

# Assessment of Existing Irrigation Practices in West Shoa Zone, Western Oromia, Ethiopia

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**Abstract:** The study was conducted to assess of existing irrigation practices in West Shoa Zone, Western Oromia with main objective to investigate existing irrigation system, to identify the major challenges and opportunities of the irrigation practice in study area. The primary data were collected using semi structured questionnaire and the secondary data were collected from selected districts. Primary data was administered to 155 farm households drawn randomly from three districts and six PAs. The collected data were analyzed by descriptive statistics. The result were indicted about 83 (53.6%), 43 (27.8%) and 29 (18.6%) households using traditional, modern and motorized pump irrigation respectively. The average household's land holding at national level was 1.34 hectare. However, the average size of land holding possessed by sample households was 1.6 ha during the survey period. Out of the overall respondent's majority (51%) of respondent produce their crop through irrigation only once in a year per a plot which less than the required. The major problems encountered in use small-scale irrigation in the study area are problems related to disease and pests problems, scarcity of water and lack of supply inputs (improved seed), farmers transport tomato by containing in fertilizer bag, no appropriate storage structure to add time value and to overcome perishability of vegetable crops in the study area. As opportunity, the study area has a great water potential for irrigation, to enhance agriculture production and productivity through irrigation, sufficient support from government and government bodies by supplying irrigation equipment's and technical support. The study recommended that government, Irrigation Water Users Associations of Oromia should produce train producers to minimize water use conflict. BAERC should be demonstrating of tomato transporting box, potato digger and different storage structures to minimize production loss.

**Keywords:** Constraints, Irrigation Practice, Opportunity and Water Resource

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## 1. Introduction

Water resource management in agriculture is a critical contributor to the economic and social development of Ethiopia. If successful, irrigation in Ethiopia could represent a cornerstone of the agricultural development of the country, contributing up to ETB 140 billion to the economy and potentially moving up to 6 million households into food security [1]. However, still agriculture in Ethiopia is heavily dependent on rainfall, which is highly variable, both spatially and temporally. To overcome this problem the Government has given priority for irrigation development in the agricultural sector [2].

West Shoazone Oromia regional state is one of the areas where small scale irrigation practices are taking place mainly for the production of cash crops. According to west Shoa

zone irrigation development authority office report, the total area cultivated for irrigation in 2018 was 3964.6 hectares with modern irrigation, 30,780.85 hectares with traditional and 8507.58 hectares covered with motorized pump with total 218,348 beneficiaries [3]. However, small scale irrigation constraints have not been well investigated in western oromia, particularly in west Shoa zone.

Hence, the main objective of this paper is therefore to investigate existing irrigation system in study area and to identify the major challenges and opportunities of the irrigation practice which was very important and relevant to formulate policy options and support systems that could accelerate small scale irrigation practice in the study.

## 2. Material and Methods

### 2.1. Sampling Techniques

In this study a multi-stage sampling procedure was used. In the first stage, the three study districts (Dano, Ejere and Ada Barga) were selected purposively as small-scale irrigation practice is available. In the second stage, six PAs (two from each district) were selected purposively depending on small-scale irrigation potential. In the third stage, the total households irrigation users in the six sample PAs was stratified into the three strata (irrigation water user using

modern scheme (concrete water diversion), traditional diversion and irrigation user through motorized water pump). In the fourth stage, simple random sampling techniques was applied to select the sample unit from each strata at each PAs via probability proportionate to size procedure.

### 2.2. Description of the Study Area

The study was conducted in West shoa Zone, Oromia National Regional State, Ethiopia, at four districts situated in the area as follow.

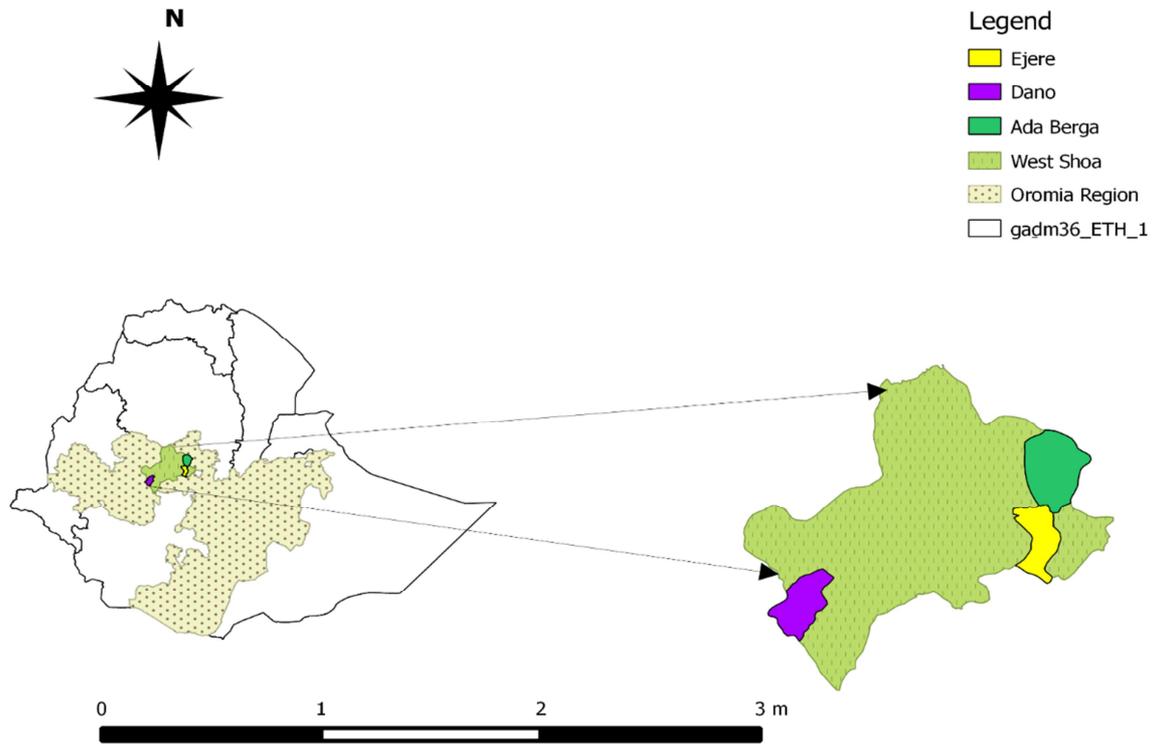


Figure 1. Map of West Shoa zone, Ejere, Dano and Ada Barga districts.

### 2.3. Methods Data Collection and Data Analysis

In this study, both primary and secondary data were utilized. To obtain primary data, structured questionnaire with both closed and open-ended questions were developed. The survey work for the collection of primary data was done in the month of April-May 2018. Moreover, secondary data were obtained through group discussions with concerned expertise of each targeted district of Irrigation Development Authority and annual report of the districts. To describe the demographic of sample producers and resources of producers

in the study area, the descriptive statistics were used.

## 3. Results and Discussion

### 3.1. Existing Irrigation System in Study Area

According to secondary data collected from the west Shoa zone irrigation office and three districts Ejere, Ada Barga and Dano district irrigation office the mostly common irrigation practice were shown in the table below (Table 1).

Table 1. Existing irrigation system in study zone and districts.

Zone/ district	Modern (he)	Traditional (he)	Motorized pump (he)	Total beneficiary
West Shoa zone	3964.6	30780.85	8507.58	218,348
Ejere	167	3260	1504	3308
Ada Barga	138	2007	552	7782
Dano	157	3506	369	12200

Source: secondary data, 2018

Therefore, the most common irrigation practices available in the study area obtained during the survey conducted were traditional, modern and motorized pump irrigation schemes

exist in Ada Barga and Ejere districts while only traditional and modern irrigation scheme were commonly practiced in Dano district in selected peasant association (PA).

*Table 2. Selected sample size across each district with different irrigation type.*

No	District	PAs	Common Irrigation methods			Total	%
			Gravity		Motor pump		
			Traditional	Modern			
1	Dano	Gidaf Abu	28	0	0	28	18.1
		Kara Garjeda	17	7	0	24	15.4
2	Ejere	Indode	0	22	4	26	16.7
		Arabsa	2	0	18	20	13
3	Ada Barga	GatraNabe	21	2	6	29	18.7
		MaruCoBot	15	12	1	28	18.1

Source: Own survey, 2018

The primary data was collected from 83 (53.6%), 43 (27.8%) and 29 (18.6%) households using traditional, modern and motorized pump irrigation respectively.

### 3.2. Socio-Economic and Demographic Characteristics of Sample Households

Sample households were composed of both male and female household heads. It was found that among the total sample household heads 87% were male and the remaining

13 were female. With regard to the marital status, from the total sample respondents 81.3%, 9%, 2.6% and 3.9% were married, single, divorced and widowed, respectively.

Age, education and farming experiences are another potentially important aggregate factors impacting agricultural productivity. The average age of respondents was 40 years with the minimum and maximum of 18 and 74 years respectively. This shows the survey collected information from households' heads younger than 18 years (see table below).

*Table 3. Distribution of sample household heads by age, education level and farming experience.*

	Variable	Minimum	Maximum	Mean	Std.v
1	Age	18	74	40	15.26
2	Education level	0	12	4	3.45
3	Farming experience	1	67	22.04	12.05
4	Total land holding (he)	0	12.06	1.6	1.88
5	Amount of irrigable land (he)	0.1	2	0.34	0.31

Source: Own survey, 2018

According to table 3, the average educational level was 4 years of schooling with standard deviation of 3.45. Regarding farming experience, it is an informal education on agricultural practices and production patterns from their surrounding environment [5]. The respondents' average experience in farming was 22.04 years with standard deviation of (12.05 years). The average household's land holding at national level was 1.34 hectares. However, as indicated in table 3, the average size of land holding (Rain fed farming and irrigation land) possessed by sample households was 1.6 ha (at least more than the national holding level). The one and twelve hectares were the minimum and the maximum land holding of the respondents respectively.

In view [4] each household is equally allocated 0.25 hectares. However, according to the survey were conducted in the 2018 cropping season showed, from the total respondents, that 38% were having less than 0.25 hectare of irrigable land, while 23% of the respondents were having equal to 0.25 hectares of land. The remaining respondents were having land size greater than 0.25 hectare (table 4). That is 75% of respondents of the study area possessed either

below or above that should have to be recommended by the proclamation.

*Table 4. Distribution of sample households categorized in terms of their irrigable land holding.*

No	Amount of irrigable land	N	Percent
1	Less than 0.25	60	38
2	Equal 0.25	37	23
3	Greater than 0.25	58	37

Source: Own survey, 2018

### 3.3. Irrigation Production Constraints in the Study Area

This section of the study paid a particular attention to the assessment of major problem or constraint which was in rank 1-4 only. The major problems encountered in use small-scale irrigation in the study area are problems related to disease and pests problems, scarcity of water and lack of supply inputs (improved seed). Other factors like Water theft or Conflict on water b/n upstream and downstream irrigating households. Due to shortage of water and unfair distribution of water and marketing constraints for irrigation product are also other problems of in using small scale irrigation. In

Dano and Ada Barga districts the respondents revealed that the primary major constraints were disease and pests problems. However, the primary major constraints for Ejere

district was water scarcity. Still water scarcity was the second major problem in their irrigation practices for Dano district.

**Table 5.** Matrix scores and ranking for irrigation production related constraints.

No.	Constraints	Districts			
		Dano	Ejere	Ada Barga	Total
1	Limited knowledge on irrigation operation	**	**	**	**
2	Disease and pests problems	12 (1 <sup>st</sup> )	17 (2 <sup>nd</sup> )	16 (1 <sup>st</sup> )	35 (2 <sup>nd</sup> )
3	Conflict on water b/n users	4 (4 <sup>th</sup> )		7 (3 <sup>rd</sup> )	7 (4 <sup>th</sup> )
4	Water scarcity	11 (2 <sup>nd</sup> )	24 (1 <sup>st</sup> )		52 (1 <sup>st</sup> )
5	Poor physical land structure for irrigation	**	**	**	**
6	Lack of improved seed supplier	6 (3 <sup>rd</sup> )	8 (3 <sup>rd</sup> )	14 (2 <sup>nd</sup> )	23 (3 <sup>rd</sup> )
7	Lack of financial service of irrigation	**	**	**	**
8	Lack of extension service for farmers on water mgt	**	**	2 (4 <sup>th</sup> )	**
9	Problems of canal damages	**	**	**	**
10	Lack of farm machinery for planting and harvesting irrigation product	**	**	**	**
11	Marking constraints for irrigation product	**	4 (4 <sup>th</sup> )	**	**
12	Irrigable Land occupied by rain fed crop	**	**	**	**
13	Others	**	**	**	**

Numbers provided out of brackets and inside brackets are respective score and rank; xx = represent it is not included as constraint in rank 1-4

### 3.3.1. The Effect of Disease and Pest for Irrigation Production

The disease affects different irrigation crops (such as coffee, tomato and paper) of the study area. The high land area of Ejere and Ada Barga cannot produce horticultural crop until the month or the first round irrigation phase because of severity of frost. Especially in Dano district die back of coffee branches was well recognized disease problem and require attention. The disease is characterized by drying of twigs and branches followed by complete defoliation.

Most farmer or youth produce hybrid pepper crop by bringing the seedling from Elfora Eastern Shewa zone with 3.5 birr per seedling and they reported as the different disease attack the crop after huge investment and even they cannot identify the appropriate type and amount of chemical they should have to use for disease, they invest high cost by simply asking chemical shopper.

### 3.3.2. The Status of Water Availability for Irrigation Production

The water scarcity is the initial problem for their success of crop production. Out of the total sampled households 60.8% pointed out they did not receive the amount of water they

necessitate. With next question was raised when the common shortage start. For more than 27% of respondent water shortage always occurring starting from February which is peak periods for irrigation production (table 6).

In addition, no body know the amount of the water their crop require and they apply and irrigate their crop by their experience. However, as indicated [6] in studying impact of irrigation method on water use efficiency and productivity of fodder crops in Nepal, higher economic yield from irrigated farmland achieved only by improved irrigation use efficiency. Their finding show that application of water through drip irrigation is able to produce acceptable yields of nutritionally dense fodder species during dry seasons leading to more effective utilization and resource conservation of available land, fertilizer and water than furrow application. The good opportunity found in Western Shoa was the availability of ground water studied in most area was the most promising. Without increase the amount of water for irrigation the status of increase from time to time of irrigation user may rise unnecessary and continues conflict between the upper and downstream users. According to west Shoa zone irrigation development authority office more than 179 extra water pumped in the zone in the last year.

**Table 6.** Status of water for irrigation production.

No	District	Do you receive water when needed			Shortage start from (N)			
		Yes	No	Dec	Feb	Mar	April	
1	Dano	18	34	1	8	17	8	34
2	Ejere	11	31	6	10	6	9	31
3	Ada Barga	29	25	4	6	7	8	25
4	Total	58	90	11	24	30	25	90
5	%	39.2	60.8	12.2	27.1	33.3	27.4	

Source: Own survey, 2018

*The competition for irrigation water and water distribution*

The survey result indicated that from all irrigation users sampled, (63%) responded that, there is sequence to use water and the rest replied there is no sequence. However, even though there is sequences there is no good coordination or there is no faire and no equal basis of water distribution. Out of the respondent said there is sequence (98 households), more than 69% responded there is no fair distribution and the rest replied relatively there is good coordination by irrigation committees (table 7). From this table out of the total respondent (155) only 30 (19.4%) fairly satisfied with water distribution. A Proclamation to Determine Irrigation Water Users Associations of Oromia Regional State Procl No: 204/2017 was a good opportunity for effective water distribution between each water users and among the different association found upper and lower stream.

*Table 7. Status sequence b/n users and its coordination.*

No	Water using among users	N	%
1	Is there sequence b/n users		
(1)	Yes	98	63
(2)	No	44	37
(3)	Total	155	100
2	Is there a good coordination		
(1)	Yes	30	30.6
(2)	No	68	69.4
(3)	Total	98	100

Source: Own survey, 2018

The committees are one of the essential factors that are responsible for efficient management of irrigation schemes. However, in the study area the respondents reported that the committee lacks transparency and accountability to irrigation water users. Only the upper stream irrigated land owner was more benefited from the river and the lower stream farm land use only the water leftover from the above. Studying the capacity of the river and planning the catchment area it may cover should be an agenda to be researched unless, renting land as well as purchasing motorized pump my leads to extra cost of the economy. In addition, the extensive work was required by varying time schedule on different stage of crop water requirement in the catchment of river for each beneficiaries. Secondly, the sequence may not be in only specific area of water user but for overall user from the river.

### 3.3.3. Market Instability

*Distribution of sample household heads by Average distance from the market*

Market place is the vital socio-economic factor for marketing agricultural products and to buy inputs for agriculture. The research [7] reported households in Machakel Woreda, East Gojjam Zone walk on their foot for three to six days went to towns to sell in better price. However, the respondents were also asked the average distance they move to sell their product or the common market they use. It show the common market they move to sell their product was an average not more than 9.3 KM or not more than 2 hours. Accordingly, they should advised to

move more distance which is preferred comparatively and have to escape from middle men to sell their products with better price. The farmers supposed the decrease of the price from 45 birr to 5 birr (Price instability) with in the stage of start the production and arrive the products to market. According to the research [8], the Oromia irrigation authority establish IMX (with the name Mefte) in Finfinne (Piyasa)to collect irrigation production from organized and legalized irrigation producers of oromia with constant price, however, there is no more success because of the farmers only move individually rather than organized and obtain legal personality. According to group discussion with zone irrigation office, this unwillingness to form legalized organization was raised from the upper stream irrigation users to not abide to distribute to lower stream users.

The majority of farmers consider producers lack bargaining power after harvest because of perishability of horticultural crops. The coping strategy they use for a good market is staying the red onion product in the ground for waiting better mkt. But it was considered during the survey conducted the system lead the product to complete deterioration. The farmer said we do not dig from the ground because, only digging and marketing price was greater than he/she can to sell and many farmers raise as marketing issues is the major constraint hinder them from maximizing the productivity of irrigated land.

Farmers in Arabsa kebele of Ejere district's due to non-convincing price of output and unsatisfactory availability of water makes them to grow non irrigable and low-value crops like wheat, barley and cheek pea on irrigation land. The system was contradicted with [9] in North Ethiopia, results which show that farmers shifted to non-cereal, more market-oriented irrigated crops in which the share of market-oriented irrigated crops increased income from 27% of the total irrigated land in 2004 to 89% in 2009. Therefore, the farmer miss this threefold of income increase in the study area. The lack of selling their product with good price is one challenge which persuades them non cash crops in the study area. [10] In his thesis market problem is as critical and the middlemen and brokers were exploiting their benefit in Ejere district and it requires strengthening the linkage among value chain actors.

The respondents in Dano distict of karagarjeda PA were said as they organized themselves to grow their crop with interval of two weeks by fearing of competition of market in order to supply the product on different time in their local market.

### 3.3.4. Challenges of Improved Seed Supply

Low supply of input, high cost of seed and chemicals, no enough storage structure to add time value and perishability are make horticulture crops very tidies. The assessment showed even though, vegetable has relatively cheaper the price and identified seed of horticultural crops was expensive. In oromia because of vegetable seed market volatility and inadequate storage facilitylimited activities were done on horticultural crop seed multiplication and there are enormous

unsatisfied seed demand in the country [11].

World Vision Ethiopia in Ada Barga district implements GINII model (Gardening for Improved Nutrition and Increased Income) project with the objective of improving household level productivity and availing nutritious food for the children started before 3 years supply 17 motor pump, 591Qt potato tuber and 769 quintal different horticultural crops like onion, tomato and like to small scale households farmers was a good lesson require appreciation [12]. This helps to improve the efforts made to satisfy irrigation input demand in the district where the project has been implemented. Nevertheless, there are key challenges that need to be addressed in other districts.

#### *The production rounds per year per plot through irrigation*

The Ethiopian government always advice beneficiaries of irrigation schemes to produce their irrigated land at least three times and above per a year [13]. Out of the overall respondent's majority (51%) of respondent produce their crop through irrigation only once in a year while the other 41% and 8% produce two and three times per year respectively (table 8).

**Table 8.** The irrigation rounds per a year.

No	X times	N	%
1	Once	79	51
2	Two	64	41
3	Three	12	8
4	Total	155	100

Source: Own survey, 2018

This irrigation frequency may also influenced due to late starting. Each respondent interviewed with question do you sow your crops in time (according to the sowing schedule?). According to group discussion of district experts, because of the frost problem the high land of Ejere and Ada Barga district irrigation production could not started until month of January. According to table 9, 23% of respondent do not start irrigation crop production in the schedule.

**Table 9.** Start crop production in time schedule.

No	Crops in time schedule	N	%
1	yes	119	77
2	No	36	23
3	Total	155	100

Source: Own survey.

Uncontrolled livestock is also the common problem to start his farm by single farmers rather he persuade to keep his border or vicinity.

#### **3.3.5. Mechanization Gap in the Study Area to Produce Irrigation Crops**

Even though it was not as major constraint raised by irrigation users, during the survey conducted, the farmers transport tomato by containing in fertilizer bag by animal cart and on animal pack which deteriorate the quality and unfavorable to transport long distance. No appropriate storage

structure to add time value and not to overcome perishability of vegetable crops were made farmers in order to lose their bargaining on horticulture crops in the study area in particular and in Ethiopia in general. Demonstration of tomato transporting box, potato digger and different storage structures these available in BAERC was a good opportunity for these different constraints.

According to key informant, digging the vegetable crops were the most labor required activity and increase production cost. In addition, especially detaching tuber and root of red onion operated with sickles manually which may be require some solution from engineering research centers.

## **4. Conclusion and Recommendation**

The study was conducted to assess of existing irrigation practices in West Shoa zone, Western Oromia with main objective to investigate existing irrigation system and to identify the major challenges and opportunities of the irrigation practice which was very important and relevant to formulate policy options and support systems that could accelerate small scale irrigation practice in the study.

The data used for this study were both from primary and secondary sources. Primary data was administered to 155 farm households drawn randomly from three districts and six PAs. The primary data were collected using semi structured questionnaire and the secondary data were obtained from group discussion and annual reports of related districts.

The primary data was collected from 83 (53.6%), 43 (27.8%) and 29 (18.6%) households using traditional, modern and motorized pump respectively. The average household's land holding at national level was 1.34 hectare. However, the average size of land holding possessed by sample households was 1.6 ha during the survey was conducted. In addition, 75% of respondents of the study area possessed either below or above irrigable land holding that should have to be recommended by the proclamation [13].

The major problems encountered in use small-scale irrigation in the study area are problems related to disease and pests problems, scarcity of water and lack of supply inputs (improved seed). Out of the overall respondent's majority (51%) of respondent produce their crop through irrigation only once in a year per a plot which less than the required.

Even though it was as major constraint raised by irrigation users, during the survey conducted, the farmers transport tomato by containing in fertilizer bag by animal cart and on animal pack which deteriorate the quality and unfavorable to transport long distance. No appropriate storage structure to add time value and to overcome perishability of vegetable crops were made farmers in order to lose their bargaining on horticulture crops in the study area the following opportunity was investigated.

- 1) Demonstration of tomato transporting box, potato digger and different storage structures these available in BAERC was a good opportunity for these different constraints.

- 2) A Proclamation to Determine Irrigation Water Users Associations of Oromia Regional State Procl No: 204/2017 was a good opportunity for effective water distribution between each water users may change the lack of water availability especially farmers found lower stream.
- 3) Coordination of farmers to the central market, especially Ejere and Ada Bargadistrict were found near to Finfinne. The Oromia irrigation authority establish IMX (with the name Mefte) in Finfinne (Piyasa) to collect irrigation production from organized and legalized irrigation producers of oromia with constant price.

## 5. Recommendation

Inputs (seeds) especially compatible with soil, disease resistance, frost resistance, and market-oriented irrigated crops have been made accessible to farmers through government intervention.

Disease attacks different irrigation crops require attention and further research by pathological of agricultural research centers. In addition, close supervision to decide amount and type of chemical the farmers have to use before the farmers on necessary additional cost.

The government/irrigation research team might think how to increase water productivity by determine the correct frequency and duration of watering in the study area.

Access to market information and linkages and time-value addition by different storing system have been exercised.

Implement for digging, detaching tuber from root of onion, different storage structure for perishable vegetable crops is required.

The farmers especially their farm found at lower stream must be informed/know strictly the amount of water including time schedule they can receive.

Unless, the risk of devastation on their crop and labor is not less than rain fed crops by keeping the charity of people found on the upper stream.

In general the deficiency of irrigation water was become the critical problem to study area, Western part of Oromia, which should be considered rather than saying the western part of Oromia is no problem of shortage of water for irrigation.

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