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CONSTRAINTS OF VEGETABLES VALUE CHAIN IN ETHIOPIA: A GENDER PERSPECTIVE

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Abstract: *Tomato and onion production play an important role in improving household's income, nutrition and food security. Despite its importance, the productivity of these crops is very low compared to the potential yield. Cross-sectional data was collected from random samples of 380 producers, 186 retailers and 293 wholesalers. A total of 550 male-headed and 309 female-headed households were sampled. The data were analyzed using descriptive statistics such as frequency, mean, percentage, t-test and chi-square were used to summarize and compare the key variables between the two groups. Moreover, censored Tobit model was employed to identify determinants of severity of production and marketing constraints. The two households have different perceptions on tomato and onion value chain constraints. Social and institutional factors created barriers for both FHH[1] and MHH[2] actors in respect to tomato and onion marketing and production in each stage of the value chain. Therefore, tomato and onion production and marketing policies need to take into account determinants of severity of production and marketing constraints to enhance efficiency, quality and linkages among actors. To address the existing gap of women in terms of low agronomic practice, low yield and financial problem, specialized programs and intensive training efforts need to be designed and executed for them.*

Keywords: *Constraint, Gender, Male-headed, female- headed, Value chain, Vegetable*

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[1] Female-headed households
[2] Male-headed households

1. INTRODUCTION

Analyses of vegetable value chain constraints in male-headed and female-headed households are vital to improve the whole vegetable value chain. It has a significant role in improving household income, nutrition and food security. From farming up to retailing, vegetable production and marketing employs nearly twice as much labor as cereals per hectare of land. Poor farmers, rural laborers and urban poor are beneficiaries from these employment opportunities (Munguzwe and Tschirley, 2006).

Varieties of vegetable crops are grown in Ethiopia in different agro ecological zones, as a source of income and food. Exports of vegetable products from Ethiopia have increased from 25,300 tons in 2002/03 budget year and it's doubled in 2009/10 (EHDA, 2011). According to CSA (2008) 453,608.8 hectare (ha) was covered by vegetable. Onion and tomato covered 15,628.44 ha and 5,341.58 ha, respectively. The estimated annual production of vegetable was 18,124,613.5 quintal (Qt). Among these, onion and tomato constituted 1,488,548.9Qt and 418,149.53Qt, respectively. Despite the enormous merits and potentials, there is no empirical evidence to inform policy makers and agricultural practitioners on hindering factors of production and marketing activities in male-headed and female-headed actors on vegetable value chain. Therefore, it is significant to identify, prioritize and analyze onion and tomato value chain constraints that affect both male and female actors in each segments of the chain system. This will help both research and development initiative, to improve onion and tomato value chain.

Different studies were conducted in the past to identify production and marketing constraints of horticultural crops value chain (Abay, 2007; Adebisi-Adelani, 2011; Almaz, 2012; Ametemariam, 2009; Bezabih, 2008; Bezabih and Hadera, 2007; Bezabih and Mengistu, 2011; Bako etal, 2013, Collins, et al, 2006; Dayanandan, 2012; Gor et al. 2012; Hanemann and Ahmed 2006; Johnson, et al., 2004.; Kenneth, 2010; Madisa etal.,2010; Ouma and John, 2010; Rutgers, 2010, Samantaray, 2009; Samuel, 2011; Suman, 2012 and Tschirley, 2010). Nevertheless, none of these studies attempted to identify determinants of obstacles to effective production and marketing of onion and tomato value chain in gender perspective. The objective of this study is therefore, to identify determinants of level of production and marketing constraints in onion and tomato value chain in men and women

actors. Identifying such determinants in onion and tomato value chain is essential in the process of vegetable production and marketing.

2. METHODOLOGY

The study was conducted in *Dugda district*, Ethiopia. Multistage sampling technique was used to draw the sampling units of the study. Formal survey was conducted with onion and tomato value chain system actors such as onion and tomato producers, wholesalers and retailers. Formal survey for producers was conducted in Dugda district in eight different Kebeles while six cities/towns (Meki, Adama, Modjo, Bishoftu, Dukem and Addis Ababa) were identified for wholesalers and retailers survey.

2.1. Data collection techniques

Information on production and marketing constraints of onion and tomato was gathered through focus group discussions, key informant interviews, observation, transact walks (farm areas and markets) and formal survey with different actors in the chain. Information on onion and tomato production and marketing constraints were collected from value chain actors (producers, wholesalers and retailers).

Six focus group discussions (involving 6-12 members each with male and female actors independently) and 25 key informant interviews were conducted with representatives from onion and tomato value chain actors. Transact walks and observations were conducted at major market centers and farm areas. A pilot survey was carried on 20 non-sampled respondents on value chain actors to check suitability of questionnaire to socioeconomic and cultural setups. Secondary data at six cities/towns were collected from district Agricultural and Rural Development and in their respective Revenue offices, internet browse, journal articles, books, published and unpublished research reports.

2.2. Sampling procedure

2.2.1. Producers

Producers: These are actors who produce and sale onion and /or tomato. They would either have their own land or rented-in to produce both or one of the two crops in 2012/2013. These farmers after they produced they sell either at farm gate or at distant market.

Producer survey was conducted in *Dugda district*, Ethiopia. Multistage sampling technique was used to draw the sampling units of the study. At the first stage, Dugda district were purposively selected. Dugda district has 39 kebeles and out of which 16 kebeles are major

growers of onion and tomato. In the second stage, eight kebeles from onion and/or tomato growers in the district were selected randomly. The sampling frame of this study was freshly prepared in consultation with Development Agents of the selected kebeles and it included the producers of onion or tomato or both in the kebeles of Dugda district. The third stage of the sampling procedure, respective sampling frame was stratified as male-headed and female-headed households. Finally, the number of respondents was determined by using probability proportional to size sampling procedure. Then the predetermined size of the sample farmers from each kebele was randomly selected using systematic random sampling technique.

Out of the total 188 female and 1032 male producers, 100 female and 280 male representative onion and tomato farmers were selected using simple random sampling methods. Interviews were conducted from November to May 2013 using structured questionnaire by trained interviewers.

This study applied sample size determination formula developed by Yamane (1967) provided below. Determine the required sample size at 95% confidence level and 10% non-response rate.

$$n = \frac{N}{1 + N(e)^2}$$

n= sample size for the research use

N= total number of households producing onion and tomato vegetables

e= margin of errors at 5% and 10% non-response rate

2.2.2. Traders

Traders (wholesalers and retailers): These are actors who trading onion and /or tomato segment of the chains. They would either be licensed or unlicensed for both or one of the two crops. They had more than 6 months at the time of surveying experience in trading of both or one of the two crops.

To conduct formal survey with traders, sample frame was developed by taking account of vegetable (tomato and onion) retailers and wholesalers in the six main open markets; Meki, Adama, Modjo, Bishoftu, Dukem and Addis Ababa. It was estimated number of vegetable retailers' and wholesalers' in Meki, Adama, Modjo, Bishoftu, Dukem and Addis Ababa. After estimating the number of retailers and wholesalers, the sampling frame was stratified as

male and female retailers and wholesalers. Finally, a proportion to size was taken. To this effect, out of 400 onion and tomato wholesalers, a total of 293 wholesalers which was 42 female, 251 male were selected. Interviews were conducted in April 2013 using structured questionnaire by trained interviewers.

Same procedures were followed to select retailers. Out of 294 onion and tomato retailers, a total of 186 retailers were selected out of which 19 were male and 167 female retailers were selected. All of these actors were selected on market day, Saturday and Thursday. After estimating the number of these actors, a proportion to size were taken and simple random sampling was employed to select actors. Interviews were conducted in April 2013 using structured questionnaire by trained interviewers. As it is mentioned in producers sample determination, sample size was determined using a simplified formula provided by Yamane (1967). Both licensed and unlicensed traders were included in the traders' survey. A total of 859 respondent were selected which were 550 male-headed and 309 female-headed households.

Table1. Sample respondents distribution

Value Chain Actors	Sex		Total
	Male	Female	
Producers	280	100	380
Wholesaler	251	42	293
Retailer	19	167	186
Total	550	309	859

2.3. Data analysis

Data analysis employed descriptive statistics (such as percentage and mean comparison), t-test, chi-square and a Censored Tobit Regression Model (CTRM), to identify the determinants of level of production and marketing constraints.

A multicollinearity test was done to ensure that the assumption of no correlation between explanatory variables was not violated. Multicollinearity happens when the two independent variables are closely related. It is difficult for the model to decide which variables have the most influence on the dependent variable (Walker and Maddan, 2008). The results indicated absence of multicolliniarity problem among the independent continues and dummy/discreet variables.

A Censored Tobit Regression Model (CTRM) statistical analysis, dependent variables are left and right censored (Maguire and Marilyn, 2012; Niño-Zarazúa, 2012). The following CTRM general equation was employed in this study:

$$y_i^* = x_i^{'}\beta + \varepsilon_i$$

$$y_i = \begin{cases} a \;\; if \;\; y_i^* \le a \\ y_i^* \;\; if \;\; a \prec y_i^* \prec a \\ b \;\; if \;\; y_i^* \ge a \end{cases}$$

Where:

α- is the lower limit of the dependent variable

b- is the upper limit of the dependent variable

Yi*- is an observed ("latent") variable

β- is a vector of unknown parameters

εi- is a disturbance term

χi- is a vector of explanatory variable

is i=1,….,n (indicate the observation)

2.4. Definition of Variables

2.4.1. Dependent Variable

The production constraints for the study were identified and listed based on the review of related literature and discussion with experts. However, the list of constraints to be included in the study were finalized only after a relevancy rating procedure using a penal of experts (farmers, wholesaler, retailers, exporters, development agents and agricultural experts) and calculation of the Relevancy Index. Based on these assessments, sixteen production constraints were identified and listed for Relevancy Ratings. Relevancy index of the production constraints were selected based on relevancy rating done by a panel of experts. For this procedure, the list of identified sixteen production constraints were subjected to rating in a four-point continuum (Highly relevant, somewhat relevant, undecided and Not relevant), respectively. The constraints with a Relevancy Index score of more than 50% were included in the study (See Appendix Table 1). Meanwhile constraints with a Relevancy Index score of less than 50% were excluded in the study. Based on the relevancy index, 11 production constraints were selected. In the past several scholars employed Relevancy

Index to select variables (for instance Almaz et al, 2011; Tsion et al, 2009 and Tsion and Worth, 2013). Calculation of the Relevancy Index is as follows:

RI (Relevance Index) = Obtainable score ×100----------(1)

Potential score

The identified production constraints based on the relevancy index is treated as the dependent variable and consider for the principal component analysis.

2.4.1.1. Production constraints

In this study, production constraints are treated as the dependent variable. For the purpose of this study, the dependent variable was onion and tomato production constraints. During the survey, sample producers were asked to rate the weight of production constraints (shortage of seed, pesticide, fertilizer, labour, capital, lack of skill, shortage of ox, diseases problem, insects problem, theft problem and adulteration (quality of seed) by giving 1, 2, 3 and 4 (no constraint, low constraint, medium constraint and high constraint weight, respectively).

All 11 production constraints were keeping for principal component analysis (PCA). Principal component analysis is a very efficient data reduction technique and used widely to find pertinent statistical description of the data (Abdi and Williams, 2010). It is used to minimize a set of original variables in to a single uncorrelated component which can represent the initial variable. PCA quantifies categorical variables by reducing the dimensionality of the data (Gupta et al., 2011; Young, Takane and Leeuw, 1978). In the past, scholars use PCA technique to reduce data (for instance, Kasturiwale and Ingole, 2012; Awotide et al. 2012; Mabuza, Ortmann & Wale, 2012; Onofrei, 2010). Accordingly, PCA was analysed using the following formula.

$PCi=A_1X_1 + A_2X_2 + \ldots + A_nX_n$----------(2)

Where,

PCi= the subject's score on principal component of the i's constraint' i=1……11

A= constraint weight for observed variable n

X= Component loading on observed variable n.

As shown in Table 2, the components are ordered so as to the first principal component (PC) captures most of the variance, 2nd second most and so on. On the other hand, the first PC retains the greatest amount of variation in the sample and the k^{th} PC retains the k^{th} greatest

fraction of the variation in the sample. A high variability means that the PCA explains by a given amount the whole data (Pearson 1901b, Hotelling 1933, Anderson 1993; De Leeuw and Meulman, 1986). The PCA result was found to be the first three PC dimensions retains the greatest amount of variation in the sample 67%, 64% and 78% for pooled data set, MHH and FHH, respectively (Table 2). Therefore, the first three PC dimensions were taken for further principal component analysis to capture the most accurate information on the data.

Table 2: Principal component analysis for onion and tomato production constraints (n =380)

Dimensions	% of Variance			Variables	Component loading		
	All cases	Male	female		All cases	Male	female
1	40.649	37.207	51.120	Shortage of seed^0	.860	.844	0.903
2	15.876	15.747	16.857	Shortage of pesticide^0	.892	.866	0.953
3	10.498	10.967	9.657	Shortage of fertilizer^0	.616	.563	0.787
4	7.753	8.104	6.932	Shortage of labour^0	.305	.261	0.404
5	6.111	6.727	5.054	Lack of capital^0	.629	.643	0.629
6	5.136	5.708	3.251	Lack of skill^0	.754	.665	0.925
7	4.240	4.679	2.524	Shortage of ox^0	-.053	.035	-0.233
8	3.354	3.562	1.741	Diseases Problem^0	.608	.602	0.617
9	2.829	3.256	1.268	Insects problem^0	.666	.615	0.789
10	2.091	2.256	1.167	Theft problem^0	.246	.273	0.229
11	1.463	1.788	.429	Adulteration (quality of seed problem) ^{0}	.790	.759	0.868

Source: Survey data (2013) Notes: ^{0}: 4 = high constraint; 3 = medium; 2 = Low; and 1 = no constraint

As indicated in Table 3 below, the Kaiser-Meyer-Olkin and Bartlett's test of sphericity results showed that the use of PCA was found appropriate to provide significant reductions in dimensionality. All Bartlett's test of sphericity results were found to be significant as evidenced by significant x^2-value at 1% level of probability for pooled data set and female-headed households and 5% level of probability for male-headed households (Table 3). The first PC was retained, which is account for 85%, 82% and 91% of total variation of production constraints for pooled data set, male-headed and female-headed producers, respectively. Based on the above evidences, PC1 was identified as a reliable indicator of production problems as it is accounted for a larger share of the variation in the original variables. Hence, PC1 was retained and used as a proxy variable for production constraints.

Finally, Production constraint is thus a continuous dependent variable, which is affected by different factors to be investigated.

Table 3: Principal component analysis of onion and tomato production constraints (N=380)

Lists		PC1	PC2	PC3
Component	All cases	.034	-.048	1.006
loadings	Male	.035	-.049	1.006
	female	.041	-.048	1.006
%of variance	All cases	85.435	10.655	3.910
	Male	82.212	12.491	5.297
	female	91.061	7.159	1.780
Eigenvalues	All cases	21	3	1
	Male	17.3	2.6	1.1
	female	36	3	1
Kaiser-Meyer-Olkin measure of		All cases	Male	Female
sampling adequacy		0.546	0.543	0.547
Bartlett's test of sphericity x^2		11.962***	8.49**	14.32***

Source: Survey data (2013) Notes: ***;** significant at 1% and 5% probability level.

2.4.1.2. Marketing constraints (for Traders)

Here the same procedure is done like production constraints to construct marketing constraints which was faced by traders' (wholesalers' and retailers) in vegetable value chain. Marketing constraints were selected based on relevancy rating done by a panel of experts. With respect to these assessments, fifteen different marketing constraints were identified and listed for Relevancy Ratings. Finally, all marketing constraints were selected based on the results of relevancy index.

The identified marketing constraints based on the relevancy index are treated as the dependent variable and consider for the principal component analysis. For the analysis of principal component, the same procedure was followed as production constraints (see Appendix Table 8).

4.1.2. Independent Variables

In this study, independent variables determining production and marketing constraints of onion and tomato farmers and traders in the value chain are derived from reconnaissance survey research conducted in the study area, evidence from past research, from published literature, as well as from discussion with experts. The dependent and explanatory variables, their definitions, symbols and hypothesized sign are shown in Table 4 and Table 5.

Table 4. Symbol, definition and hypothesized sign of variables determine marketing constraints

Sl.No	Definition	Symbol	Type of variable	Hypothesized sign
	Marketing constraints in score	CONST	Continuous	Dependent variable
1	Respondents age (in Years)	AGEHH	Continuous	(+)
2	Gender (1= male ; 0= female)	GENDR	Dummy	(-/+)
3	Educational level of household head (1= unable to read & write, 2=read & write, 3= primary cycle,4= secondary cycle,5= tertiary cycle, 6=preparatory, 7=higher	EDUCA	Discrete	(-)
4	Family Labor (in man equivalent).	LABOR	Continuous	(-)
5	Traders' participation in social organization in score.	SOCLP	Continuous	(-)
6	Distance from the nearest market (in km).	DSTMA	Continuous	(+)
7	Accessing of market information (1= yes; 0= No)	INFOR	Dummy	(-)
8	Marketing experience of household (years).	EXPER	Continuous	(-)
9	Ownership of mobile phone(1= yes; 0= No)	MOBIL	Dummy	(-)

Table 5. Symbol, definition and hypothesized sign of variables determine production constraints

Sl.No	Definition	Symbol	Type of variable	Hypothesized sign
	Production constraints in score	CONST	Continuous	Dependent variable
1	Respondents age (in Years)	AGEHH	Continuous	(-)
2	Educational level of household head (1= unable to read & write, 2=read & write, 3= primary cycle,4= secondary cycle,5= tertiary cycle, 6=preparatory, 7=higher	EDUCA	Discrete	(-)
3	Family Labor (in man equivalent).	LABOR	Continuous	(-)
4	Actors getting extension service(1= yes; 0= No)	EXTSR	Dummy	(-)
5	Accessing of market information	INFOR	Dummy	(-)

	(1= yes; 0= No)			
6	Utilization of credit (1=yes 0=No)	CREDT	Dummy	(-)
7	Distance from the nearest market (in km).	DSTMA	Continuous	(+)
8	Farmers' participation in social organization in score.	SOCLP	Continuous	(-)
9	Farm experience of household (years).	EXPER	Continuous	(-)
10	Participation in income generating non-farm activities (1= yes; 0= No)	NOFAR	Dummy	(-)

3. RESULT AND DISCUSSIONS

3.1. Summary of Results of Descriptive Analysis

3.1.1. Producers

The analysis of field data shows that onion and tomato productivity at farm level was 228.58 quintal per hectare(ha) and 346.86 quintal per ha, respectively. This indicated that onion and tomato productivity at farm level is under potential which is 35-40 ton/ha and 40-50 ton/ha, respectively (BoARD, 2012). Hence, it is important to identify and prioritize production constraints at farm-level.

The average yield of onion and tomato for MHH and FHH was about 130.5 and 95.3 quintal, respectively, which was statistically significant at 5% (t=2.53). This indicates that MHH had higher yielded per ha of land compared to FHH (Table 6). The result is supported by, Pender and Gebremedhin (2006) found that female-heads of household achieve 42 percent lower crop yields than male-heads of household. Similarly a study by GTZ, 2009 also confirm that land Productivity on female farms is slightly lower that of men.

Table 6: Productivity level reported by the respondents (in quintal)

Gender	Tomato	t-value	Onion	t-value	Both crops	t-value
Male(280)	180.6	2.86**	91.95	0.837	130.5	2.53**
Female(100)	116.8		75.12		95.33	

Source: Own survey (2013) ***, **, represents 1% and 5% level of significance, respectively.

Evidences from the t-test indicated that, MHHs had younger age, high family labor, better vegetable farming experience and better participated in social organization than their FHH counterparts. These all factors helped MHH are able to reduce production constraints (Table 7).

As indicated in Table 7, MHH had better access to market information and utilized credit than FHHs. MHH had a better visit from extension agents during last production season than FHH. It is important to keep in mind that the differences in number of reported visit by extension agents may not only be attributable to the gender of the farmer but instead could result from other factors that are interrelated with gender. Extension agents might prefer to visit farmers with more land or those who have already adopted improved technology, all of which happened to be linked with gender.

The Chi-square statistics is testified the presence of statistical difference between the two groups ($\chi 2=128$, $p=0.000$). In line to the above justification, MHHs were better in education level than FHHs which could be one of the factors for MHHs to be less vulnerable to production constraints as compared to FHHs (Table 7). This finding is consistent with the finding of Suleiman (2004) which indicated that MHHs are significantly more educated than FHHs in Ethiopia.

Table7: Descriptive Summary results of explanatory variables (producers)

Lists of Variables		Female (N=100)	Male (N=280)	All cases (N=380)	t-value/ χ2-value
AGEHH		42.93	38.55	39.70	3.47***
LABOR		2.457	2.78	2.70	-1.87**
DSTMA		5.89	5.59	5.67	0.66
EXPER		3.775	6.43	5.73	-7.09***
SOCLP		2.46	3.38	3.13	-4.07***
EXTSR	Yes	70	79.6	77.1	3.88**
	No	30	20.4	22.9	
CREDT	Yes	38	55.7	51.1	9.25***
	No	62	44.3	48.9	
INFOR	Yes	58	70.4	67.1	5.10**
	No	42	29.6	32.9	
NOFAR	Yes	59	55.7	56.6	0.324
	No	41	44.3	43.3	
Education of HHH					
Illiterate		48	4.6	16.1	128.0***
Read & write		28	15.7	18.9	
Primary cycle		11	32.5	26.8	
Secondary cycle		10	32.9	26.8	
Tertiary cycle		3	9.3	7.6	
Preparatory		0	1.8	1.3	
Higher		0	3.2	2.4	

Source: Own survey (2013) ***, **, represents 1% and 5% level of significance, respectively.

3.2.2. Traders

With reference to Table 8, male retailers were younger than female retailers whereas, female retailers had better market information than male retailers. With regard to educational level, experience, labor, distance to the nearest market, mobile owned and participation in social organization, the chi-square test indicates that there is no significant difference between the two retail groups.

The t-test result indicated that, there is a significance difference between MHH and FHH wholesale actors in distance to the nearest market and marketing experience at 5% probability level. FHH wholesale actors had less marketing experience and near to the market than MHHs wholesale actors (Table 8).

The survey result as provided Table 8 illustrated that, female wholesale actors had less access to information than MHHs wholesale actors. The distribution of total wholesale actors in terms of literacy level has shown that 100% were literate. From sample wholesale actors, MHHs had better educational level than FHHs households. In general, FHHs had less access to market information, low participation in social organization, low educational level and low marketing experience than male counter parts. With reference to the above evidences FHHs wholesalers were more vulnerable to marketing constraints.

Table 8: Descriptive Summary results of explanatory variables (Traders)

Lists of Variables		Retailer				Wholesaler			
		Female (N=167)	Male (N=19)	All cases (N=186)	t-value/ χ2-value	Female (N=42)	Male (N=251)	All cases (N=293)	t-value/ χ2-value
AGEHH		40.02	35.84	39.59	-1.705*	39.83	40.57	40.46	0.73
LABOR		2.65	2.66	2.65	0.04	3.57	4.50	2.57	0.34
DSTMA		2.82	2.96	2.84	0.38	2.51	2.58	3.87	2.17**
EXPER		11.29	11.53	11.32	0.11	3.25	3.98	8.27	-2.05**
INFOR	Yes	63.5	42.1	61.3	3.28*	35.7	69.3	64.5	17.75***
	No	36.5	57.9	38.7		64.3	30.7	35.5	
MOBIL	Yes	37.1	47.4	38.2	0.758				
	No	62.9	52.6	61.8					
SOCLP	Yes	74.9	68.4	74.2	0.368	45.2	79.3	64.5	21.90***
	No	25.1	31.6	25.8		54.8	20.7	35.5	
Education of HHH									
Illiterate		5.4	15.8	6.5	5.06	47.6	10	15.4	41.107***
Read & write		7.0	0	7.0		7.1	22.3	20.1	
Primary cycle		19.2	21.1	19.4		16.7	20	19.1	
Secondary cycle		22.2	21.1	22.0		7.2	18.4	16.7	
Tertiary cycle		3.6	0	3.2		11.9	16	15	

Preparatory	0	0	41.9	9.5	14.6	13.7
Higher	41.9	42.1	6.5	47.6	10	15.4

Source: Own survey (2013)*, **&*** =Significant at 10%, 5% and 1% probability level, respectively.

3.2. Perception of Actors' in Onion and Tomato Value Chain Constraints

3.2.1. Farmers' perception on production constraints

Production and marketing development of vegetables was not without a problem. Understanding problems and opportunities with priorities was very important for both research and development initiatives. Production in value chain system is an important component. There are influential factors that impede the production of onion and tomato products in the study area. As it can be seen from Table 9, even though, production problems faced by FHH and MHH producer actors are the same, severity of production problems were different between FHH and MHH producers. This gives clue for policy makers to focus on more critical production constraints than others.

Table 9 indicated that 68%, 64%, 57% and 54% of FHH respondents perceived that there was high capital shortage, disease problem, seed shortage and poor quality of seed on onion and tomato production. Similarly, MHH had perceived that during 2012/2013 production season, there was high capital shortage (60.71%), disease occurrence (51.07), shortage of seed (45.36) and poor quality seed (46.07). About 39% of FHH and 20.7% of MHH had perceived high production skill problems during 2011/2012 production season.

It can be conclude that, during 2012/2013 production season, shortage of capital, diseases occurrence, shortage of seed, problem of seed quality, lack of production and insect occurrence was a serious production problem for both MHH and FHH. But Majority of female-headed households had high production problems than male-headed households.

Table 9. Producer Actors' perception on vegetable production constraints

Constraint lists	Constraint severity (%)							
	No constraint		Low		Medium		High	
	Female	Male	female	Male	Female	Male	Female	Male
Shortage of seed	22	18.2	4	7.5	17	28.9	57	45.4
Shortage of pesticide	28	20.4	4	14.3	29	35.4	39	30
Shortage of fertilizer	28	28.9	37	24.6	16	23.9	19	22.5
Shortage of Labor	33	42.1	49	32.5	13	21.1	5	4.3

Lack of Capital	7	12.5	8	9.3	17	17.5	68	60.7
Lack of skill	28	20.4	11	17.5	22	41.4	39	20.7
Shortage of ox	57	53.6	19	11.1	17	25.7	7	8.9
Diseases problem	0	1.4	23	22.5	13	25	64	51.1
Insects problem	0	1.0	24	22.1	30	35.7	46	41.1
Theft problem	5	5.7	78	63.2	6	17.	11	13.9
Problem of Adulteration (quality of seed)	5	3.6	30	28.2	11	22.14	54	46.1

Source: Own survey data (2013)

3.2.2. Traders' perception on Marketing Problems

This study also identifies the bottlenecks of marketing functions in the study area. Value chain actors (wholesalers and retailers) have given their perspectives on most severe constraints affecting onion and tomato marketing and their responses are summarized in Table 10. The four most frequently reported constraints by female wholesale actors are problem of unable to have good government vegetable policy (90.48%); problem of rural road access (88.1%), inadequate information (78.6%), storage problem (76.2%) and high brokerage fee (76.2%). Problem of road access (83.3%), storage problem (74.9%), inadequate credit access (73.31%) and high brokerage fee (72.91%) are the four most frequently reported constraints by male wholesale value chain actors. These results also supported by focused group discussion with wholesalers', except Addis and Mojo; wholesale actors had poor storage system. The government has failed to provide them appropriate marketing place. As a result, trading was undertaking unsuitable place. Due to poor rural road access, vegetable loaded trucks frequently face accident; as a result, wholesalers lost their tomato and onion. Moreover, the VAT system had also created its own problem on vegetable trading in the study area.

Table 10 shows that 92.81%, 86.14%, 83.13%, and 80.72% female retail respondents perceive the existence of improper shading, lack demand, high competition with unlicensed traders and absence of good government policy in onion and tomato marketing, respectively. Meanwhile, 92.47%, 85.48%, 82.80%, and 78.49% of male retailers perceived that, improper shedding , high competition with licensed traders, high competition with unlicensed traders and absence of good government policy were the major marketing constraints. Retailers in a group discussion expressed that, 2012/2013 production season

was not in favor of them; since, the price of both onion and tomato were too low. As a result, consumers were able to buy onion and tomato directly from wholesalers'. Unlicensed traders' participation will be high whenever the price is low hence, consumers' easily got onion and tomato around their home.

Table 10. Value chain traders' perspective on constraints in vegetable value chain

Lists of constraints	Wholesale Actors(N=293)		Retail Actors(N=186)	
	Female % reporting problem	Male % reporting problem	Female % reporting problem	Male % reporting problem
Inadequate credit access	66.67	73.31	74.70	72.58
Problem of theft	16.67	4.38	7.23	9.14
Problem of price setting	40.48	36.25	17.47	18.82
Problem of scaling weighting	19.05	6.37	23.93	23.50
Shortage supply	57.14	37.75	21.95	21.86
High brokerage fee	76.19	72.91	***	***
Storage problem/improper shading	76.19	74.90	92.81	92.47
Lack demand	40.54	13.11	86.14	76.34
Capital shortage	50.00	24.30	66.27	63.98
Problem of rural road access	88.10	83.27	***	***
Inadequate information	78.57	70.92	16.87	16.67
High competition with licensed traders	61.90	25.90	78.18	85.48
High competition with unlicensed traders	50.00	28.69	83.13	82.80
Quality problem(adulteration)	38.10	17.34	77.11	75.27
Unable to have good government policy	90.48	52.99	80.72	78.49

Source: Own survey data (2013)

3.3. Determinants of production and marketing constraints

The econometric analysis was planned to investigate factors determining both production and marketing constraints of vegetables in each stage of the chain. The analysis was undertaken for male and female actors in the chain separately. The estimated result of censored Tobit regression models for producer actors are provided in Table 11. The overall model is statistically significant at 1% level as indicated by the Chi-Square value 208.66, 119.31 and 252.64 in MHH, FHH and pooled data set, respectively.

As reflected in Table 11 below, Gender of the household head was found to be a negative and significant factor in explaining severity of production constraints at 1% probability level.

The negative coefficient on gender indicated that, being female-headed households more vulnerable to onion and tomato production constraints by a 1.32 unit compared to their male counterparts. This may be due to the female- headed households are vulnerable to resource constraint like labor, capital and skill for onion and tomato farm operation.

As hypothesized, the censored Tobit regression result shows that participation in social organization significantly affected both FHH and MHH farmers' at less than 1% probability level. The negative and significant relation between the variables indicates that FHH and MHH producer gets a member in social organization by a one unit, severity of production constraints decreased by a 0.69 unit and a 16.10 unit, respectively. In FHH and MHH, the estimated coefficient for utilization of credit indicated a negative and significant relationship between production constraints and utilization of credit, as expected. When a respondent used credit, production constraints level decrease by a 2.25 and a 2.00 unit for MHH and FHH, respectively (Table 11).

As *prior* expectation, access to market information and educational level of the respondent had negative and significant influence on MHH at 1% significant level. The negative association suggests that having information and educational level of the producers, the more likely they decrease severity of production constraints. Hence, the variable indicates that, severity of production constraints decreased by a 0.60 and a 0.10 unit with use of market information and increase level of education, respectively (Table 11).

Distance from nearest market center was assumed to determine severity of production constraints in MHH producers. The finding in Table 11 agrees with the hypothesis in that farm distance to the nearest market is positively and significantly associated the probability of severity of production constraints in vegetables at less than 1% significant level. As distance decrease by a km, severity of production constraints decreases by a 0.02 unit.

The findings of this study pinpointed that FHH producers participated in non-farm activity, farming experience in onion and tomato and contact with extension agents had negatively related with severity of production constraints at less than 1% significance level. The result from this test in the model shows that in FHH severity of production constraints decreased by a 5.49, 4.14 and a 0.36 unit as increases vegetable farming experience by one year, household heads had contact with extension agents and involved in non-farm activities, respectively.

Table 11. Determinants of farm level production constraints by female and male producer actors in the value chain

Explanatory Variables	Pooled (N=380)		MHH (N=280)		FHH (N=100)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
AGEHH	-0.03	-1.56	-0.02	-0.68	-0.01	-0.37
GENDR	-1.32	-2.67***	-0.47	----------	----------	----------
EDUCA	-0.41	-2.55***	-0.10	-2.80***	-0.37	-1.24
LABOR	0.09	0.58	-0.23	0.59	-0.19	-0.61
DSTMA	0.25	-5.52***	0.02	-4.85***	0.01	0.06
EXPER	-0.06	-1.2	0.55	-0.39	-0.36	-2.52***
EXTSR	-2.13	5.13***	1.28	1.21	-5.49	7.17***
CREDT	-1.48	3.61***	-2.25	2.93***	-2.00	2.83***
INFOR	-2.18	5.58***	-0.60	5.26***	0.99	1.54
NOFAR	-0.67	1.88***	0.91	-1.61	-4.14	6.19***
SOCLP	-0.88	8.28***	-16.10	8.64***	-0.69	2.66***
Constant	16.37	14.91***	-0.02	12.30***	12.30	6.12***
LR chi2		252.64***		208.66***		119.31***
Log likelihood		-992.46		-702.54		-248.82

Source: Own survey data (2013) ***&**, represents 1% and 5% level of significance, respectively.

The estimated trader actors' result of censored Tobit models is provided in Tables 12 and 13. The overall model is statistically significant at 1% level as indicated by the X^2 value. Five explanatory variables, age of the respondent, family labor, experience, market information and participation in social organization have statistically significant coefficients for female wholesale actors. Regarding to male wholesale actors, two independent variables, participation in social organization and market information appeared to have statistically significant coefficients. However, these exogenous variables with the exception of gender, experience, social participation, ownership of mobile and market information were found statistically insignificant in explaining retail actors in level of marketing constraints.

As producers' regression result, here also found the same result. Gender of the household head was found to be a negative and significant factor in explaining level of marketing constraints at 1% probability level. The negative coefficient on gender indicated that, being female-headed households had high level of onion and tomato marketing constraints by a 1.02 unit compared to their male counterparts. The same reason as mentioned above.

In consistent with our *priori* expectations, female wholesalers' level of marketing constraints were significantly and negatively influenced by participation in social organization, market information and marketing experience at 10% probability level. The results show that level of marketing constraints decreased by a 0.72 unit, 0.46 and a 0.053 unit as increases household heads marketing experience by one year, membership in one social organization by a unit, and accessed to market information, respectively. The estimated coefficient for family labour in female wholesalers' indicated a negative and significant relationship with level of marketing constraints, as expected. A one unit increase in family labour with a 0.3 unit decreases in the predicted value of level of marketing constraints (Table 12).

Contrary to *prior* expectation, age of the household is negatively and statistically significant with level of marketing constraints. This showed that level of marketing constraints decreased by a 0.036 unit, as household age increased by one year in female wholesale actors. The plausible reason might be social participation increases opportunities to market information and both have also increase with age of the respondent.

Findings showed that market information and participation in social organization are statistically significant and negatively associated with level of marketing constraints by male wholesale actors at a probability of less than 1%. The variable indicates that as number of social organizations increases by a member, level of marketing constraints decreased by a 0.8 unit and households who used market information decreases level of marketing constraints by a 0.1 unit.

In general, male wholesalers in onion and tomato value chain, household heads who have access to market information, and who participate in social organizations were more likely to have low level of marketing constraints. Female wholesalers marketing constraints were lower, households who had old aged, many years of marketing experiences, large family labor, had access to market information and membership to social organization.

Table 12. Determinants tomato and onion marketing constraints by wholesalers in the value chain

Explanatory Variables	Pooled (N=293)		MHH (N=251)		FHH (N=42)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
AGEHH	0.015	1.11	-0.016	-0.03	-0.036	-1.84*
GENDR	-1.023	-4.3***	_____	_____	_____	_____
EDUCA	0.032	0.62	0.042	0.75	-0.018	-0.19

LABOR	-0.026	-0.39	0.001	0.01	-0.322	-2.17**
DSTMA	0.006	0.15	0.009	0.13	-0.033	-0.51
EXPER	-0.002	-0.12	0.010	0.25	-0.053	-1.75*
INFOR	-0.063	-0.38	-0.103	-6.00***	-0.461	-1.86*
SOCLP	-0.524	-2.6***	-0.831	-4.59***	-0.720	-1.98*
constant	3.131	5.34***	3.400	15.65***	14.816	17.18***
LR chi2(8)		36.45 ***		15.18 ***		25.64***
Log likelihood		-490.70		-424.53		-40.62

Source: Own survey data (2013) ***, **&* represents 1%, 5%and 10% level of significance, respectively.

With respect to retailers' econometric analysis (Table 13), censored Tobit regression models were regressed to the retailers' data as pooled set because the numbers of male retailers were few in number (10.2%) whereas 89.8% were female retailers. Ametemariam (2009) also found about 80% of vegetables retailers were women.

As displayed in Table 13, Gender of the household head was found to be a positive and significant factor in explaining level of marketing constraints at 5% probability level. The positive coefficient on gender indicated that, being male-headed households more vulnerable to onion and tomato marketing constraints by a 0.54 unit compared to their female counterparts.

As expected, social participation and experience of the retail actors are negatively related and statistically significant with level of marketing constraints at 1% and 5% probability level, respectively. This implies that, retail actors' onion and tomato marketing experience increases by one year and participation in social organization increases by one unit, level of marketing constraints decreased by a 0.9 unit and a 0.02 unit, respectively.

In contrary to our *prior* expectation, ownership of mobile and market information is positively associated and statistically significant with level of marketing constraints. This revealed that level of marketing constraints decreased by a 0.27 and a 0.26 unit, as retailers who had mobile phone and accessed market information.

Table 13. Determinants of tomato and onion marketing by retail actors in the chain (n=186)

Explanatory CONST	Estimated Coefficients	Standard Error	t-ratio	P-value
AGEHH	0.013	0.009	1.49	0.14
GENDR	0.543	0.242	2.24**	0.03
EDUCA	-0.028	0.035	-0.79	0.43
LABOR	-0.059	0.066	-0.89	0.38
DSTMA	0.053	0.049	1.08	0.28
EXPER	-0.021	0.010	-2.23**	0.03
INFOR	0.256	0.150	1.71*	0.09
MOBIL	0.273	0.148	1.84*	0.07
SOCLP	-0.924	0.168	-5.51***	0.00
constant	-0.108	0.439	-0.25	0.14
LR $chi^2(9)$			44.91***	
Log likelihood			-258.32	

Source: Own survey data (2013) ***, &** represents 1%, and 5% level of significance, respectively.

4. CONCLUSION AND POLICY IMPLICATIONS

Although there were several studies which focused on identification of constraints in the value chain, no known study was found to examine the effect of socio-economic, demographic and institutional factors on level and severity of value chain constraints streamlined gender perspective in Ethiopia. The findings of this study had important policy, education and research implications; because, determinants of severity of production and marketing constraints in value chain play a substantial role for both FHH and MHH actors' income and livelihood. It is important to understand these factors for the benefit of poor male and female farmers, wholesalers, retailers and other actors in the chain.

Constraints impeding the improvement of onion and tomato value chain are found in all stages of the chain. Onion and tomato value chain is complicated by substantial problems including; low yield, lack of production and marketing skill, lack of capital, Adulteration (poor quality of seed), lack of market information, brokers hindering fairness price, unable to have good vegetable marketing policy, problem of rural road access, storage problem, improper shading and lack of demand. As a result, vegetable marketing and production needs due attention in any on-going and future vegetable development plan.

The productivity level of onion and tomato in the study area is below its potential. Female-headed producers had low yield compared to their male counterparts. This needs to be call for urgent action at different levels in terms of research and extension efforts. To bring about equitable and sustainable changes in the value chain, efforts should be made to improve the yield of both male-headed and female-headed producers' by providing; improved seeds and technical support to farmers in agronomy practices. Moreover, improved seed production, multiplication, distribution and farm trial should be strengthened.

The extension services delivered to female and male headed farmers should be taking into account the perceived rates of production and marketing constraints in the value chain.

Even though, women playing a central role in onion and tomato value chain and the government has given due attention for gender equity and equality, women actors (producers, and wholesalers) were more vulnerable to the marketing and production constraints compared to their male counterparts. Technical support on entrepreneurship, agronomic practices, adult education and saving and credit would be strengthening for female actors in the value chain. Ethiopian Government in its Growth and Transformation Plan (GTP) has taken different measures (legislative, political and socio-economic) to empower women, but, practically they are still more disadvantaged. Therefore, continues follow up and supervision should be taken. Therefore, government should give attention to improve the inefficient market chain, through strengthening institutions like cooperatives and unions since cooperatives are not actively involving in vegetable production and marketing.

Even though, female and male wholesale actors had different perspectives on marketing constraints in the value chain, the most frequently rated problems were road access in the production area and storage problem. Due to poor road access, vegetable loaded trucks frequently face accident; as a result, wholesalers lost their tomato and onion. Therefore, the government should give attention on construction and upgrading rural roads.

The survey result also indicated that, improper shading was highly perceived problems by retail actors. Except Mojo, retail stalls were poor and exposed to sun heat and rainfall. Strong support should be made by the government, to improve market centers.

Moreover, the regression result shows that, female-headed producers' who had better contact to extension agents, utilized credit, better participation in social organizations, better onion and tomato farming experience and participated in non-farm activities had low level of production constraints. In male-headed households, education, credit utilization, market information and participated in social organization were important variables to reduce severity of production constraints. Hence, to improve onion and tomato value chain, institutional support should be improved; such as credit service, access to rural road, linking farmers to the market, access to research and extension services.

In general, to address the existing gap of women in terms of access to market information, low agronomic practice, low yield and financial problem, specialized programs and intensive training efforts are to be designed and executed for them. They should be given technical training on saving and credit schemes and agronomic practices. They should also be linked to the market and given technical assistances as well.

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Appendix

Table 1. Relevancy index rating score

Sl.No	Variable	Degree of relevance				Total score (%)
		Highly relevant	Somewhat relevant	undecided	Not relevant	
1	lack of skill					70
2	lack of capital					80
3	Adulteration					81
4	Inadequate extension services					30
5	Shortage of land					45
6	Diseases					75
7	Lack of pesticide					90
8	Fertilizer shortage					92
9	labor shortage					95
10	Oxen shortage					96
11	Insects					90
12	Seed shortage					85
13	Drought					40
14	Frost					30
15	Flood					41
16	Theft					54
	Marketing constraints					
1	Inadequate credit access					83
2	Problem of theft					86
3	Problem of price setting					98
4	Problem of scaling weighting					87
5	Shortage supply					91

6	High brokerage fee					73
7	Storage problem					89
8	Lack demand					57
9	Capital shortage					82
10	Problem of road access					78
11	Inadequate information					69
12	High competition with licensed traders					65
13	High competition with unlicensed traders					72
14	Quality problem(adulteration)					90
15	Unable to have good govn't policy					58
16	Absence of government support					64