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Factors Affecting Smallholder Crop Production Commercialization Decision: The Case of Sinana and Agarfa Districts of Bale Zone, Southeastern Ethiopia

Ayalew Sida

Sinana Agricultural Research Center, Oromia Agricultural Research Institute, Ethiopia

*Author's email: ayalew.sida@yahoo.com

ABSTRACT

Crop commercialization decision involves product choice decision, input use decision and the use of purchased agricultural inputs. The current study identified the status and factors affecting crop commercialization decision of smallholders in Agarfa and Sinana districts of Bale zone. The study employed cross-sectional data collected from 188 sample households. The study was used three stage random sampling procedure. Both secondary and primary data sources were used to collect the desired quantitative and qualitative data types in which interview schedule, focus group discussion and key informant interview were used as methods of data collection. Descriptive statistics such as mean, standard deviation, percentage and frequency were employed to analyze the collected quantitative data while narration, interpretation, and conceptual generalization were used to give meaningful information for qualitative data type. Binary probit regression was used for econometric analysis. About 84% of total households in the sample were decided to commercialize their crop production in the output market while the remaining 16% fail to commercialize. The result of binary probit model depicts factors such as farm size, livestock TLU, fertilizer use, use of irrigation facilities and use of extension services were found to positively and significantly affect smallholders' crop commercialization decision. On the contrary, household size, non/off-farm income and use of credit affected smallholders' crop commercialization decision negatively and significantly. Therefore, policies and development interventions which focused on rural land redistribution reform, sufficient and timely provision of fertilizer, irrigation scheme development and provision of market oriented extension services should be given a prior attention.

Keywords: *Commercialization, crop, decision making, product choice, output market, smallholder*

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1. Introduction

In Ethiopia, about 95% of the total arable is cultivated by smallholder farmers which provide more than 90% of the total agricultural output (Debebe, 2018). In the country, smallholder farming is the key source to the livelihood of many rural households which is characterized by largely subsistence oriented production accompanied by traditional production system and a predominance of food crops (CSA, 2018). In the long run, this smallholder farming may not be a guarantee to secure the livelihood of most rural population in the developing countries (Berhanu and Moti, 2010; Abafita *et al.*, 2016)

As a result, commercialization of smallholder farming is supposed to be an important pathway to reduce poverty and enhance development of the nation. It is argued that commercialization of smallholder farming would increase the income, enhances the purchasing power, as well as reduces the smallholders' vulnerability to food insecurity (Afework and Endrias, 2016). Scholars asserted that Smallholder commercialization is said to be a vital strategy to ensure sustainable household food security and welfare, and an important pathway to economic growth and overall development (Afework and Endrias, 2016; Gutu, 2017).

Commercialization of smallholder crop production refers to a progressive shift from subsistence oriented to market oriented production system based on market signals. It also includes product choice, input use and decisions making based on profit maximization (Berhanu and Moti, 2010). Smallholder commercialization takes place when households purposively target markets in their production decisions rather than only relating to the

amount they likely to sell as a result of surplus production (Sokoni, 2007). Moreover, Agricultural commercialization occurs when agricultural enterprises or the agricultural sector as a whole rely increasingly on the market for the sale of produce and for the acquisition of production inputs, including labor; and, it involves the decisions of farmers, input suppliers, traders and processors (APRA, 2018).

However, commercialization of smallholder farming in Ethiopia is constrained by a number of demographic and marketing challenges (ATA, 2017; Pauw, 2017). Similarly, smallholder crop commercialization in Bale zone particularly in Sinana and Agarfa districts is constrained by internal and external factors to the smallholders. Smallholders couldn't get the expected benefit from commercialization due to these internal and external factors. Hence, identifying the factors affecting smallholder crop commercialization decision could indicate the key intervention areas for policy makers and development planners envisioned for improving the welfare of smallholders in the study area. Therefore, the study was initiated i) to identify crop commercialization status of smallholder in the study areas; ii) to identify major crop production and marketing challenges; iii) to analyze factors affecting smallholder crop commercialization decision in the study areas.

2. Methodology

2.1. Description of the Study Area

Sinana District

Sinana district is found 430 km away from Addis Ababa to the Southeast direction. The district is one of the potential districts of Bale zone which are suitable for crop production. It is mainly characterized by highland agro-ecology (90%) while the rest (10%) accounts for midland agro-ecology. The district has 20 rural kebeles and four rural towns. According to the Central Statistics Authority (CSA,2007), the population of Sinana district was 119,208 of which the share of male and female are 62,280 and 56,928, respectively in the district from which 5% are urban dwellers and 95% are rural dwellers. About 99% of the population is engaged in agriculture. The land use of the district is characterized with 63% crop land, 11.78% grazing land, 7.5% covered with forest and about 0.07% barren/degraded land and 17.65% of land occupied with others (for construction, rivers, gorges and others). The major crops grown in the district include wheat, barley, Faba bean, field pea, lentil, potato, onion, pepper and emmer wheat (SDANRO, 2017).

Agarfa District

Agarfa district is also found to the southeastern direction from Addis Ababa at a distance of about 465km. The district has twenty kebeles and 2 towns with a total land area of 1343 km^2 (134,300 hectares) and out of which 45% is arable land, 30% is grazing land, 12% is forest, 5% is covered by barren/degraded area, and 8% is occupied by rivers, mountains, different constructions. According to the Central Statistics Authority (Population Census, 2007), the population of the district was 104,412 out of which 53,276 are male and 51,136 is female. It is estimated that 13,760 (13.2%) are urban dwellers and 90,852 (86.8%) are rural dwellers. More than 95% of the population is engaged in agriculture. The agro-ecological zones of the district are highland (83%), midland (11%) and lowland (6%). The altitude ranges from 1250m to 3855m a.s.l. The major crops grown in the district includes wheat, barley, faba bean, field pea, maize, pepper, potato and onion (ADANRO, 2017).

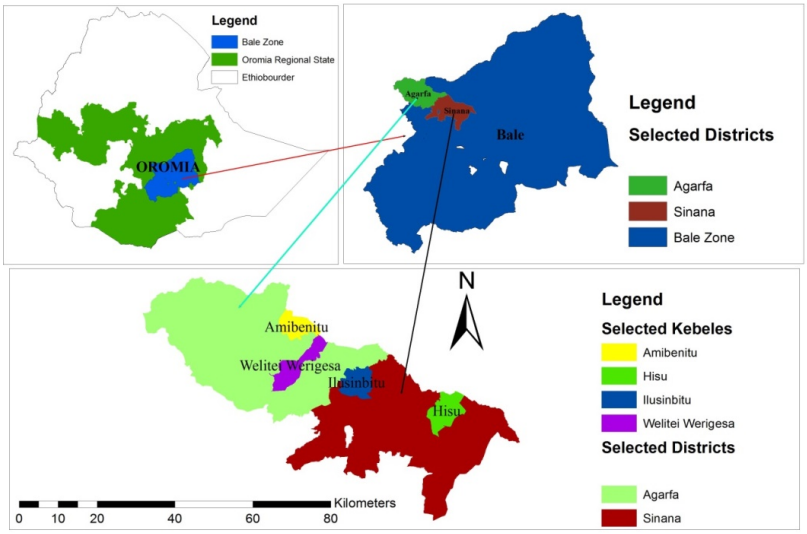

Diagram 1: Map of the study area

2.2. Sampling Techniques and Procedures

Three stages random sampling technique was used to select the study areas and the sample households. In the first stage, the districts (Sinana and Agarfa districts) were selected using simple random sampling technique among highland districts of Bale zone. In the second stage, two representative kebeles were selected from each district by simple random sampling technique. Accordingly, Ambentu and Weltei Wergessa kebeles were considered from Agarfa district while Hisu and Ilusanbitu kebeles were selected from Sinana district. In the third stage, sample households were selected by systematic random sampling procedure.

2.3. Sample Size Determination

Several factors limit the sample size of the study. Among them logistic, human resource, budget and time limitations determine the sample size of the study. Thus, taking optimum, manageable and representative sample size is important to infer about target population. The current study employed a simplified formula provided by Kothari. The sample size determination technique developed by (Kothari, 2004) is mainly used by different researchers. For instance, (Falmata, 2018) used Kothari's formula to determine his sample size.

The formula developed by Kothari is used at 95% confidence level and desired level of precision at 5% (0.05) provided by:

$$n = \frac{Z^2pqN}{e^2(N-1)+Z^2pq} = \mathbf{188}$$

Where, n is the desired sample size; Z is the standard cumulative distribution that corresponds to the level of confidence with the value of 1.96; e is the desired level of precision; p is the estimated proportion of an attribute (degree of variability) present in the population with the value of 0.15 as suggested by (Falmata, 2018) to get the desired minimum sample size of households at 95% confidence level and ±5% precision; q=1-p; and N (4696) is the total number of rural households in the four kebeles of the two districts. Based on the aforementioned formula a total of 188 of sample households were considered during the interview schedule.

2.4. Sources and Types of Data

Both primary and secondary data sources were used to achieve the objectives of the study. Primary data were collected from sample respondents, focus group discussants and key informants while secondary data were collected from different sources such as records of line offices, Central statistical Authority and other publications.

Quantitative and qualitative data types were used. Qualitative data types include production and marketing constraints in the study areas. The quantitative data types mainly include the amount of input used in production of each crop; the total output (yield) obtained from each crop, and the amount of produce supplied to the market by each household for each crop.

2.5. Methods of Data Collection

Interview schedule, focus group discussion (FGD) and key informant interview were the major data collection methods employed for this study. Concerning data collection tools, semi-structured questionnaire was used as a data collection tool for interview schedule while checklist was used for focus group discussants (FGD) and key informant interview.

2.6. Method of Data Analysis

Descriptive statistics such as mean, standard deviation, frequency and percentage were used to describe the status of demographic and socio-economic characteristics of sample households. Inferential statistics such as chi-square and t-test were used to estimate about the population parameters based on the characteristics of the samples. Chi-square test was used to see whether there are association between market participants and non-participants in terms of dummy or categorical variables. On the other hand, t-test was used to analyze the mean difference between market participants and non-participants for the continuous variables considered in the study.

Econometric model specification is based on the nature of the dependent variable. The descriptive result of the current study showed that among total households in the sample, 15.96% of them did not participate in crop commercialization whereas the majorities (84.04%) of them were participated in crop commercialization. Therefore, the dependent variable (commercialization decision) is binary dependent variable. Thus, to analyze factors affecting smallholder crop commercialization decision, probit model is appropriate.

The probit model assumption is given by the following formula.

$Y_i^*=\alpha' Z_i+\mu_i$,
$Y_i=1$, if $Yr^*> 0$ and 0, if $Y\leq 0$
Where, Y* is a latent variable that takes the value 1, if the farmer sells and zero otherwise: and α is a vector of parameters. Z is a vector of explanatory variables.

3. Results and Discussion

3.1. Characteristics of Sample Households

3.1.1. Demographic characteristics

As it was indicated in the Table 1, majority of the households in the sample were male-headed (86%) and female-headed households were only 14%. Concerning their marital status, the number of married households takes the highest share of 88.8% followed by the widowed households (5.9%); while, divorced and single households occupied 3.2% and 2.1%, respectively. Above half (54%) of the sampled respondents were Muslims while the followers of orthodox Christianity and Protestants occupied 37.2% and 7%, respectively. The number of Adventist and Catholic religion followers was negligible with the share of 1% with equal shares (Table 1).

Table 1: Chi-square test results of demographic characteristics of sampled households

Variables		Non-participant		Participant		Total		χ^2-Value
		N	%	N	%	N	%	
Sex	Male	25	15	137	85	162	86	0.24
	Female	5	19	21	81	26	14	
Marital	Single	1	25	3	75	4	2.1	
Status	Married	27	16	140	84	167	88.8	
	Widowed	1	9.1	10	90.9	11	5.9	0.64
	Divorced	1	16.7	5	83.3	6	3.2	
Religious	Muslim	14	13.6	89	86.4	103	54.8	
status	Orthodox	15	21.4	55	78.6	70	37.2	
	Protestant	1	7.7	12	92.3	13	7	3.03
	Adventist	0	0	1	100	1	0.5	
	Catholic	0	0	1	100	1	0.5	

Source: Author's own computation from survey data, 2020

The overall average year of formal schooling of the total sampled household heads was 4.16. The mean difference among market participants and non-participants for educational level of household heads was statistically significant at less than 1% significance level with t-value of -4.19. The average year of formal schooling for market participant household heads was 4.59 with standard deviation of 3.48 while it was 1.87 with standard deviation of 1.74 for non-participants. Similarly, the average household size the sample was 6.66. The mean household size for market participants and non-participant households were 6.45 and 7.8, respectively. The result of t-test reveals a significant mean difference among market participants and non-participants with the t-value of 2.6 at less than 5% significance level (Table 2). The overall average year of farming experience of the total households in the sample was 23.6 years. The average year of farming experience of market participants was 23.76 with standard deviation of 13.92. Non-participants, in average, found to have 22.77 years of farming experience with the standard deviation of 14.69.

Table 2: The t-test results of demographic characteristics of sampled households

Variables	Total	Non-participant		Participant		*t*-value
	(n=188)	(n=30)	Std.dev	(n=158)	Std.dev	
Educational level	4.16	1.87	1.74	4.59	3.48	-4.187***
Household Size	6.66	7.8	2.62	6.45	2.61	2.600**
Farming experience	23.60	22.77	14.69	23.76	13.92	-0.342

Symbols ** and ***, represent statistical significance at 5% and 1% significant level, respectively. Source: Author's own computation from survey data

3.1.2. Socio-economic characteristics

The average farm size of the total households in the sample was 2.70 hectare; and the figure is attributed for farm land owned by the household, land rented in and shared in. Similarly, the average farm size of the market participants was 3.07 hectare with standard deviation of 1.66 while average farm size of non-participants was 0.75 hectare with the standard deviation of 0.21. The result of t-test analysis also indicates significant mean difference between the two groups with the t-value of -7.6216 at less than 1% level of significance. The result suggests households with large farm size have an opportunity to produce surplus production. Having surplus production encourages the household to participate in the market as a seller.

The average livestock ownership (TLU) was 5.89. The mean comparison carried out among market participants and non-participants using t-test indicates significant mean difference with the *t*-value of -3.768 at less than 1% significance level. The average number of livestock owned by the market participant group was 6.30 with standard deviation of 3.56 whereas the average number of livestock owned by the counterpart group was 3.74 with standard deviation of 2.51. Number of equine refers to the total number of donkey, horse and mule possessed by the household and measured by TLU using the standard conversion factor. Accordingly, the average TLU of equines owned by the total households in the sample was 1.15. The average number of equines owned by market participants was 1.22 with the standard deviation of 0.97. Whereas, the average number of equine owned by the non-participants was 0.79 with 0.84 standard deviation and it is relatively lower than the counterparts.

Moreover, the average income earned from non-farm activities was 7,224.50 ETB per annum. The average annual non/off-farm income gained by the market participants was 6,969.62 birr with standard deviation of 16,654.30. On the other hand, the highest mean annual income, 8,566.70 birr, received from non/off-farm activities was attributed for the non-participants with standard deviation of 16,454.30. Furthermore, the average capital allotted for input purchase, hired labor and rent of machinery during crop production by the total households was 27,335.00 birr. The average capital allocated by the market participants was 30,632.50 birr with standard deviation of 22107.5. Similarly, the average capital allotted by the non-participants was 9,968.4 birr with standard deviation of 6938.80. The result of t-test (*t*=-5.063) depicts a significant mean difference for average capital allocated by the two groups for crop production in 2018/2019 production season at less than 1% level of significance.

Table 3: The t-test result of socio-economic characteristics of the sampled households

Variables	Total	Non-participant		Participant		*t*-value
	(n=188)	(n=30)	Std.dev	(n=158)	Std.dev	
Farm size (ha)	2.79	0.75	0.21	3.07	1.67	-7.622***
Livestock (TLU)	5.89	3.74	2.51	6.30	3.56	-3.768***
Equine (TLU)	1.15	0.79	0.84	1.22	0.97	-2.297**
Non/off-farminc	7224.47	8566.7	16454.3	6969.62	16654.3	0.486
Capital allotted	27335	9968.4	6938.8	30632.5	22107.5	-5.063***

Symbols ** and ***, represent statistical significance at 5% and 1% significant level, respectively.
Source: Author's own computation from survey data, 2020

3.1.3. Institutional and infrastructural services

This sub-section focused on integral factors of smallholder commercialization that may enhance the status of smallholder commercialization if fulfilled adequately and otherwise impede the commercialization process. The institutional and infrastructural services considered in this study include frequency of extension contact, credit use, membership to cooperative, access to market information, social network (participation in social organization), distance from all-weather road, distance from market center, distance from farmstead and distance from farmer training center (FTC). The result of chi-square test shows significant percentage difference among market participants and non-participants for access to credit, membership to cooperative, access to market information and social network while it didn't indicates significant percentage difference for the occurrence of disease and pest, and rainfall problem (Table 4).

Considering access to credit, only about 31% of the households in the sample used credit in 2018/2019 fiscal year. As it was stated by participants of focus group discussion, group responsibility was major factor which impedes credit use of sampled households in the study area. Access to credit could enhance smallholder commercialization by solving cash constraints that could face farmers during planting through enabling the users on time purchasing of production inputs. Out of those who did not used credit, 88.46% of them were market participants. Similarly, the highest share of credit used (74.14%) was held by those who participated in the output market. The result of chi-square test revealed significant percentage difference among market participants and non-participants with χ^2 value of 6.136 at less than 5% significance level.

71.28% of the total households in the sample were organized under agricultural cooperatives. Among market participants, 93.28% of them were organized under agricultural cooperatives while, only 4.44% of the non-participants were organized under cooperatives. Moreover, the chi-square test reveals significance percentage difference between the two groups with χ^2-value of 29.706 at less than 1% significance level. This may suggests households who organized under cooperatives could get inputs on time either in cash or credit and they could also sold their produce at high market price. Therefore, these promoting conditions enhance commercialization of farmers.

In the study area, majority of households in the sample have an access to market information. Accordingly, 84.57% of the sampled households have an access to market price information in which the lion's share (89.94%) was apprehended by market participants. On the contrary, majority of non-market participant households had no access to market information. The result of chi-square test (χ^2-value=26.7) indicates significant percentage difference among market participants and non-participants at less than 1% level of significance. Moreover, about 89% of the total households in the sample had social network. Among households who had social network, majority of them were market participants (88.10%) whereas the remaining 11.90% was ascribed for the share of non-market participants. The result of chi-square test (χ^2=19.340) indicates significant percentage difference among market participants and non-participants in terms of social network at less than 1% level of significance.

Table 4: Chi-square test result of institutional and infrastructural services used by households

Variables		Non-participant		Participant		Total		χ^2-value
		N	%	N	%	N	%	
Access to credit	No	15	11.38	115	88.46	130	69.15	6.136 **
	Yes	15	25.86	43	74.14	58	30.85	
Cooperative	No	21	38.89	33	61.11	54	28.72	29.706***
membership	Yes	9	6.72	125	93.28	134	71.28	
Access to Market	No	14	48.28	15	51.72	29	15.43	26.705***
inform	Yes	16	10.06	143	89.94	159	84.57	
Social network	No	10	50	10	50	20	10.64	19.340***
	Yes	20	11.90	148	88.10	168	89.36	

Symbols ** and ***, represent statistical significance at 5% and 1% significant level, respectively. Source: Author's own computation from survey data

The result of t-test indicated the average number of extension contact of the total households was 6.25. Likewise, the average number of extension contact for market participants was 6.93 with standard deviation of 8.33. Whereas, the average number of extension contact for non-participant group was 2.67 with standard deviation of 5.99. The result of t-test (t=-2.67) displays significant mean difference between the two groups at less than 1% significance level. Focus group discussants asserted agricultural experts from agricultural office and research center provide sound training and advice for farmers in the respective localities to improve farmers' awareness with respect to efficient and timely use of agricultural inputs, proper application of full production packages, post harvesting handling and market linkage facilitation. Close supervision and technical advice were frequently undertaken by development agents. In average, the time taken to reach the nearest market center by sampled households was 21.27 minutes. The highest minutes of walk to reach the nearest market was recorded by the non-market participant group with the average minutes of walk of 30 minutes and standard deviation of 14.33. On the other hand, market participants recorded the lowest minutes of walk to reach the nearest market center with the average minutes of 19.73 minutes with standard deviation of 13.67. The t-test result also demonstrates significant mean difference between the two groups with t-value of 3.519 at less than 1% level of significance. The t-test result may suggest household who reside far away from market center is less likely to sell his/her produce. As a result, the likelihood of household commercialization in the output market decreases.

Moreover, the average time taken to get all-weather road by the sampled households was 18.38 minutes. The comparison of market participants and non-participants in terms of time taken to get all-weather road reveals significant mean difference between the two groups with t-value of 6.44 at less than 1% significance level. Accordingly, the average time taken to reach all-weather road by non-participant was 45.56 minutes with standard deviation of 13.33. Whereas, the average time spent by market participant was found to be 16.14 minutes with standard deviation of 11.01. The result leads longer time spent to get all-weather road, the less probability to commercialize crop production. Therefore, households who live nearest to all-weather road have the likelihood to participate in the market due to they are more likely to get transportation options with low cost.

The distance from home to farmers training center (FTC) was also measured in terms of the distance travelled in minutes of walk. Accordingly, the average time spent by the total households to reach FTC was 25.79 minutes. The time spent by the non-participants was longer than the market participants with average minutes of walk of 33.33 and 24.27, respectively. The standard deviation of the market participants was 13.83 while that of the non-participants was 15.52. The result of t-test (t=3.4058) reveals significant mean difference between the two groups for the time spent to reach FTC at significance level of less than 1%. The average time travelled to reach farm land by the total sampled households was 30.50 minutes. The result of t-test displays both market participants and no-participants spent almost equal time to reach their farm with 30.47 and 30.67 minutes,

respectively. The result of t-test does not indicate significant mean difference between the two groups statistically.

Table 5: The t-test result of institutional and infrastructural services used by households

Variables	Total	Non-participant		Participant		*t*-value
	(n=188)	(n=30)	Std.dev	(n=158)	Std.dev	
Extension contact frequency	6.25	2.67	5.99	6.93	8.33	-2.672***
Distance from market center	21.27	30	14.33	19.73	13.67	3.519***
Distance to all-weather road	18.38	45.56	13.33	16.14	11.01	6.440 ***
Distance from farm land	30.50	30.67	17.68	30.47	17.62	0.055 (NS)
Distance from FTC	25.79	33.83	15.52	24.27	13.83	3.406***

Symbols ** and ***, represent statistical significance at 5% and 1% significant level, respectively.
Source: Author's own computation from survey data, 2020

3.1.4. Usage of farm inputs

The result of chi-square test indicates significant percentage difference among market participants and non-participants for all inputs used by households in the sample (Table 6). Regarding the use of improved seed, 74.47% of the sampled households used improved varieties of different crops while the rest 25.53% did not use improved varieties for any crop. About 87.14% of market participants used improved varieties of different crops while only 12.86% of non-participants had used improved varieties. The percentage difference between the two groups is statistically significant at less than 5% with the χ^2-value of 3.93.

Out of the total sample households, 97.34% of them applied inorganic fertilizer for crop production while 2.66% were not used inorganic fertilizer at all. The result of chi-square test (χ^2=15.70) shows statistically significant percentage difference among market participants and non-participants at less than 1% level of significance. Among the sampled households, the majority of them did not get irrigation facilities; only 12.23% had an access to irrigation facilities in the study area. The chi-square result also exhibits significant percentage difference among market participants and non-market participants for irrigation use with the χ^2-value of 4.096 at less than 5% significance level. Moreover, the sampled households were compared for the use of agro-chemicals by collecting information separately for fungicides, insecticides and herbicides application. Accordingly, 98.94% of total households in the sample applied agro-chemicals in the 2018/2019 production season. The remaining 1.06% was attributed for those who did not apply agrochemicals and it was also held by the non-participant group. The result of chi-square test depicts significant percentage difference between market participants and non-participants with χ^2 value of 10.64 and significance level exhibited at less than 5%. Among the sampled households, majority of them (96.81%) used farm machineries mostly combine harvester in the form of rent per quintal. The result of chi-square test also illustrates the existence of significant percentage difference among the market participants and non-participants with the χ^2-value of 11.88 at less than 1% significance level.

Table 6: Farm input use of sampled households in 2018/2019 production season

Variables		Non-participant		Participant		Total		χ^2-value
		N	%	N	%	N	%	
Improved seed	No	12	25	36	75	48	25.53	3.93**
	Yes	18	12.86	122	87.14	140	74.47	
Fertilize use	No	4	80	1	20	5	2.66	15.7091**
	Yes	26	14.21	157	85.79	183	97.34	
Irrigation use	No	23	13.94	142	86.06	165	87.77	4.0956**
	Yes	7	30.43	16	69.57	23	12.23	
Use of agro-chemicals	No	2	100	0	0	2	1.06	10.6466**
	Yes	28	15.05	158	84.95	186	98.94	
Use of farm machinery	No	4	66.67	2	33.33	6	3.19	11.8836***
	Yes	26	14.29	156	85.71	182	96.81	

Symbols ** and ***, represent statistical significance at 5% and 1% significant level, respectively. Source: Author's own computation from survey data, 2020

3.1.5. Crop production status

Cereal crops are the dominant crops in the study area. Among the cereal crops grown in the area, wheat is a major crop produced by almost all farmers both for home consumption and commercial purpose. Other cereal crops such as barley, emmer wheat, maize and *teff* also produced in the study area. Moreover, pulse crops, some

of oil crops and a few vegetable crops also cultivated in the study area. The major crops grown in the study area with their respective area of production during 2018/2019 production year were presented below (Table 7).

Table 7: Crops produced and area allocated by sampled households in the study area

Crops Produced	Land Allocated in 2018/2019 (ha.)	Area Proportion (%)	Mean	Std. Deviation	Total Production (qt.)
Wheat	354.29	68.04	1.88	1.37	12462.5
Barley	78.69	15.10	0.42	.42	1985.5
Faba Bean	15.82	3.04	0.08	.19	329.5
Field Pea	16.43	3.16	0.09	.24	241
Potato	3.79	0.73	0.02	.13	375
Teff	1.54	0.30	0.01	.05	17
Pepper	10.14	1.95	0.05	.17	167.9
Emmer Wheat	8.47	1.63	0.05	.13	254
Lentil	1.82	0.35	0.01	.05	15
Linseed	3.57	0.68	0.02	.11	43.5
Maize	22.01	4.22	0.12	.19	327
Onion	4.15	0.80	0.02	.16	69
Total	520.72	100			16,286.9

Source: Author's own computation from survey data

3.2. Commercialization Status of Sampled Households

Commercialization status of households in the study area was identified by crop output market participation as a proxy measure. Accordingly, the sampled households were categorized into market participants and non-participants based on status of commercialization decision. Accordingly, the result of descriptive analysis indicates, among the total of 188 households in the sample, 158 (84%) of them were market participants while the rest 30 (16%) were non-participants.

3.3. Major Crop Production and Marketing Constraints

3.3.1. Major crop production constraints in the study area

Crop production constraints prevailing in the study area were disease and pest problem, weed infestation, shortage and late provision of inputs, high cost of inputs, high cost of machinery rent, land scarcity, poor quality of agro-chemicals, labor scarcity, drought prevalence and water logging (Table 8). Out of these problems, disease and pest prevalence, weed infestation and high cost of inputs take the first, second and third ranks in order of severity in the study area.

Table 8: Major crop production problems in the study areas

Production Constraints	**Frequency**	**Rank**
Disease and pest Prevalence	185	1st
Drought prevalence	16	9th
High cost of inputs	148	3rd
High cost of machinery rent	127	4th
Poor quality of agrochemicals	28	7th
Shortage of inputs	96	5th
Shortage of labor	18	8th
Shortage of land	28	6th
Water logging	15	10th
Weed Infestation	171	2nd

Source: Author's own computation from survey data

3.3.2. Major marketing constraints in the study area

Constraints prevailed in the study area related to marketing include high involvement of brokers in marketing activities, lack of suitable road, lack access to market, lack of market information providing institutions, low market price for agricultural outputs and unbalance of price at the time of harvesting and planting (price fluctuation). As it was depicted in the Table 9, among these major marketing constraints price fluctuation, low market price for agricultural produce and lack of suitable road were the serious marketing problems which seized the rank of first, second and third, respectively.

Table 9: Major marketing constraints prevailed in the study areas

Marketing Constraints	Frequency	Rank
High involvement of brokers	47	5th
Lack of suitable road	78	3rd
Lack of access to market	21	6th
Lack of market information	13	7th
Lack of suitable market policy	60	4th
Low market Price	128	2nd
Price fluctuation	155	1st

Source: Author's own computation from survey data, 2020

3.4. Factors Affecting Households' Crop Production Commercialization Decision

Factors influencing crop commercialization decision were analyzed using probit regression estimation. The result of the model indicated that, out of the explanatory variables used in the model, household family size, livestock ownership (TLU), farm size, non/off-farm income, application of chemical fertilizer, use of irrigation facilities, frequency of extension contact and use of credit were found to affect significantly crop commercialization decision of households in the study area (Table 10).

Household size: Household size was found to have negative effect on smallholders' crop commercialization decision. The effect is statistically significant at less than 5% level of significance. The result of probit regression shows that as the household size increases by one person, keeping other factors constant, the probability of the household to commercialize crop production decreases by 1.25%. The result suggests as the number of household members' increases, they tend to consume more of their produces and the expected commercialization decision in crop output market decreases. The result is corresponding with the finding of (Guta *et al.*, 2019) who found that keeping other factors constant, the probability of household fruit commercialization decreases by 16.8% as the number of family size increases by one person at less than l% significance level. Likewise, it is also consistent with what had been reported by (Efa *et al.*, 2016; Edosa, 2018) in which an additional unit of household size showed significant effect to decrease the farmers' commercialization decision in *teff* output market by 6% and 2.8%, respectively.

Farm size: The result of probit regression indicates farm size was found to influence positively and significantly the household's commercialization decision. The result of marginal effect displays for every additional one hectare of land allocated for crop production, the probability of household commercialization decision in the crop output market increases by 5.3% ceteris paribus. The result indicates the fact that, large farm size allotted for crop production results in surplus production which in turn enhances the household's decision to commercialize crop production in output market. The result also agreed with what had been reported by (Addisu, 2018) who found a positive and significant association between additional land allocated for *teff* production and farmers' commercialization decision. His result shows that for every additional one hectare on the size of land allocated for *tef* production, there is a 12.9% increase to the likelihood of farmers' *teff* commercialization decision in the output market at 1% significance level.

Livestock ownership (TLU): The number of livestock owned affected household's commercialization decision positively and significantly. Keeping other factors constant, as the number of livestock owned by the household increases by one TLU, the probability of household's crop commercialization increases by 0.8% at less than 5% significance level. The result is comparable with the result attained by Addisu (2018) who stated that for every an additional one TLU of livestock owned by the farmer, the probability of *teff* output market participation increases by 2.3% at less than 5% level of significance. On the other hand, the result is in contradiction to the result reported by Alelign *et al.* (2017) who found that a unit increase in the livestock ownership, leads to a 12.8% decrease to the households' likelihood of market participation. The result of the current study being positive and significant implies the fact that livestock and crop production are a complementary enterprises, that livestock can positively contribute to crop production by providing natural fertilizer (manure), oxen used for draught power and source of cash to finance purchased inputs and enables to rent land which in turn results in surplus production for market. Thus, an additional TLU of livestock owned by the household, increases the likelihood of crop commercialization in the crop output market.

Non/off-farm income: The result of marginal effect indicates, as the amount of income obtained from non/off-farm activities increases by one birr, the probability of the household to commercialize crop production in the output market decreases by 0.00032% (3.20e-06) ceteris paribus and the effect is significant at less than 1% (p=0.008). The result supports the finding obtained by Addisu (2018) who reported that as non/off-farm income obtained increases by one birr, the likelihood of the household to participate in the *teff* market decreases by 0.6% and his result was statistically significant at less than 5% level of significance. This result may indicates the household who earn more non/off-income spent less time on farm activities and tend to produce low output which used for mainly home consumption. Therefore, such household uses income earned from none farm activities to cover household expenditure for different purposes. As a result, the probability of household crop commercialization decreases.

Application of chemical fertilizer: The marginal effect of probit regression estimation reveals, keeping other factors constant, for the household who applied chemical fertilizer in crop production, the likelihood of crop commercialization increases by 9.5% than who did not applied; and the result is statistically significant at less than 5%. The result is consistent with the finding reported by Getachew (2018) whose result portrayed positive and significant result between *teff* commercialization decision and chemical fertilizer application. According to his finding, the household who applied chemical fertilizer for *teff* production, increases his/her probability of participation in *teff* market by 5.7% than who did not applied chemical fertilizer at less than 1% significance level. The result of the current study supported by empirical evidence suggests household who applied chemical fertilizer at recommended rate and time could produce quality and surplus production. Eventually, having surplus production supported by reasonable decision making ability could increase the probability of household's crop commercialization in the crop output market.

Use of irrigation facilities: The result of probit regression indicates that the use of irrigation facilities affected commercialization decision positively and significantly. The marginal effect reveals keeping other factors constant, household who used irrigation facilities tend to increase the probability of crop commercialization by 19% than who didn't use irrigation facilities at less than 1% significance level. This might suggest that the use of irrigation facilities increases household's level of crop productivity resulting in surplus production as compared to those solely depend on rainfall which in turn increases the likelihood of crop commercialization.

Frequency of extension contact: Frequency of extension contact positively and significantly correlated with the household's decision to commercialize crop production in the output market. Accordingly, the marginal effect shows, keeping other factors constant, a unit increase to the frequency of extension contact, leads to a 2.1% increase to the probability of household's crop commercialization at less than 1% level of significance. The result is consistent with the finding of Addisu (2018) who found that as the frequency of extension contact increases by one day, the household would be 2.5% more likely to commercialize *teff* production at less than 5% significant level. Similarly, the study conducted by Asfaw *et al.* (2018) revealed that an additional increase on the frequency of extension contact by one day increases the likelihood of potato commercialization by 11.3% at less than 1% level of significance. This implies, farmers with more extension contact has better access to information, knowledge and skill on production packages, access to modern technologies and market linkage. Therefore, they tend to commercialize than those who have less frequency of extension contact.

Access to credit: Access to credit found to affect household's crop commercialization decision negatively and significantly. The result displays, keeping other factors constant, household who has an access to credit was 11.3% less likely to commercialize crop production at less than 1% of level of significance. The result is in line with the result of Alelign *et al.* (2017) who found that access to credit decreases the probability of maize commercialization by 18.1%. Similarly, the result is also similar to the finding reported by Taye *et al.* (2018) who suggested that an access to credit tend to decrease the probability of onion commercialization by 1.1%. The existing reality in the study area shows majority of non-participants operate their farm activities on small plots of land which forced them searching for other business options helping to earn additional income in order to lead their living. Hence, the non-participant used the credit received for the purpose of starting or running non/off-farm activities such as petty trade and other related business enterprises through which the revenue obtained from such business activities in turn used to cover the expenses that might be incurred from the sale of crop products. Therefore, all these facts suggest negative correlation between access to credit and household crop commercialization decision.

Table 10: Factors affecting households' crop commercialization decision

Variables	Coefficient	Robust Std. Err.	Marginal effect
Sex of household head	.678	.598	.037
Education level of household head	.084	.068	.005
Farming experience	.024	.022	.001
Household size	-.227**	.097	-.012
Farm size	.961***	.303	.053
Livestock ownership (TLU)	.146**	.069	.008
Non/off-farm income	-.0000582***	.0000219	-3.20e-06
Use of improved seed	.221	.558	.012
Application of chemical fertilizer	1.728**	.796	.095
Use of irrigation facilities	3.477***	.934	.191
Access to market information	.055	.608	.003
Frequency of extension contact	.386***	.141	.021
Use of credit	-2.055***	.625	-.113
Cooperative membership	.065	.508	.004
_cons	-2.697**	1.118	
Number of observations = 188	Wald $chi^2 = 37.64$	Prob > $chi^2 = 0.0006$	
Log likelihood = -18.70	Pseudo $R^2 = 0.77$		

Symbols ** and ***, represent statistical significance at 5% and 1% significant level, respectively.
Source: Author's own computation from survey data

4. Conclusion and Recommendations

4.1. Conclusion

The study examined factors affecting smallholder crop commercialization decision in Agarfa and Sinana districts of Bale zone. The descriptive result of the study reveals that about 84% of the total households in the sample supplied crop output to the market; while, the remaining 16% of them were not participated in the crop output market. On average, households in the sample offered 44.64% of total produce to market ranging from a minimum of 0 (zero) to a maximum of 91.04%. This indicates the existing wide gap among households in crop commercialization status due to the associated different factors which affect commercialization decision in crop output market.

The result of probit model reveals farm size, number of livestock (TLU), application of chemical fertilizer, irrigation use and frequency of extension contact affected crop commercialization decision positively and significantly. These factors contribute in increasing crop production resulting in surplus production intended for market. Therefore, the surplus production produced as a result of the positive effect of these factors in increasing crop production enhances commercialization decision of the households in crop output market. On the contrary, household size, none/off-farm income and credit use were found to affect the probability of household crop commercialization negatively and significantly. This implies household with high family members tend to use high proportion of produces for home consumption which in turn leads to decrease the likelihood of household commercialization. Similarly, household who earns more income from non/off-farm activities is more likely to cover more of the household expenditures from non/off-farm income. Therefore, the primary objective of crop production for such type of household is supposed to be food self-sufficiency. Similarly, the result exhibits about half of the non-market participant households used credit while the number of participant households who used credit is negligible as compared to the total number of households considered in the sample. This may suggest the non-participants could employ credit for starting or running off-farm businesses such as petty trade and other activities. The revenue obtained from such businesses used to meet the basic needs of the household instead of selling crop produces. As a result, the probability of household crop commercialization decreases.

4.2. Recommendations

i. Use of irrigation facilities was found to influence positively the crop commercialization decision of households. Thus, government and other stalk holders ought to develop supplementary irrigation schemes and divert rivers accompanying by equitable use of available irrigation facilities by organizing farmers under different water use associations.

ii. Farm size allocated for crop production was found to affect positively and significantly the likelihood of smallholder commercialization; therefore, government should revise rural land redistribution reform to ensure equitable access of farmland by smallholders focusing on households with no or small farm size.

iii. Frequency of extension contact was positively and significantly affected smallholder crop commercialization decision. Hence, agricultural extension provision system in the study areas should have to focus on market oriented extension.

iv. Use of fertilizers affected positively and significantly households' commercialization decision positively and significantly. Therefore, agricultural unions should supplied fertilizer at required type, quantity and time to increase crop production and productivity which in turn enhance smallholders' crop commercialization decision.

v. Livestock ownership (TLU) affected the probability of smallholders' crop commercialization positively and significantly. Hence, government should give emphasis for livestock production while developing agricultural policy. Because, the result of the current study revealed that crop production and livestock husbandry are supplementary businesses.

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