite the above fact only an insignificant portion of this huge amount of water resources potential is being utilized.

Since the fall of Dergue regime, the current regional government of Amhara was trying to address the problem of efficient utilization of river water by constructing a dam to the farmers. Similar to the regional government, NGOs were contributing various activities to solve existing problem. Canal from the river Alewuha was constructed to address the life of the farmers in particular Raya – kobo woreda in

general. But the inefficient utilization of this river water still exists. That is why this research studies the constraints and their effects for efficient utilization of river water in this area.

Scope of the study

In Alewuha sub-basin there are two farmer’s association that use this river for irrigation; Dur-Lebbes and Haddo. Therefore, this study was limited these to farmer’s associations which are found in Raya-kobo woreda in north Wollo zone. It is highly limited to the constraints and their effects for efficient utilization of the river water.

Objective of the study

As indicated by the justification of the paper and statement of the problem the general objective is to assess the constraints for efficient utilization of river water and their economic and social effectiveness in Alewuha sub-basin.

Specific objectives

Apart from the general objective stated above, the paper also aims at attaining the following specific objectives:-

- To analyze the constraints for efficient utilization of river water for irrigation purposes.
- To examine the social and economic effects of the constraints on the society.
- To forward suggestions to minimize or to avoid these constraints.

Literature Review

Irrigation and water management

In the Umbeluzi experimental station, studies were done on field application efficiency the fluctuation is the river water table. The conclusion of the efficiency study was that due to the undulating characters of the fields, the field application efficiency of ferrous irrigation is very low, ranging in the four cases from 25-50%. Sprinkler application efficiencies under two treatments studied were 50 and 70%. Too long operation time’s percolation losses and wind probably caused this low efficiency.

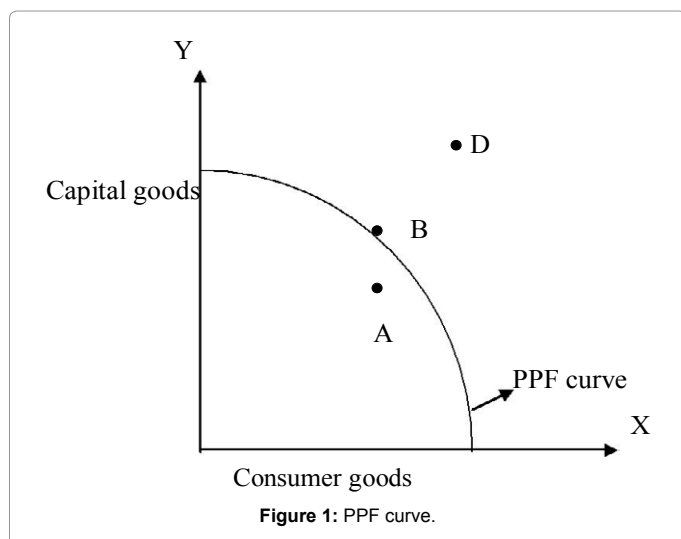
Water as a finite resource

Human consumption is obliged to share its demands for fresh water supplies with the needs of agriculture. Even if the donated community met all the funding demands of international NGOs for water and sanitation, the MDGs targets could still fail through inadequate integration with the bigger water picture.

Integrated water resource management inter-related water shad and rivers across national boundaries and oceans. In addition to educational programs for raising awareness of water conversation wise and efficient water use measures embrace water pricing.

Irrigation theory and practice

The practice of chaining water rate on area and crop basis has no relevance to the quantity of water supplied or used by the cultivator. There is always a dependency among the cultivators for over irrigation and wastage of water. This leads not only the loss of a valuable resource development at high cost but also the loss of costly nutrients through deep percolation. Further, it gives rise to problem of water logging a salt- build-up in a short period.



Climate change and water

This describes climate change as an “additional burden” to provide water services, rather an understatement in relation to the accompanying catalogued of potential impacts. The reduction in water availability caused by retreating Himalaya glaciers is possibly the impact on fresh water which carries the greatest risk to the greatest number of people to use the water efficiently and adequately. Along list of adaptation strategies in the inter government plan on climate change report concludes with a brief recognition that developing countries cannot possibly afford them and may have to resort to “unsustainable practices such as increasing ground water over exploitation”.

Methodology and Data Set

Description of the study area

Alewuha sub-basin is one of the four rivers in Raya-kobo woreda of north Wollo zone in Amhara region. It is located at the south east of the woreda. It is bordered on the south by Gubalafto woreda and drainage in the mountain terrain with in the area in general to the east. It is also located, north latitude 11°30” and 12° 18” and east longitude 39° 23” and 39° 52” covering an area of 248 m² [3]. The area is flattened and suitable to deposition from the surrounding scraps. Small streams such as; Tikure wuha, Aba kolash, Gimbara and Belers are the major tributaries which are originated from topographically high one as of the Lasta Mountains at all average elevations of 2006 masl. The all-weather road from Addis Ababa to Mekelle passes through the basin. The local communities around this river are endowed by indigenous knowledge to prepare the local beer, the so called, “tejj”.

Based on figure published by the CSA in 1994, these kebeles had estimated total population of 5482, of whom 2505 were males and 2777 were females. 86% of the total population of the woreda who live in these kebeles was agricultural population and the rest 14% live in the small town (Gobiye) as civil servant, merchants and daily labourers [3].

This area has elevation of between 1355-1640 masl and basaltic rock. And its means annual rain fall is between 800-1200 mm and average temperature is between 16-20°C. The local community's economic activity on irrigation is in this river basin and most of the time they produce teff, maize and recently sugar cane and onion.

Sampling technique

In Alewuha sub-basin, there are two farmer's associations who cultivate maize, sugar cane and onion by irrigation activity namely, Dur Lebbes and Haddo. There were 3500 households that use the river actively. But, it was tedious to draw 50 sample sizes out of 3500 households because of the societies' attitude towards this new task. Even though many difficulties arose in order to draw the sample, the local water leader /Yewuha Abbat/ provided his support by assembling the farms in the meeting hall. There by therefore drew 50 samples out of 3500 households that are active to use that arable land by proportionate representatives.

Because of time and financial budget to collect the primary data, the type of sampling was simple random particularly lottery method Table 1.

Method of data collection

To get necessary data for the thesis; primary data were collected through interview to the farmers those who are the Alewuha sub – basin utilize. Secondary data from different sources like Kobo Girrana

No.	Name of Kebele	Total No. of house holds	Let 50 = z, proportionate sample size = (x/y)z
1	Dur – Lebbes	1750(x)	25
2	Haddo	1750	25
Total		3500 (y)	50

Table 1: Population and sample size.

valley development study project, websites of irrigation, research thesis done in Amhara region and other parts of the world were incorporated. In general, to collect all the necessary data, interview in structured questionnaire and personal observation were conducted.

Data analysis

To get answers stated in questionnaire, both tabular and descriptive (narrative) analysis were used. The data were collected on February 14 and analyzed on February 22 Table 2.

Note:

- All the respondents gave answers.
- Households in percentage are out of the sample size (50).
- Someone can be understood from the table that utilization of river water have constraints and these constraints have negative effect on grain yield.

Note: - yield reduction is for maize production. Year is in E.C. As it can be seen from the table the constraints for efficient utilization of river water in Alewuha sub-basin had a great role for yield reduction from 1997-2001 and they had a positive impact on emigration, i.e. as the constraints become savior, the grain yield become reduced and emigration became enhance Table 3.

Results and Discussions

As Table 2 shows, 50% of the respondents gave their responses. They raised 6 major constraints for efficient utilization of river water in that area.

- * Land fragmentation * Lack of technology
- * Management problem * Nature of Channel constructed
- * Disease * lack of skilled man power

Land fragmentation

The current Ethiopian government EFDR conducted land redistribution among the farmers in 1983 E.C for the rural people. Because of larger population size, an individual farmer had gotten small land size as a livelihood which is a state land. As a result, it was difficult to manage the river water in order to deliver water from the main canal to the irrigable arable land. Since land is small in size, it was worse off constructing wider and longer channel through the irrigable land. There by therefore as they said the water simply flows and loss. This intern created yield reduction, conflict among the farmers and emigration to another country or region. Thirty percent of the sample size gave answers.

Management problem

Because of mismanagement of the natural resource (river water), the local peasants had suffered both economic and social aspects. The zonal bureau of agriculture in general and the woreda bureau of

Responses		No. of respondents		
Constraints	Effects	House holds	Associations	Households (%)
<ul style="list-style-type: none"> land fragmentation Management problem Nature of channel constructed lack of technology 	<ul style="list-style-type: none"> Conflict Migration (emigration) Yield reduction 	15	Dur- Lebbes	30
<ul style="list-style-type: none"> lack of skilled man power lack of Technology 	<ul style="list-style-type: none"> Migration (emigration) Yield reduction 	10	Dur- Lebbes	20
<ul style="list-style-type: none"> lack of budget to maintain the channel system and repair the damage channel Lack of interaction among the peasants Bad seed bed preparation and type of irrigation. 	<ul style="list-style-type: none"> Night irrigation reduction in water volume drought loss of nutrient 	25	Haddo	50

Table 2: Responses and number of respondents in the 2 associations.

Effects	Years				
	1997	1998	1999	2000	2001
Yield reduction	20.00	17.00	6.03	10.00	8.01
Emigration	12.50	13.01	14.00	16.30	17.02

Source: kobo- Girran valley Development study project [3].

Table 3: Effects of constraints and number of peasants suffered by these constraints in different years. Assume yield is quantified by q/ha and emigration is quantified by percentage.

agriculture in particular have no inspired confidence to manage the natural resource (river water). The natural resource managers in the woreda level and water leader (Yewuha Abat) did not implement rules and regulation properly. They did not also evaluate and monitor their doings (works). So as a constraint of efficient utilization river water; the management problem has a negative effect on economic and social aspects, yield reduction, conflict and emigration respectively. Simply supervision was not common in that area.

Nature of channel constructed

In that area the channel was constructed from traditional materials (mud, cow dung, plant remains, stones and so forth). In this, the farmers have no a common inlet/out let that connect their field because of this conflict has always arose among the farmers. Farmers considered canals as a state property and they did not take maintenance of canals. Since construction of the channels was from traditional materials/earthen/, huge amount of water loss and the field that they need to irrigate become dry and yield reduction took place. As a result, emigration happened among the farmers. Fifteen households gave this answer from Dur Lebbes farmer's association.

Disease

As Dur Lebbes respondents mentioned, yellow fever and malaria are available in that area, because of the elevation of the land (3000 massl). This area is preferable for reproduction of mosquitoes. There by therefore, the farmers afraid off diseases and they did not engage to irrigate their land at night. Unfortunately, the river water flows without any economic benefit and yield became down. This leads to emigration. This was answered by fifteen households from Dur-Lebbes farmer's associations.

Lack of skilled man power

Even though two research centers are available in that woreda, no economic research at all about river Alewuha. And also natural resource experts are not disseminated in that two farmer's associations to handle the problem of mismanagement of river water. Because of this constraint, the problem still up graded from day to day. And the farmers used the water unwisely; as a result their yield became less and

suffered for migration to cope up with drought. Ten households raised this constraint from Dur-Lebbes.

Lack of technology

Because of land fragmentation, the farmers did not accept new technology to use the river water wisely. For example, the farmers did not allow using tractor to plough their land because land is fragmented. They feared conflict among the farmers. As a result, because of mismanagement of the natural resource (river water) by using technology, yield reduction took place which also leads emigration. Ten respondents gave this answer from Dur - Lebbes. In Haddo farmer's association 25 households or 50% respondents gave answer for the questions. These constraints are:

- Lack of budget to maintain the channel system and repair the damage channel.
- Lack of interaction among the farmers and
- Bad seed bed preparation and types of irrigation.

They gave effects for these constraints too.

Lack of budget to maintain the channel system and repair the damage channel

The peasants in those associations are not mature in terms of finance to maintain the canal and repair the damaged channel. Because of these constraints the problem of inefficient utilizations of river Alewuha sub- basin is still enhanced, therefore the volume of water through the channel is minimized as a result sufficient amount of water did not reach at the irrigable arable land. This leads yield irrigation and emigration.

Lack of interaction among the farmers

The farmers in this area had no cooperation among themselves for their common goals. They did not take maintenance of the channel before a rain had come. This is to mean that, they did not give their lion's share of maintenance in terms of monetary value and non - monetary value. If that was so, as the farmers said the river water cannot be managed well. Due to this reason the water didn't reach on

the target irrigable land. It is simply loss. This by itself enhanced yield reduction, conflict and finally drought took place.

Bad seed bed preparation and types of irrigation

Plenty of water was wasted in that sub – basin because of poor land preparation as the farmers mentioned. In that area peasants did not prepare land for irrigation or land levelling properly. That did not improve the uniformity of applied water to the irrigable land. They did not clear the bushes, grading the land finally as desired. Without confronting these constraints they irrigate the land by surface irrigation (sheet run off) method. As a result, a plenty of water cannot infiltrate to the ground. This is because of clods and aggregate soils. Therefore, this leads to yield reduction because plants on the farm don't get sufficient water supply.

In Table 3 effects of constraints and a number of peasants suffered by those constraints in different year is given.

Yield reduction

As it can be seen from the table, someone can understand that grain yield of maize is decreased from 1997 – 2001 E.C. This is because of inefficient utilization of river water.

Emigration

Because of different factors the peasants Immigrate to Arabian countries (outside of Ethiopia) and to another region (inside the country Ethiopia). As the table shows in 1997 a number of emigrate were 12.50% and in 2001 it was increased by 4.52% i.e. 17.02. This is as a result of yield reduction in that basin.

Conclusion and Recommendation

Conclusions

The overall study aims to assess efficient utilizations of river water; constraints effects in Alewuha sub – basin. As the constraints mentioned, all the constraints have a negative effect on utilization of

river water that is, as the constraints become saviour, the water loss problem become higher.

As a result these constraints have negative effect on yield and positive effect on emigration. This is to mean that, as the problem become saviour, yield reduction takes place in that area. Not only the yield but also on the social aspects (emigration) those constraints have a great role.

As Table 3 shows, from 1997 – 2001 yield reduction is reflected. The population effect (emigration) became increase that is the populations emigrated from that woreda to another woreda even to outside the country (Arabian countries).

In general these constraints have a negative effect on the economic as well as on the social aspects.

Recommendations

It is difficult to give remedies for the problem and answers for the questions if the causes or constraints cannot know. But, the constraints and their effects are on hand in this study. If this is so, as a natural resource economics researcher what I need to give some suggestions here is that the farmers in that river basin should develop another area as an irrigable land around that river. In that area there is an idle land and teff cultivation by using rain fed agriculture. And they should utilize the river wisely by constructing a channel together. To avoid land fragmentation they should convert rain fed land in to irrigable land by making a channel.

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