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Financial Analysis of Small Scale Irrigation Based Vegetable Production in Wondo Genet District of Sidama Zone, Southern Ethiopia

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ABSTRACT

Agriculture in Ethiopia is a prime economic sector from which more than 85% of the citizens earn their livelihoods. In this connection, small scale irrigation based agriculture contributes at large to movements to higher productivity and sustained development farming system. To meet the objectives, the study used data that came from 120 vegetable producers. The data were collected from November 2014-March 30, 2015. This study was aimed at analyzing the profitability of vegetable production, identifying the major determinants of gross annual income and identifying the major farm and market level constraints of small scale irrigation based vegetable production. The study used the distractive statistics (gross margin, benefit-cost ratio and net benefit-cost ratio) and the econometric model (the multiple linear regression model) approaches to address the study objectives.. About 80% of the respondents were engaged in irrigation based vegetable production. The average age of the respondents was 39 years with minimum and maximum age of 18 and 70 years, respectively. The minimum and maximum gross income per hectare was 1200 and 52600 Birr with average gross income of 12093.77 Birr. The average production and marketing cost accounted for 93.9% and 6.1%, respectively; whereas, irrigation cost and labour cost respectively accounted for 25% and 24%. The mean operating ratio and benefit cost ratio was accordingly 0.48 and 2.1. On the other hands, among 13 variables used in multiple regression analysis, number of vegetables grown, size of irrigated land, education, costs of seed, fertilizer, and irrigation correlated positively and significantly with annual gross income.. Thus, considering the important variables according to the study report is key in efforts done to improve agricultural productivity and sustainability in the study areas in particular.

Key words: Ethiopia. Horticultural crops, irrigation, operating ratio, profit

INTRODUCTION

Background and Problem Statement

Abundant labour and water sources combined with a wide range of agro ecological diversity give Ethiopia an opportunity to grow all crop types including vegetables. On the other hands, the return to scarce farm resources such as labour, land, capital and management has been remained minimal. This was mainly due to low level of improved technology adoption like irrigation based agriculture which in turn reduces small holder farmers susceptibility to erratic rain fall patter. This has put majority of Ethiopian farmers live under subsistence farming which in turn contributes the country to delay in achieving its national goals. However, potentially, Ethiopia has about 3.5 million hectares of irrigable land. But the land currently at under irrigation use is reported to be only 18% (625, 819 ha) of it (Awulachew et al., 2007). Meanwhile, irrigation is expected to reduce the impact of erratic rainfall on household income fluctuations, promote intensive land use therefore reducing the risk of crop failure (Rahmato, 1999). Likewise, research report by MoWR (2001) suggested that irrigation have positive impacts on small scale producers in reducing poverty and increasing food self-sufficiency and farming equipment. A report by RiPPLE (2010) indicated that through intensified production and reduced losses, irrigation agriculture could reduce losses and contribute more than 20% to 300% compared to nonirrigated agriculture. Likewise, Fitsum et al. (2011) indicated that irrigation could generate about 120% times higher income than rain fed based vegetable farm. Further, research report by MoWR (2001) indicated that irrigation have positive impacts on small scale producers in reducing poverty and increasing food self-sufficiency and farming equipment.

Major vegetables grown in Ethiopia includes lettuce, head cabbage, Ethiopian cabbage, tomatoes, green peppers, red peppers, Swiss chard, potatoes, beetroot, garlic, snap beans, shallot, carrot and onion (CSA, 2012). Vegetables serve as source of income, food and feed. According to (EARO, 2000), vegetables have high nutritive value compared to cereals. Furthermore, vegetables can generate high income for the farmers because of high market value and profitability (Kumilachew et al., 2014). Moreover, vegetables' leftovers are important sources for animal feed in both urban and rural areas.

In Ethiopia, about 97% of the vegetables come from small scale farmers. But the problems with these farmers are that they undervalue both economic and nutritional value at farm level. Therefore, the farmers mainly emphasis on production of cereal crops with little addition of vegetables (SNV, 2012; Miklyaev and Jenkins, 2012; Kumilachew et al., 2014). This is confirmed by an enormous decline in both production area and yield. For instance, area from year 2012 to 2013 and from 2013 and 2014 declined by -16% and -22%, respectively and the yield declined by -15% for the two years intervals

(CSA, 2014). Therefore, effort must be made to exploit current and potential growing demand for vegetable through informed policy and strategy. However, studies conducted and documented on economics of small scale irrigation based vegetable production in study area in particular and in Ethiopia in general is scant. In the absence of empirical evidence at micro level, however, the design and implementation of effective vegetable production is hardly possible.

To put the efforts made by the government on policy to ensure food security and sustainable development through irrigation agriculture against rain fed agriculture into effect, a better understanding of economics of small scale irrigation based vegetable production would facilitate rational decision on scarce farm resource allocation by small scale farmers and adoption of modern agricultural technologies so as to improve productivity and return per small scale farm. Moreover, understanding profitability of vegetables and factors affecting profitability of vegetables is a key element in helping policy makers and implementers thereby assisting small scale irrigation based vegetable producers in the study area. Hence, this paper came up with following major and specific objectives:

The Objectives of the Study

General objectives

The general objective of the study was financial analysis of small scale irrigation based vegetable production in Wondo Genet District of Sidama Zone, Southern Ethiopia

Specific objectives of the study

The outlined specific objectives based on problem statement of the study were to i. Analyzing the profitability of vegetable production; ii. identify the major determinants of gross margin; and iii. identify production and marketing constraints of small scale irrigation based vegetable enterprises in the study area.

MATERIALS AND METHODS

Area description

Wondo Genet is located at about 25km south east of Hawassa city, the capital of Southern Nations, Nationality and People's Regional State. Livestock rearing, both rain fed and irrigation based crop production and petty trade were the major economic activities accounting for 13%, 85% and 2%, respectively. The total human population of the woreda was estimated at 148, 202. From a total of land coverage, the area on vegetable based irrigation was only 1.5% (165.4 ha). Hawassa market was a terminal market for vegetable producer. Vehicles, horse and donkey carts were the major means of transporting vegetable to markets. Producers, collectors, wholesalers, retailers and consumers were the main vegetable market actors.

Sampling Procedure and Sample Size

The data were mainly primary. A multi-stage sampling technique was employed to draw a total of 120 vegetable producing households. The

first stage involved purposive selection of three Kebele Adminstrations (KA); namely, Ado, Yuwo and Aruma in Wondo Genet district. These KAs were selected based on vegetable production potential. In the second stage, households were grouped into vegetable producers and non-producers. Finally sample households were selected from vegetable producers sample frame using proportional probability to sample size by employing simple random sampling techniques to draw a total of 120 vegetable producers.

Data analysis

Descriptive statistics such as frequency, mean and percentage were used to analyze the socio-economic characteristics of the households and profitability of the vegetable farm. Whereas multiple linear regression was used to identify the determinants of gross profit per vegetable farm per year.

The descriptive methods

Gross margin**:** is defined as the difference between total revenue and total variable cost incurred in production and marketing of vegetables by smallholder producers. The equation of gross margin analysis is: $GM = GR - VC$. Where, GM is gross margin per hectare per year in Birr; GR is gross revenue (sale value) in Birr per year per hectare and VC is variable costs associated with vegetable production and marketing per hectare during the production season. Study conducted by Khan et al (2013) in Pakistan used gross margin, profit and breakeven point analysis methods to analyze economics of vegetable production. Owombo et al. (2012), Akter (2011)**,** Ekunwe et al. (2007) and Alimi et al (2000) used the gross margin analysis technique to analyze the economic viability of small scale vegetable production in different regions of the globe. Woldemichael (2014) also used gross margin analysis technique to analyze the profitability of dairy production in Wondogenet district of Sidama Zone, Southern Ethiopia. Accordingly, this study also used the gross margin analysis technique to address the profitability of the vegetable enterprise.

Benefit and net benefit cost ratio (BCR**):** It is a systematic approach to estimating the strengths and weaknesses of alternatives that satisfy transactions, activities or functional requirements for a business. Jumo et al (2013), Ibekweand Adesope (2010) in Nigeria used benefit cost ratio in analyzing economics of vegetable production. Likewise, Akter (212) and Woldemichael (2014) used benefit cost ratio in economic analysis of vegetable and dairy production, respectively. Similarly, this study used BCR as a tool to address the question of how profitability is the vegetable production to a farmer. The arithmetic formula to compute benefit cost ratio (BCR) and net benefit cost ratio (NBCR) are presented as follows:

$$BCR = \frac{Gross\ Income}{Total\ \text{cost}\ and\ Net\ benefit\ \text{cost}\ ratio}$$

$$NBCR = BCR - 1$$

The econometric method

Study by Ibekwe and Adesope (2010), and Owombo et al. (2012) and Angula et al. (2014) used linear regression analysis in their economic analysis of vegetable production. Josephine (2014) used the multiple linear regression models in his comparative economic analysis of tomatoes under irrigation and rain fed system in Nigeria. Similarly, Owombo (2012) used multiple linear regression models in his gross margin analysis of vegetable production in Nigeria. Accordingly, this study used the multiple linear regression analysis to address the study objective. The mathematical equation for multiple linear regression analysis was:

$$GM = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10} + B_{11}X_{11} + e$$

Where,

GM = is *the annual gross margin Birr*;

B_0=The intercept;

B_1 ….B_7 =The coefficients of the regression analysis;

$X_{1=}$Number of vegetables grown (continuous, measured in number)

$X_{2=}$Total land owned (continuous, measured in ha)

$X_{3=}$*Total irrigated* land for vegetable production (continuous, measured in ha)

$X_{4=}$Education(1=formal education; 0= no education) (dummy)

X_5=Number of working person per household (continuous, measured in man day)

X6=Number of vegetables grown (continues, measured in number)

X_7=Seed cost(continuous, measured in Eth Birr)

X_8 = *Fertilizer cost* (continuous, measured in Eth Birr)

$X_{9=}$Pesticide cost (continuous, measured in Eth Birr)

$X_{10=}$Irrigation cost (continuous, measured in Eth Birr)

$X_{11=}$Age(continuous, measured in years)

$X_{12=}$ *Distance (continous,measured in km)*

e =Is the error term assumed to be independent and normally distributed with zero mean and constant variance.

RESULTS AND DISUCSSION

Demographic background of respondents

The minimum and maximum age of the respondents was 18 and 70 years, respectively. The dominant age group ranged from 30-45 years, accounted for 40%. On the other hands, the later age, above 60 years, found hardly to participate in vegetable business. This implies that vegetable production is labour intensive.

Table 1: Demographic background of the respondents

	Category	Percent (%)
Age (years)	18-30	33
	30-45	40
	46-60	20
	Above 60	7
Total		100
Education (years)	Non-formal education	11
	Primary(≤ 6th grade)	60
	Secondary (7th-12th grade)	26.8
	Tertiary (above 12th grade)	2.2
Total		100
Marital status	Married	91.1
	Unmarried	8.1
Total		100
Average experience (years)		6.3

Regarding education, majority (60%) of the responded attended primary education, followed by secondary education (26.8%). The average experience of the sample vegetable producers was 6.3 years (Table 1). With regard to marriage, 91% was married. This is because of the fact that education and experience are important variables in entry to and running vegetable production.

Land Holding

The average land holding per household ranged from 0.25 ha to 2.5 ha with mean land holding of 0.85 ha in the study area. However, the majority (40.1%) of the sample households had land size less than 1 ha (0.5-0.75 ha). On average, about 51% and 31% of the respondents had land size ranged from 0.13-9.25 and 1-1.5 ha on average, respectively. With regard to land owned and irrigated, the proportion of land irrigated for vegetable production increased with land size owned. When land size owned increased from 0.25 to 2.5 ha per house household, land size irrigated increased from 0.13 to 2.5 ha per household (Table 2). On the other hands, the proportion of irrigated land increased from 53% to 91.24% of the total land owned by sample household. This indicates that land to allocate to irrigation based vegetable production is a function of the size of total land owned (Table 2).

Table 1: Land distribution

Land (ha)	% of HH	Irrigated land (ha)	% of HH	% of irrigated land to total land
0.25-0.50	6.7	0.13-0.25	51.1	53
0.5-0.75	40.1	0.38-0.5	6.6	62.4
0.75-1.0	22.2	0.5-1.0	2.2	51.5
1.25-1.5	24.4	1.0-1.25	22.2	71.4
1.50-2.0	4.4	1.25-1.5	11.1	77.7
2.0-2.50	2.2	1.5-2.5	6.7	91.24

Number, Type and mode of vegetable production

Table 4 discuses major vegetable produced in the study area. The dominant vegetable produced in the study area was potatoes, accounting for 22% of the sample households engaged in producing potatoes followed by 17.8% of the sample households engaged in producing potatoes, tomatoes, cabbage and hot pepper at a time. But households engaged in producing different combinations of vegetables accounted for 38%. On the other hands, households engaged in producing only tomatoes accounted only for 2.4%. This implies that the environment is not favorable due to its more sensitiveness to disease and frost. Furthermore, the majority of the sample households engaged in producing more number of vegetables as they have awareness on the benefit of diversification from view point of production and market related risks. With regard to mode of vegetable production, the dominant mode of vegetable production was sole type, reported by 73.3% of the sample households. Mixing with crops and vegetables other hands accounted 13.3% and 13.3.%, respectively.

Water Source for Irrigation and Average Number of Harvest per Year

Table 5 discusses source of water for irrigating vegetables farm and number of vegetables harvest per year. Among the water sources, borehole accounted for 60% of the sample households. The rest, 22% and 18% of the sample households used river and spring as their major water sources (Table 4).

Table 2. Type and mode of vegetable production

Major vegetables	% of households producing
Potatoes	22
Tomatoes	2.4
Potatoes, tomatoes, cabbage and hot pepper	17.8
Potatoes, head cabbage and carrot	11.1
Potatoes and cabbage	13.3
Other combinations	38
Total	100
Mode of vegetable production	
Mode	%
Sole	73.3
Mixing with cereals	13.3
Mixing with other vegetables	13.3

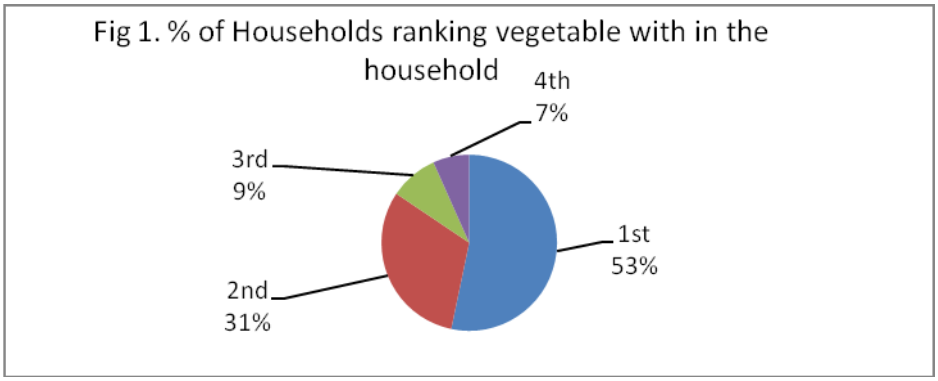
With regard to number of harvest, two times harvest was used by more than 62.2% of the sample households followed by three times harvest used by 24.4% of the sample households. One time harvest was used by 13.3% of the sample households, however (Table 5). This implies that number of harvest per farm varied depending on access to water and orientation to market. In connection to frequency of water applied to vegetable farm, majority (53.3%) of the households used for 6-10 times until harvest is made followed by 24.4% of sample households used for 1-5 times. This implies that majority were using the lower level frequency of water application. This indicates that water application is capital and labour intensive.

Table 3: Water source for irrigation and frequency of vegetables grown per year

Source type	% of household using
Bore hole	60
River	22
Spring	18
Number of harvest per year	
Number	% of household
One	13.3
Two	62.2
Three	24.4
Frequency of water applied to vegetable farm	
Number	% household used
1-5	24.4
6-10	53.3
11-15	8.9
15-20	13.3

Contribution of Vegetables to Household Annual Income

Figure 1 discusses the report by the sample households on rank of vegetable within household annual income. About 53% of the sample households reported that vegetable played the first rank in their average income followed by 31% of the respondent reported vegetables to be the second rank in their average annual income. On the other hands, only 9% and 7% of the respondents' report indicated that vegetable has third and fourth rank in their average annual income compared to other means of incomes portfolio.



Source: own data, 2015

Vegetable Marketing

Table 5 depicts the major vegetable actors, place of sale, reasons for selling vegetable to specific place and buyer and ways to find buyer. Accordingly, the major market actors were producers, semi-wholesaler, retailers and consumers. About 90% of the vegetable produces found to be channeled through producer-wholesaler-retailer-consumer, which accounted for 45% of the total vegetable produce. Producer-retailer-consumer was also the second important channel accounting for 44% of the produce to flow from producer to consumer followed by producer-consumer channel, accounting for 11% of the total produces coming from sample area to reach vegetables to consumer.

Table 4: Vegetable buyer type, place of sale and ways to find buyer

Type of buyer	% share	Place of sale	% share	Reason for selling	% share	Ways to find buyer	% share
Producer-consumer	11	Local market	4.4	Better price	57.8	Direct contact	67
Producer-retailer-consumer	44	Hawassa	86%	Proximity	37.2	Through broker	33
Producer-whole seller-retailer-consumer	45	Hawassa local market	4.1	No alternatives	4.4		

With regard to place of sale, Hawassa was the most important place of sale. About 86% of producers reported that they had been using Hawassa as their main market to sale their produce. The possible reason was better price at Hawassa than places like Shashemane, which is relatively closer to Wondogenet district. Better price, reported by 57.8% of the producer was the vital factors in choosing market place to sale followed by proximity, which accounted for 37.2%. With regard to ways to contact the buyer, direct contact was the most important ways in finding the right buyer. With regard to distance from farm to market place, the furthest and the closest distance was 2 km for local market and 22 km for Hawassa market. Given other factors, volume per farm affects the decision where to sale. The higher the volume of vegetables produced, the further the market to sale. But about 4.4% of the sample producers reported that they would sell to whoever comes with reasonable price as they had no information for their produce.

Means of transport

The major transport means for vegetable was donkey, reported by 95.5% of the sample producers. Very small number (4.44%) of producers used vehicle to transport their vegetable produce to market because it was reported that as produces were small, it would not be feasible to have the vehicles (Table 6). Surprisingly, there were no producers using back or head to transport their produce. This implies that the infrastructure like road related problem was less important in the study area.

Table 5: Means of Transport

Transport means	% household used
Donkey	95.6
On foot	0
Vehicle	4.4

Profitability Analysis of Vegetable Production

Input and marketing costs were respectively accounted for 91% and 9%. Among inputs costs, water and labour costs were the major once, accounting for 25% and 24%, respectively. For vegetable production, manure was reported to be less important due to its low contribution from the view point of yield.

According to survey data in Table 7, the minimum, maximum and average income generated per farm was Birr 1, 200, Birr 52, 600 and Birr 12, 093 respectively. Likewise, the minimum, maximum and average gross margin per hectare was Birr 514 Birr, Birr 41, 760, and Birr 8, 116, respectively. This result is in disagreement with report by Fistum et al el (2012) and Adugna (2009). The authors respectively reported that average gross income per ha to be Birr 3, 421.1 and 14, 000, respectively.

The value of operating ratio for minimum, maximum and mean gross income value per hectare was computed to be 0.14, 0.72 and 0.48, respectively. This means that income generated for every Birr invested per unit of variable input is positive. This implies that vegetable business in the study area is found to be profitable. This result was confirmed by the benefit cost ratio and the net benefit cost ratios, which was computed to be 1.72 and 0.72, respectively. This was in disagreement with Jumo et al (2013). Jumo et al (2013) reported that benefit cost ratio and net benefit cost ratio to be 2.2 and 1.2, respectively. However, the result is closer to report by Akter et al (2011) who reported benefit cost ratio to be 1.82. This implies that the benefit from vegetable can vary depending on the economic (cost and price) and physical factors (distance from market centers).

Table 6: Profitability analysis of vegetable production

Items		Minimum	Maximum	Mean	% share on mean
Gross income (A)		1200	52600	12093.77	
Input costs (Birr)	Seed cost	50	6540	1036.58	17.7
	compost cost/manure	0	1300	48.88	0.83
	Pesticide cost	0	2530	357.22	6.1
	Fertilizer cost	0	3397.0	1164.86	19.93
	Labour cost	120	7800	1406.22	24.1
	Irrigation cost	0	13800	1472.88	25.2
Total input cost (Birr) (B)		170	10840	3977.9	91
Marketing cost (Birr)		0	2530	357	9
Total variable cost (Birr)(B)/ha		170	37897	5843	100
Operating ratio (OR) (B/A)/ha		0.14	0.72	0.48	
Gross margin (GM) (A-B)/ha		514	41,760	8, 116	
Benefit-cost ratio (BCR) /ha				2.1	
Net benefit cost ratio (NBCR)(C-1)/ha				1.1	

The result of benefit and net benefit cost ratio report further indicated that for every Birr invested, there could be 0.72 Birr net return. This report is in agreement with report by Emokaro et al (2007) and Owombo et al (2012). The result of this study further indicates that vegetable production in the study area is financially and economically viable.

Labour Division in Vegetable Production and Marketing

About 13% of the sampled households reported that farm level vegetable activities were solely carried out by husband only. However, majority (49%) of the respondents reported that all the works related to vegetable production were shared among family members, depending on the capability of the members. On the other hands, about 35.5% of the respondents reported that the vegetable production activities on the farm level were performed in collaboration with both husband and wife excluding children.

Despite production activities, majority (42.2%) of the respondents indicated that marketing activities (transporting and selling) were carried out by husband and wife only. Whereas, about 35.2% of the respondents reported that marketing activities were handled by all the family members depending on availability of time and level of responsibility. Likewise, 20% of the respondents reported that marketing activities were performed by husband only (Table 9).

Table 7: Labour division in vegetable production and marketing

Production activities		Marketing activities	
Performer	% performed	Performer	% performed
Husband only	13.3	Husband only	20
Husband and wife	35.5	Wife only	2.2
All family members	48.9	Husband and wife	42.2
Husband and children	2.2	All family members	35.6
Total	100		100

Source: Own survey, 2015

Source of Inputs and Information

With regard to information and inputs sources, other farmers were the major input and information sources for about 35.5% and 33.3% of the sample households. This exchange particularly on seed could be barter kind, cash based or gift. The other main sources for agricultural inputs were trader (20%), cooperative (17.8%) and Development agent MoA through development agents 13.3%. However, according to the sample respondents, NGO played the least (2.2%) role in accessing inputs to farmers. In connection to source of information, traders played the major role (35.6%) in conveying timely information for producers on demand and supply, followed by farmer (33.3%) and DA from woreda office of agriculture (31.1%) (Table 9).

Table 8: Source of agricultural inputs and production and marketing information

Input sources	% share	Source of information	% share
Farmer to farmer	35.6	Farmer	33.3
WoA DA	13.3	Trader	35.6
Trader	20	DA	31.1
NGO	2.2		
Cooperatives	17.8		

Source: own survey, 2015

Type of Seed and Pump Used

Majority (46.7%) of sample respondents used local seed. However, about 49% of the respondents used both types of seed based on profitability of the type of vegetable. Those who used only the improved type of seed accounted for only 4.4%. With regard to types of equipment used in irrigating the vegetable farms, majority (58%) of respondents used rented pump whereas 20% of the respondents used own pump. But those who used local plastic cans

accounted for 2.2% with the remaining 20% being rain fed agriculture users.

Table 9: Type of seed and irrigation pump used in vegetable production

Type of seed used	% share	Means to irrigate the vegetable farm	
Local	46.7	Plastic cans	2.2
Improved	4.4	Own pump	20
Both	48.9	Rented pump	57.8
		Rain fed agriculture	20

The Relationship between Vegetable Supply and Demand

Today time, it is obvious that price for vegetables has been rising continuously. Accordingly, Table 11 discuses reasons for rising demand for vegetables against time. Increased consumer awareness on benefit of vegetables to health due to important nutritional value accounted for 56%. Connected to this concept, rising purchasing power was also reported by 21.8% of the sample households. The other possible reason reported by the respondents was decreasing supply due to decreasing yield and area.

Table 10: The relationship between vegetable supply and demand

Reasons	% share
Improved infrastructure	11.1
Consumer awareness	56
Improved effective demand	21.8
Decreasing number of supplier	11.1
Total	100

Results of Regression Analysis

Table 13 discusses the results of the multiple regression analysis. The result of R^2 indicated that about 78% of variation in dependent variable was explained by the explanatory variables in the model. The model output indicated that number of vegetables grown, education level, costs of seed, fertilizer and irrigation, and land size owned were found to be significant at 1% significance level. However, the signs for cost variables obtained to be positive implying sub optimal input use by vegetable producers. Therefore, the farmers were encountering cost due to reduced yield as the farmers were not in position to exploit the potential from variable and fixed inputs as well.

Table 11: Results of Regression Analysis

Variables	Unstandardized coefficient		Standardized coefficients	t value	Sign
		St. error	Beta		
Constant	6993	10555		0.663	0.512
Number of vegetable grown	4166.43	1241	0.449	3.52	0.002***
Land owned	5061.94	1311.5	0.352	2.4	0.23
Land size (irrigated)	1654.287	5430	0.431	3.047	0.004***
Education	5067	1311.5	0.547	3.86	0.000***
No of working person	-868.9	492.26	-1.81	1.765	0.086*
Seed cost	2.748	.800	.305	3.435	0.002***
Fertilizer cost	3.779	1.29	0.320	3.074	0.004***
Pesticide cost	2.559	2.43	0.131	1.065	0.294
Irrigation cost	1.43	0.377	0.386	3.77	0.0011****
Age	-38.634	-88.573	-0.049	-4.36	0.665
Marital status	-1351.465	3498	0.038	0.386	0.702
Distance	37.874	216.389	0.017	0.175	0.862
R-square=0.78					

* and *** respectively represents significance at 10% and 1% probability level

On the other hands, distance to market was positively correlated. This indicates that distance has no negative effect on annual sale rather it has positive relation. This is because as distance increases, selling price per unit increase as demand increases when produce comes closer to urban/city. Furthermore, Table 12 depicts that labour was negatively correlated with gross annual income. This is because the major composition labour was family labour with lower marginal productivity due to lower efficiency.

Production and Marketing Constraints

Frequent drought was the major constraint affecting vegetable production, reported by 35% of the respondents, followed by disease, reported by 29% of the respondents as primary. This was because of the fact that majority of the sample responds were found to use the rented pump, finance was reported to be their limiting factor; thereby leading the farmers more to apply water less frequently. On the other hands, constraints related to flood and frost were less important constraints in vegetable production as they were reported by majority of respondents to be 8th and 9th constraints (Table 13). Perishability was the most important problem in the study area related to marketing constraints, which was reported by 37% of the respondents to be their prime constraint combined with lack of suitable storage, reported by 40% of the respondents. However, about 42% and 22% of the respondents reported lack of transport and seasonal/erratic demand to be their less important constraint from the view point of marketing constraints.

Table 12: Vegetable production and marketing constraints

Particulars	Vegetable production constraints									
	% of household ranked the constraints									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	%
Ox shortage	12	7	7	2.3	14	7	12	14	24	100
Insect infestation	2	14	6	10	8	15	14	12	22	100
Disease prevalence	29	14	26	17	7	2.4	2.4	2.4	0	100
Frequent drought	35	9.6	16	9.7	6.4	16	3.2	3.2	0	100
Weed	2.2	6.7	4.4	18	18	17.7	22.2	4.4	6.7	100
Flood	2.4	0	2.4	7.3	7.3	9.6	4.9	17	49	100
Frost	0	2.9	2.9	5.7	11	9.7	5.7	31	31	100
Poor access to improved seed	21	19	7.1	17	2.8	9.5	7.1	4.7	12	100
Poor access to information	0	17	17	8.5	17	11.4	11.4	5.7	11	100

Vegetable marketing constraints								
Particulars	% of households ranked the constraints							
	1st	2nd	3rd	4th	5th	6th	7th	Total (100%)
Seasonal demand	14	18	11	26	3.7	3.7	22	100
Low price	10.4	19	8.3	10	25	17	10.4	100
Lack of storage	23	40	4.3	6.4	14.9	9	2.1	100
Lack of transport	2.7	5	5.5	5.5	2.7	28	42	100
Lack of information	2.7	8	24.	35	11	8.1	10.8	100
Brokers	10.4	6.3	29	15	21	13	13	100
Perishability	37	8.1	13	11	10.54	16	5.32	100

CONCLUSION AND RECOMMENDATION

Conclusion

Financial test ratios such benefit cost ratio and net benefit cost ratio indicated that vegetable production in the study area is feasible business. The gross annual income ranged from 1200 to 52, 600 Birr. On the other hands, input costs were the major impeding factors in entering to vegetable production, accounting for about 94% of the total production cost. Among the inputs costs, renting for irrigation pump was the major input cost which accounted, for 25% of the input cost. Moreover, the multiple regression analysis result confirmed that cost of irrigation, seed and fertilizer, and number of vegetable grown and land irrigated were statistically significant at 1% and positively correlated with gross income. Hence, the following policy recommendations are forwarded:

Recommendation

In order to bring a positive and significant impact on small scale irrigation based vegetable producers 'policies ought to target

at facilitating the increase in production and productivity of selected high value crops such as vegetables and ensuring their sustainable supply rising effective demand by designing production and market incentives. Accordingly, the present study draw the following recommen-dation based on the research findings:

1. As the study results showed that perishability and lack value addition through processing are major bottlenecks in the vegetable business, policy promoting modern storage and processing should receive prime attention from the perspectives of small scale resource poor farmers;
2. According to survey findings, borehole is the most important water source for irrigation, hence, strategies focusing on the development of borehole water source may have a significant economic impact on smallholder resource poor farmers so long development partners are concerned;
3. As frequent drought is reported to be the major bottleneck in vegetable production in the Wondogenet area, accessing to sustainable and adequate water sources may have a positive impact on the livelihood of the small scale vegetable producers thereby ensuring sustainable supply of vegetables to ever raising effective demand across rural and urban localities.
4. Since the regression analysis revealed that the marginal contribution of the inputs are positive despite their prior expectation. This implies that the small scale farmers have been using the inputs sub-optimally due to economic and physical reasons. Therefore, improving the access to these inputs and creating awareness in optimum resource utilization to the small scale farmers should be the major components of development policy priority thus, the farmers may fetch better return per their scarce resources
5. As brokers are reported to be a means for market inefficiencies for some of the producers for who have no bargaining power, there must be legal standards for their operation and close watch if they are supposed to be important marketing agents in the vegetable marketing system.

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RREFERENCES

Awulachew, S.B., Lambisso, R., Asfaw, G., Beyan, A. Yuya. (2014). Comparative analysis of technical efficiency of smallholder irrigated and rain-fed farm production: The case of Girawa District, Oromia, Ethiopia. J, Agricultural Economics, Extension and Rural Development. 2(5): 054-062.

Awulachew, S. B., Yilma, A. D., Loulseged, M., Loiskandl, W., Ayana, M., Alamirew, T. (2007). Water Resources and Irrigation Development in Ethiopia. Working Paper 123.

Central Statistical Agency (CSA). 2014. Agricultural sample survey. Volume (1). Addis Ababa Ethiopia.

EARO (Ethiopian Agricultural Research Organization). (2000). Dry Land Crop Research Program. Addis Ababa, Ethiopia

Ekunwe, P.A. and Atalor, I.V. (2007). Return on investment in plantain processed products in Benin City, Nigeria. J, Food, Agriculture and Environment. 5(1): 82-84

Fistum, H., Gayathri J,.Seleshi,B.A., Mekonen L., Aster D.Y. (2012) Agricultural water management and poverty in Ethiopia. J, Agricultural Economics. 43(1):1-13

Angula M., , B., Thomas, B., Ijambo. (2014). The Economics analysis of small scale vegetable production in North Central Namibia. Universal, J, of Agricultural Research. 2(5): 141-146

Miklyaev M., and G. P., Jenkins.(2012). An integrated appraisal of irrigated vegetable production and with limited house holdings in Amhara region, Ethiopia.Development Programdiscusiion papers, JDI executive program, Queens University, Kingston, ON, Canada, http://wwwqueensjdiexc.org /publications/qed_dp_pdf

Owombo, P.T., Adiyeloja, D.K., Koledoye, G.F., Ijigbade, J.O and Adeagbo, M.A. (2012). Gross Margin Analysis of Amaranth Vegetable Production in Ondo State, Nigeria: A Gender Perspective. J, Agriculture and Biodiversity Research. 1(6):91-96

RiPPLE.(2010).Small-scale irrigation in the Ethiopian highlands. Briefing paper 3.

Akter S., M. S., Islam and M.S., Rahman. (2011). An economic analysis of winter vegetables production in some selected areas of Narsingdi district. J, Bangladesh Agril.Univ. 9(2): 241–246

Woldemichael S. (2014). Economic analysis of dairy production and gender roles in dale district of southern Ethiopia. Ethiopian, J, Applied Science and Technology (EJAST). 5(1):85-110

Ibekwe1 U.C., and O.M. Adesope. (2014). Analysis of dry season vegetable production in Owerri West Local Government Area of Imo State, Nigeria. J, Development and Agricultural Economics. 2(6): 245-249.