

**MARKET CHAIN ANALYSIS OF *TEFF (ERAGROSTIS TEF)*: THE
CASE OF SHASHAMANE DISTRICT OF OROMIA NATIONAL
REGION STATE, ETHIOPIA**

MSc THESIS

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**Market Chain Analysis of *Teff* (*Eragrostis tef*): The Case of
Shashamane District of Oromia National Region State, Ethiopia**

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DEDICATION

I dedicate this thesis manuscript to my dad, Keno Dule and my mam, Kedija Tuke, for their continuous contribution throughout my academic endeavours.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every serious effort has been made to avoid any plagiarism in the preparation of this thesis. This thesis is submitted in partial fulfilment of the requirement for a degree from the School of Graduate Studies at Haramaya University. The thesis is deposited in the Haramaya University Library and is made available to borrowers under the rules of the library. I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate. Brief quotations from this thesis may be used without special permission provided that accurate and complete acknowledgement of the source is made. Requests for permission for extended quotations from, or reproduction of, this thesis in whole or in part may be granted by the Head of the School or Department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interest of scholarship. In all other instances, however, permission must be obtained from the author of the thesis.

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BIOGRAPHICAL SKETCH

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ACRONYMS AND ABBREVIATIONS

ADEA	Association for the Development of Education for Africa
AERC	Agro-Economic Research Centre
AIC	Akaike Information Criteria
ATA	Agricultural Transformation Agency
BMGF	Bill and Melinda Gate Foundation
CSA	Central Statistical Agency
DH	Double Hurdle
EIA	Ethiopian Investment Agency
FAO	Food and Agricultural Organization of the united Nation
FAOSTAT	Food and Agricultural Organization Statistics
GIAN	Global Agricultural Information Network
GMM	Gross Marketing Margin
GMMp	Gross Marketing Margin of Producers
HSD	Halaba Special District
HSRC	Human Sciences Research Council
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
MVP	Multivariate Probit
NBE	National Bank of Ethiopia
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Square
SHDAO	Shashamane District Agricultural Office
SIFSIA	Sudan Integrated Food Security Information for Action
TGMM	Total Gross Marketing Margin
TLU	Tropical Livestock Unit
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VCA	Value Chain Analysis
WFP	World Food Program

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Market Chain Analysis of *Teff* (*Eragrostis tef*): The Case of Shashamane District of Oromia National Region State, Ethiopia

ABSTRACT

In Ethiopia, teff (Eragrostis tef) is an important cereal crop, particularly in Shashamane district as source of food and cash income for majority of the smallholder farmers. However, the supply of teff in the study area still cannot satisfy the existing market demand and also efforts to enhance smallholders' participation in cereal market in general and teff in particular, through surplus production have been made, but there is dearth of information on the status of market participation and market outlet choice particularly in Shashamane district. The aim of this study was to analyze teff market chain in Shashamane district. Both primary and secondary data were used for study; primary data were collected from 202 randomly selected teff farmers, 22 teff traders and 28 consumers through structured questionnaire. Both descriptive statistics and econometric models were used for data analysis. Producers, rural collector, wholesalers, retailers, processors and consumers were the main chain actors on teff market in the study area. The structure of the teff market was weak oligopoly with four firms' concentration ratio of 36.78%. Teff market conduct deviated from competitive market norm in that some traders were price makers and the price was affected by individual firms. Performance of teff market was analyzed using marketing margins based on costs incurred and gross profit generated by teff market chain actors. Six teff market channels were identified. Total gross marketing margin is highest in channel V (producer-rural collector-wholesaler-central wholesaler-consumer) which was 50% and lowest in channel IV (producer-wholesaler-retailers-consumer) which was 36%. Producer's share was highest in channel IV which accounts 64% from the total consumer's price. Hence, from the result of market structure, conduct and performance analysis it is possible to conclude that teff market in the study area was inefficient. Double hurdle model was used to identify the determinants of market participation decisions and extent of market participation and Multivariate probit model was used to identify the determinants of market outlet choices. Double hurdle model regression results showed that, educational level, livestock owned, land under teff, number of contact with agricultural extension agents had significant positive effect on market participation decision, while sex of household head, family size, distance to nearest market had significant and negative effect. Extent of market participation was affected positively and significantly by land under teff, while it was significantly and negatively affected by family size and non-farm income. The multivariate probit model result indicated that educational level, family size, livestock owned, equines owned, land under teff, distance to the nearest market and current market prices of teff significantly influenced teff producers' choice of alternative market outlets. The probability of choosing wholesalers, consumers, collectors and retailers outlets was 49.49%, 30.51%, 36.93% and 49.18%, respectively. A wholesaler is the most likely chosen market outlet while consumers were the less likely chosen market outlet. Therefore, strategies aiming at promoting teff producers market efficiency, market participation and extent of participation and market outlet choices should focus on strengthening the technical, resource base, infrastructural and institutional capacity building of smallholder farmers.

Keywords: *Teff* market participation, concentration ratio, Double hurdle model, Multivariate probit, Smallholder farmers, *Teff*.

1. INTRODUCTION

1.1. Background of the Study

Agricultural sector is a backbone of the Ethiopian economy accounting for 36.3% of overall GDP (NBE, 2018) and 70% of foreign exchange earnings and the sector provides employment for 72.7% of the population (USAID, 2018). In addition; it supplies 70% of the raw-material requirements of local industries (ADEA, 2014; FAO, 2015; Zerihun *et al.*, 2016). In Ethiopia 95.9% of the total area is cultivated by smallholder farmers and contribute 90% of the total agricultural output indicating the dominant contribution of smallholder farmers to the overall agricultural growth in the country and the entire movement of the agriculture sector depends on what is happening in smallholder sub-sector (USAID, 2018; Gebreslassie and Bekele, 2012).

In the agriculture sector, cereals are dominant in terms of both land area coverage and volume of production. They cover about 80.71% of the total grain crop area (10,232,582.23 hectares) and contribute about 87.48% (267,789,764.02 quintals) of the grain production (CSA, 2018). In addition, it is recognized that nationally *teff*, maize, and wheat in particular, are at the center of the increasingly vibrant agricultural output markets in Ethiopia. Ethiopia is the center of both origin and diversity for *teff* (Vavilov, 1951).

Teff (*Eragrostis tef*) accounts for the largest share of total cultivated area (23.85%) in 2017/18 production season, followed by maize (16.79%) and sorghum (14.96%). But, in terms of total production, *teff* takes the second rank (17.26%) next to maize (27.43%) (CSA, 2018). Apart from this, *teff* straw is important as raw material for local house construction and livestock feed especially during the dry season. Like other crops, *teff* can be exported to other countries. According to Fufa *et al.* (2011), in 2005, there was about 30 thousand tons of *teff* flour exported and earning of the country was about 13.7 million USD. However, due to policy reasons, *teff* flour export dropped in 2006 and only 3 million USD was earned. Starting from 2008, Ethiopia has been exporting processed *teff* especially in the form of fresh *injera* and dry *injera* (Dirkosh) and the export is steadily increasing. With growing demand for gluten-free

products in the United States and elsewhere around the world, Ethiopia is launching a pilot export program for gluten free flour made from the country's indigenous *teff* grain (GAIN, 2015).

Teff is a major staple food crop for both rural and urban consumers (Bart *et al.*, 2013; FAO, 2015). It is used to prepare spongy flat bread called *injera* which is consumed by about 70% of the Ethiopian population (Wondimu *et al.*, 2015). Because of its nutritional value and cultural preferences, demand for *teff* is very high especially in urban areas (Demeke and Marcantonio, 2013). Commercial surplus of *teff* is equal to commercial surplus of the three other main cereals combined in the country (sorghum, maize and wheat) (CSA, 2013).

Marketing is the most significant energetic force of economic development and contains a guiding and simulating impact on production and distribution of agricultural products. The agricultural marketing system needs to bring an improvement in income and livelihood of agrarian societies. According to FAO (2005), in developing countries, most permanent crops produced by smallholder farmers and their product were marketed by the non-public entrepreneurs who operates as marketing chain, and distribute the products to terminal markets. Although the marketing chain is well known, smallholder farmers specifically face high cost in accessing markets and market information.

Teff is largely produced for market because of its high price and absence alternative cash crops (such as coffee, tea and cotton) in the major *teff* produce areas of the country (Demeke and Marcantonio, 2013; FAO, 2015). It is the second most important cash crop after coffee and generates almost 500 million USD incomes per year for local farmers (Bar *et al.*, 2013). Compared to other staple crops, the value of *teff* grain has increased at faster rate in recent years and hence the price gap amid *teff* and other staples is widening. In particular, the price gap between *teff* and maize has widened considerably since 2008 (Fufa, *et al.*, 2011). The annual volume of marketed surplus of *teff* depends on the yearly use of improved agricultural technologies, weather condition suitable to *teff* production and availability labor for peak agricultural activities (Engdawork, 2009).

Shashamane district is characterized by mixed farming activities where crop production dominates. It has different kinds of cereals, root crops, *enset* and others. Major cereal crops grown in the area are *teff*, barley, wheat, and maize. The district is one of the potential producers of *teff* in west Arsi zone. *Teff* production in the district is both for consumption and market purpose. In the district, more than 10,000 ha of land are suitable for *teff* production. *Teff* yield in the district is 17.5qt/ha (SHDAO, 2018). Slightly more than the national average of 17.48qt/ha (CSA, 2018).

It is widely understood concept that, level of income earning and the welfare status of smallholder farmers is determined by the level they participate in a given market as seller. But, there is a dearth of information that enhances or retard smallholders in terms of decision to participate in *teff* market and extent of market participation and factors affecting market outlet choices of *teff* producer particularly in Shashamane district West Arsi Zone of Oromia region, one of the potential areas of *teff* production in central Ethiopia. Such information is essential for making knowledge-based decision that are geared towards improving market participation of farmers in *teff* and contribute to the national development goals of eradicating poverty and improving food security. Thus, this study aims to emphasize on identifying market efficiency, factors affecting market participation and extent of market participation and market outlet choice of *teff* producers in Shashamane district.

1.2. Statements of the Problem

Improved access to market plays an important role in improving rural incomes of smallholder farmers in developing countries, particularly in sub-Saharan Africa. Despite this, participation of smallholder farmers in markets in most sub-Saharan African countries remains low due to a range of constraints. One of the limiting constraints faced by smallholder farmers is linked to poor market access. Poor infrastructure and weak institutions raise transaction costs that considerably alter production and market participation decisions. The majority of smallholder farmers are located in remote areas with poor transport and market infrastructures, contributing to the high transaction costs. Furthermore, the poor do not possess the level of

assets required to protect themselves from market, natural, political and social shocks (Mmbando *et al.*, 2015).

In Ethiopia, even though relatively high economic growth rates registered over past years and the agriculture sector has shown steady annual growth rates for over a decade, it remains dominated by subsistence-based farming and pastoralist practices. Agricultural productivity is still at low levels and most of the food produced on the farm remains consumed by the farm household (ATA, 2015). Market access has been identified as one of the critical factors influencing the performance of smallholders' agriculture in developing countries (Barrett, 2008). Marketing plays an important role in agricultural market participation and accessibility of the market for commodities allows specialization of production, which in turn increases productivity and efficiency. Well-functioning market leads to efficient allocation of scarce resources and maximization of the general welfare of the society. Proper functioning market will only occur when enough markets and efficient market outlets exist for the sale of produced output and no single entity can individually influence the price (Wickramasinghe and Weinberger, 2013).

Teff marketed quantity flows from producers to consumers through various market outlets, and the key market players are rural assemblers, wholesalers, food processors, exporters and retailers (USAID, 2010). However, the link between the producers and the consumers is weak, due to the large number of ineffective intermediaries operating in the market chain, poor quality supplied and sold coupled with high transportation costs (IFPRI, 2010b). Improved information and marketing facility enables farmers and traders to move their produce profitably from surplus to deficit market, to make decisions to the price discovery process (Kholi and Uhl, 2002). However, USAID (2010) and Tadele *et al.* (2016) explained that in Ethiopia, general performance of agricultural marketing system and the growth of both production and trade of staple food crops are constrained by many factors such as poor quality of agricultural produce, lack of market facilities, weak extension services, and absence of marketing information.

In Ethiopia, *teff* is an important cereal crop that covers 23.85% area of land that is under grain crops (CSA, 2018). It is first among all cultivated crops in terms area coverage and second to maize in terms of its contribution to total grain production contributing 17.26% to grain production (CSA, 2018). For this study, *teff* is selected, because it is primarily grown and marketed by majority of the smallholder farmers in Shashamane district and it is source of food and cash income for the smallholder farmers. According to ATA (2017), Shashamane district is one of the agricultural commercialization cluster areas in *teff* production in West Arsi zone. However, the supply of *teff* in the study area still cannot satisfy the existing market demand and the farmers are not benefited from *teff* price increment. The effect of different social, cultural, institutional and economic factors influencing the level of household market participation warrants better attention as stated by (Benjamin, 2013).

Various studies on the determinants of smallholders' market participation (Mussema and Dawit, 2012; Efa *et al.*, 2016; Gebremedhin and Hoekstra, 2007 Alelign *et al.*, 2017; Hlomendlini 2015) and market outlet choices (Addisu, 2016; Shewaye, 2016; Takele *et al.*, 2017; Oliyad *et al.*, 2017) were conducted in different regions of Ethiopia on *teff*, wheat, maize crop output and haricot bean, red pepper, rice and onion.

Past studies conducted in different regions of Ethiopia; did not address the market participation and market outlet choice problems of *teff* producers of the study area. Efforts to enhance smallholders' participation in cereal market in general and *teff* in particular, through surplus production have been made, but there is dearth of information on the status of market participation and market outlet choice particularly in Shashamane district. Since *teff* is the most economically and socially crucial crop and growing demand for this crop both in local and nearby markets, there is a strong need to address the prevailing information gap and contribute to proper understanding of the demographic, socio-economic, institutional and infrastructural determinants of *teff* market efficiency, participation decision, extent of participation and market outlet choices of smallholder farmers. Therefore, these studies were investigated *teff* market chain in Shashamane district of west Arsi zone.

1.3. Research Questions

The study was attempted to answer these research questions:

1. Who are the main actors in *teff* market chain and what are their roles?
2. What does the market structure, conduct and performance of *teff* market look like in the study area?
3. What are determinants of *teff* market participation and extent of participation in the study area?
4. What are the key factors affecting farmers *teff* market outlet choice decision in the study area?

1.4. Objective of the Study

The general objective of the study was to analyze *teff* market chain in Shashamane District of Oromia National Regional state, central Ethiopia. The specific objectives of the study were:

1. To identify *teff* market chain actors and their roles;
2. To analyze the structure, conduct and performance of *teff* market in the study area;
3. To analyze determinants *teff* market participation and extent of participation in the study area; and
4. To analyze factors affecting *teff* market outlet choices of producers in the study area

1.5. Scope and Limitation of the Study

This study focus on analysis of *teff* market chain on smallholders of Shashamane district central Ethiopia. The study addressed only one district, one commodity's market chain of *teff* producers. It is clear that households may participate in a market either to purchase inputs or sale of outputs. This means evaluation of market participation can be possible from both input and output sides. Also, farm households can participate in output market to purchase *teff* from the market. Therefore, this study would focus on output market participation as a seller that is; it does not include participation in input market and market participation as a buyer in *teff*

output market. Due to use cross-sectional nature of data the result may not reflect the time dimension of market participation. Furthermore, analysis of determinants of *teff* market participation and market outlet choice simultaneously need high sample size. Due to lack of farm records among the farmers, this study mainly relied on the farmer's memory in the collection of the data.

1.6. Significance of the Study

In Ethiopia the efforts to develop agriculture is mainly focused on the supply side of the sub-sector without giving much attention to the demand side (Aysheshm, 2007). Experience showed that smallholder farmers could not benefit from increased production of crops in the absence of markets or demands. *Teff* plays a central role in the economic development and is a key contributor to poverty reduction in Ethiopia. Because *teff* constitute one of the major exportable crops in Ethiopia, identifying the factors that influence farmer participation in the market is important for increasing their income. The results of this study could serve as a major input in the formulation of appropriate marketing policies and strategies in Shashamane district by identifying interventions that improve efficiency of the marketing system. Furthermore, the findings of the study will be as a reference material by policy makers, non-government organizations, *teff* producers, other market intermediaries along the market chain and serve as an input for conducting other studies related to market chain of agricultural commodities. The study fills the gap in existing literature on factors affecting smallholder *teff* farmers' market participation, their extent of participation, efficiency of *teff* market and available marketing channels on *teff* market chain at Shashamane districts.

1.7. Organization of the Thesis

The thesis has been organized under five chapters. Chapter two presents review of theoretical and empirical evidences. Chapter three and four discusses about research methodology and result and discussions of it along with comparison with results of previous similar studies are presented respectively. Chapter five summarizes the main findings of the study and draws conclusion and appropriate recommendation.

2. LITERATURE REVIEW

In this chapter, an attempt has been made to define certain concepts used in the study. In addition, this part is intended to critically review the literature of the past research work in relevance to the objective of present study. So that theoretical views and empirical evidences of the reviews enables better understanding of the study.

2.1. Basic Concepts and Definition

Smallholder farmers: Smallholder farmers are defined as the basis of land and livestock holdings, cultivate less than two hectares of land and own only few herds of livestock (Salami *et al.*, 2010). Hazell *et al.* (2007) also define smallholders by assigning numerical values as those with less than two hectares of crop land and with few numbers of livestock. The majority of farmers in Ethiopia are subsistence smallholders, with little separation between production and consumption decisions (Muller, 2014). Smallholders in Ethiopia are known for their resource constraints such as capital, inputs and technology; their heavy dependence on household labor; their subsistence-orientation; and their exposure to risk such as reduced yields, crop failure and low prices (Mahelet, 2007; Diao *et al.*, 2010).

Market: a collection of buyers and sellers who transacting a particular product class, as in the housing market or the grain market (Kotler *et al.*, 1999 and Kotler and Keller, 2012). According to Kohls and Uhl (2002), market is an arena for organizing and facilitating business activities and for answering the basic economic questions: what to produce, how much to produce, how to produce, and how to distribute.

Market channels: According to Kotler *et al.* (1999) marketing channels are essentially the routes through which harvested produce reaches the consumer. These channels consist of number of intermediaries who may either just exchange the produce or change the form of the produce to add value.

Marketable surplus: The marketable surplus at farm level is the residual. Left with the producer-farmer after meeting genuine requirements for family consumption, farm seed, feeding, barter system, wage payment in kind to labor, social obligation and physical losses at post-harvest stages (AERC, 2013).

Marketing chain: Defines follow of commodity from producer to consumers that brings into place economic agents who perform complementary functions with the aim of satisfying both producers and consumers (Islam *et al.*, 2001).

Agricultural marketing: is defined as agriculturally oriented marketing. It embraces all operations and institutions involved in moving farm products from farm to consumers (Pritchard, 1969). It covers all the activities associated with the agricultural production and food, feed, and fiber assembly, processing, and distribution to final consumers, including analysis of consumers' needs, motivations, and purchasing and consumption behavior (Branson and Norvell, 1983).

Agricultural marketing was viewed by Olukosi and Isitor (1990) and Idem (1999) as the process by which agricultural products flow physically and economically from the producers to the consumers in order to effect exchange of goods and services that satisfy the needs of individuals, groups or the entire society. In the process of marketing, buyers and sellers are linked together and can react to current situations of supply and demand. Participants thereby generate income which enhance their welfare. Generally, an effective and efficient marketing system enhances consumption, output and economic development.

Marketing outlets: Marketing outlets can be described as a path of a product as it moves from the producers to the final consumers (Olukosi and Isitor, 1990). According to Kotler and Armstrong (2003), it is a business structure of interdependent organizations from the point of product origin to the consumer with the purpose of moving products to their final consumption destination.

Market participation: refers to any market related activity which promotes the sale of produce (Key *et al.*, 2000). According to Ana *et al.* (2008) defined market participation in terms of sales as a fraction of total output, for the sum of all agricultural crop production in the household which includes annuals and perennials, locally-processed and industrial crops, fruits and agro-forestry.

2.2. Approaches to Study Agricultural Marketing

Marketing studies adopt different viewpoints and approaches to study agricultural marketing problems. The functional, institutional (organizational) and commodity approaches are a few systems of understanding or analyzing marketing (Mendoza, 1995).

2.2.1. Functional approach

Functional approach involves classifying and studying specialized activities performed as marketing works (Branson and Norvell, 1983; Kohls and Uhl, 1985), and this approach helps to compare cost and benefits of different functions. The chief marketing activities are selling, buying, transporting, warehousing, and financing.

2.2.2. Institutional approach

In this approach, the concern is the number and kinds of business firms that perform the marketing task (Branson and Norvell, 1983). Marketing institutions that are analyzed in this approach include market stabilization agencies, board of foreign trade, supermarket chains, wholesaler/retailer network, town's central market, or agreements between producers and millers. These organizations or market actors perform the operations which are necessary to transfer goods from the producer to consumer, because of the benefit of specialization and scale that exist in marketing as well as production (Cramers and Jensen, 1982).

2.2.3. Commodity approach

This approach deals with list of products and detail analysis of classification, characteristics, source of supply, transportation, its financing, storage, and advertisement of the product. This approach focuses on what is being done to the product after its transfer from its original production place to the consumer. It helps to pinpoint the specific marketing problems of each commodity as well as improvement measures (Branson and Norvell, 1983, Kohls and Uhl, 1985; Mendoza, 1995). This approach has been used in this study as a guideline to identify different aspects of the problem.

2.3. Market Structure, Conduct and Performance (S-C-P)

The S-C-P is an analytical approach used to study how the structure of the market and the behavior of sellers of different commodities and services affect the performance of market, and consequently the welfare of the country as a whole (Kizito, 2008). This approach examines the causal relationships between market structure, conduct and performance.

2.3.1. Market structure

Market structure refers to those organizational characteristics of a market which influence the nature of competition and pricing, and affect the conduct of business firms; and/or it refers to those characteristics of the market which affect the traders behavior and their performances; The components of the market structure, which together determine the conduct and performance of the market are concentration of market power, degree of product differentiation, conditions for entry of firms in the market, flow of market information, and degree of integration (Lenovo, 2011). Thomas and Maurice (2011) cited in Wisdom *et al.* (2014), and USAID (2008) also defined market structure as a set of market characteristics that determine the economic environment in which a firm operates. They also characterized market structure on the basis of four industry characteristics: number and size distribution of active buyers and sellers and potential entrants; degree of product differentiation; amount and cost of

information about product price and quality and condition of entry and exit. Market structure can be measured by the following listed methods.

Market concentration ratio: Concentration refers to the proportion of industry sales made by its largest firms. In general, the more concentrated the industry sales, the more likelihood that the market will be imperfectly competitive (Kohls and Uhl, 1985). Kohls and Uhl (1985) suggested that as a rule of thumb, the four largest enterprises concentration ratio of 50 % or more is an indication of the existence of a strongly oligopolistic industry, 33 to 50 % is a weak oligopoly, and less than 33% indicates that the existence of competitive industry. Despite wide application of concentration ratio as a measure of the ratio of market concentration, there are limitations against the index.

The problem associated with concentration ratio is the arbitrary selection of r (the firms that are taken to calculate the ratio) (Scarborough and Kydd, 1992). The ratio does not indicate the size distribution of r firms. However, when the numbers of participants in an industry is large, it will be difficult to organize oligopolistic behavior.

Herfindahl Index (HHI): it is calculated by summing the squared market shares of all the firms. HHI includes all firms in the calculation. The problem with this measure is that it needs more data to be collected. Squaring of the individual market shares of the firms gives proportionately greater weight to the market shares of the larger firms. Lack of information about small firms is another problem though it is not critical because such firms do not affect the HHI significantly (Kanyengam and Mangisoni, 2012).

Gini-coefficient: Gini-coefficient is a ratio of area between the Lorenz Curve of the distribution and the line of equality (uniform distribution) to the lower triangle. It shows the sales distribution among the firms in the industry. Therefore, Gini coefficient is applied to indicate how the distribution of shares has changed within an industry over a period of time, thus it is possible to see if inequality is increasing or decreasing. Gini-Coefficients can vary anywhere from zero (perfect equality) to one (perfect inequality). In actual fact, the Gini-Coefficient with highly unequal distributions typically lies between 0.50 and 0.70, while with

relatively equitable distributions it is on the order of 0.20 to 0.35 (Kanyengam and Mangisoni, 2012).

However, although Gini-Coefficient provides useful information based on Lorenz curve shape, a problem arises when Lorenz curves cross. It is problematic whether we can in this special case claim that a higher coefficient means a more unequal distribution. The other problem associated with Gini-Coefficients is that it favors equality of market shares without regard to the number of equalized firms. In other words, the coefficient equals zero for two firms with 50 percent market shares, for three firms with 33.33 percent market shares each, and so on (Kanyengam and Mangisoni, 2012; HSRC, 2016).

From the available measures of market structure herfindahl index is mostly applied to calculate the share of largest companies and industries (e.g. the share between national banks are analysed through herfindahl index). On other hand gini-coefficient is mostly applied to analyse income/wealth inequality between different nations or populations. But, concentration ratio is the most commonly used method for analysing market share of the first largest firm in the market. Due to this reason, for this study concentration ratio was used to calculate the market share of the four largest *teff* traders in the district.

2.3.2. Market conduct

Market conduct refers to the patterns of behavior that traders and other market participants adapt to affect or adjust to the market in which they sell or buy. These include price setting behavior, buying and selling practices (Kizito, 2008). Market conduct investigates the behaviors and rules that regulate the relationships between actors or how they engage with one another (WFP, 2011).

2.3.3. Market performance

Market performance is the impact of structure and conduct on product price, costs, volume, and quality of output (Cramers and Jensen, 1982). If the market structure in an industry

resembles monopoly rather than pure competition, then one expect poor market performance. According to Abbott and Make ham (1981), performance is how successfully its aims are accomplished. Market performance indicates, how product assembled, delivered on time and without wastage? Is it well packed and presented attractively? Is its quality reliable and are contract kept? and is the consumption of the products increasing and sales in competitive market expanding? Market performance can be evaluated by analysis of costs and margins of marketing agent (Wisdom *et al.*, 2014). There are large differences between prices paid by consumers and prices received by farmers for a given commodity. It can be measured by the following methods.

Marketing margin

Marketing margin is defined as the difference between the price paid by consumers and that obtained by producers. It is also called the ‘Farm- Retail Price Spread (SIFSIA, 2011). It is the price variation at different segments with the comparison of the final price to the consumer. It is the percentage of final weighted average selling price taken by each stage of marketing chain. Total marketing margin is the difference between what a consumer pays and what a producer/farmer receives for the product. A wide margin usually means high prices to consumers and low prices to producers (Dirriba, 2013; Biruk, 2015). It is calculated by determining price variations at different segments and compares them with the final price paid by the consumer (Wisdom *et al.*, 2014). Wider marketing margin indicates high price to consumers and low price to producers and it is indicator of existence of imperfect markets (Cramer and Jenson, 1982).

Marketing cost: It refers to those costs, which are incurred to perform various marketing activities in the shipment of goods from producers to consumers. Marketing cost includes handling cost (packing, loading and unloading putting inshore and taken out again), transport cost, product loss, storage costs, processing cost, capital cost (interest on loan), commission, and unofficial payments (Heltberg and Tarp, 2001).

2.4. *Teff* Production and Marketing in Ethiopia

2.4.1. *Teff* production in Ethiopia

Ethiopia is the center of origin for *teff* and endowed with a varied agro-ecology for growing *teff* with a combination of appropriate altitude, temperature, rainfall and soil. *Teff* is mainly grown in Oromia and Amhara, with smaller quantities in the Southern Nations, Nationalities and Peoples, Tigray, and Benishangul-Gumuz regions. According to the CSA data on annual agricultural sample survey, there are 49 zones and 4 special districts in the country in which production of *teff* is practiced. These include five zones in Tigray regions, eleven zones Amhara regions, seventeen zones in Oromia regions, four zones in Benishangul-Gumuz regions and twelve zones and four special districts in Southern Nations, Nationalities and Peoples regions. However, 87.78% of the country's *teff* production comes from Oromia and Amhara regions; the surplus *teff* production in the market comes from these major producing areas and is distributed to the deficit markets through the grain market channels. Additional 6.8 percent coming from the Southern Nations, Nationalities, and Peoples Region (SNNPR) and 0.6 % from Benishangul-Gumuz and 4.82% from others (CSA, 2017)

The sustained cultivation of *teff* in Ethiopia has been accentuated by a multitude of its relative merits in both husbandry and utilization. The major relative merits of *teff* over the other crops in terms of husbandry include its: 1) broad adaptation to a range of altitudes and to varied agro-ecological and edaphic conditions; 2) reasonable tolerance to both low (drought) and high (water logging) moisture stresses; 3) importance as a reliable and low-risk catch crop at times when other crops fail (such as *maize* and sorghum) due to natural calamities such as drought, insect pests, striga and diseases; 4) adaptable to various cropping systems and crop rotation schemes; 5) relative resilience to epidemics of pests and diseases; and 6) minimal post-harvest losses since the grains suffer less from storage pests (such as weevils) and diseases (Kebebew *et al.*, 2013). Compared to other cereals, *teff* is considered a low risk crop as it can withstand adverse weather conditions (Bekabil *et al.*, 2011).

Teff accounts for the largest share of the total value of cereal production. *Teff* is grown by a total of 6.5 million farmers. Since *teff* farm operations such as land preparation, weeding and harvesting are highly labor intensive, with limited availability of suitable mechanical technology, there are no large-scale *teff* farms in the country. According to CSA data, *teff* covering 2,866,052.99 hectare of cultivated area of land and grown by 6,562,325 farmers in Ethiopia, it covers 1,443,847.96 hectare of cultivated area of land and grown by 2,765,117 farmers in Oromia and it covers 28,581.19 hectare of cultivated area of land and grown by 101,709.00 farmers in West Arsi Zone. The national productivity of *teff* is (17.48 qt./ha), and in Oromia it is (17.88qt./ha) where as in West Arsi Zone it is (15.6 qt./ha) (CSA, 2018).

In Ethiopia, statistical data shows that area harvested and volume of *teff* produced has grown year-over-year. Increase in trends of *teff* production was attributed due to different factors that include good rainfall, national and international efforts to rising use of improved seed and fertilizer. In addition, the government's extension package continues to have a positive impact on production. The extension services among other activities provides for the distribution of improved seed and fertilizer, education on the optimal application of inputs (e.g. seed) and other agronomic techniques. Currently, *teff* is strategic crop in Ethiopia's agriculture included under Agricultural Commercialization Cluster (ATA, 2017). Trends of area harvested and *teff* production in Ethiopia is shown in figure below.

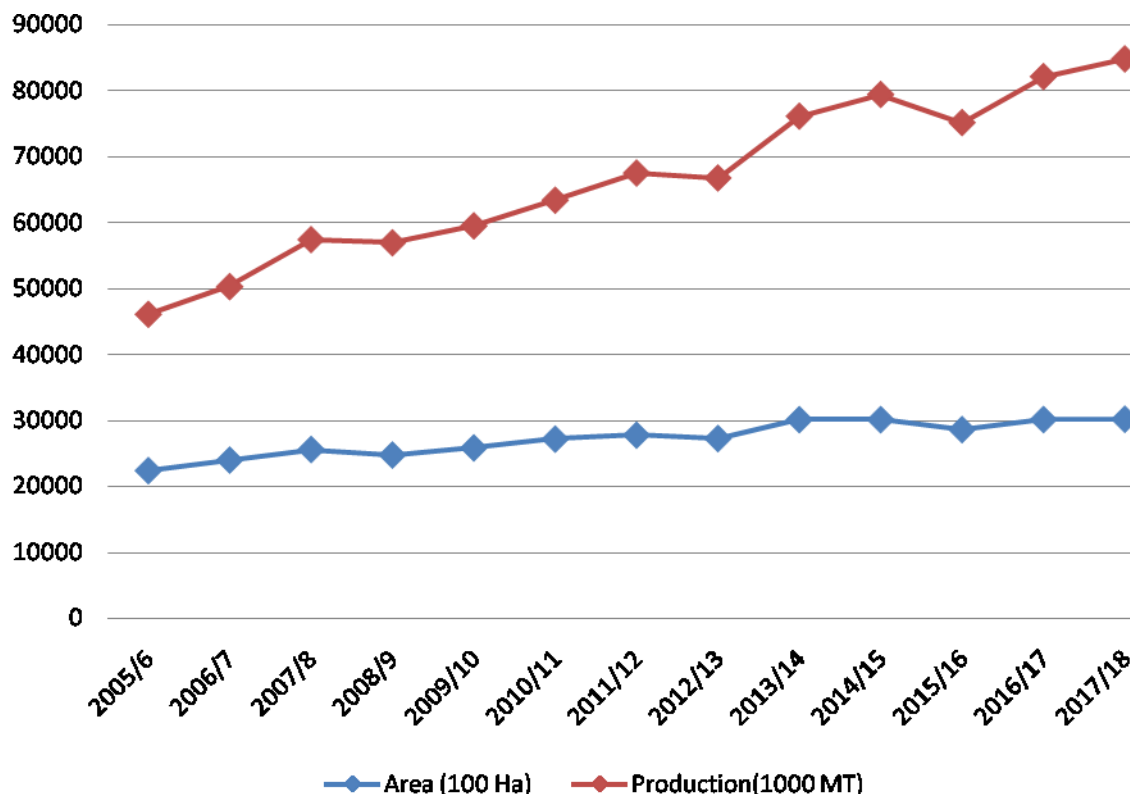


Figure 1. Trends of *teff* production in Ethiopia

Source: analysis based on CSA data from 2005/6 – 2017/18

2.4.2. Consumption of *teff* in Ethiopia

According to Sinshaw (2013) about two thirds of produced cereals is still consumed by the producer households themselves, with only just over 16% being supplied to the market. *Teff* is grown in almost in all regions of the country for the market as well as for home consumption since it is a preferred grain and for local market since it fetches the highest grain price compared with other cereals (Seyfu, 1997).

Teff grain nutrients are promising alternative food for celiac patients. Its straw is most preferred for animal feed and also used as building purpose mixed with mud (Fufa *et al.*, 2011; Vandecasteele *et al.*, 2016). For farmers, it earns more value than any other cereals cultivated and it is the most nutritious of all grains grown in Ethiopia (Crymes, 2015).

Most Ethiopians like to consume *teff* but, only middle and high income people in urban areas can have access to this grain. It contributes approximately 600 kilo calorie per day in urban areas, compared to 200 kilocalories in rural areas (FAO, 2015). FAO (2015) and Bart *et al.* (2013) also demonstrated that, *teff* is a major staple food for many Ethiopians and highly considered as an economically superior good. But, it is widely consumed by the economically better off urban residents than by rural households.

2.4.3. *Teff* marketing in Ethiopia

Teff is a commercial crop mainly because of the high price it fetches and the absence of alternative cash crops (such as coffee, tea or cotton) in the major *teff* producing areas of Gojam (Amhara) and Shewa (Oromia) (FAO, 2015). *Teff* has the highest market value among all cereals grown and it is a source of cash income for Ethiopian small farm households. Compared to other staples, the price of *teff* has increased at faster rate in recent years, hence the price gap between *teff* and other staples is widening. Particularly, the price gap between *teff* and other crops such as wheat and *maize* has widened considerably since 2008 (FAO, 2015). From 2015 through 2017, the average year-on-year price of *teff* increased 9% or 145 Birr (Ethiopian currency equivalent to USD 5.3) per 100 kg in the surplus market. In January 2017, the price of 100 kg *teff* was 1750 Birr or USD 64.1, which was twice than that of wheat (Lee, 2018).

The central market in Addis plays an important role in determining prices in the major production areas (Demeke *et al.*, 2013). The benefits that *teff* market suppliers reap from this price trend are a strong indication of the great economic potential of the international *teff* trade. If *teff* is traded internationally, global demand for *teff* will raise prices further and incentivize production increases, which will directly drive domestic economic growth (Rashid and Negassa, 2011).

Trends are showing that because of the increasing price of *teff* compared to wheat and corn, many Ethiopian middle and lower class populations are shifting to greater consumption of wheat and corn (Bekabil *et al.*, 2011; Demeke *et al.*, 2013). Most of the Ethiopian flour mills

in the rural areas mix corn and wheat with *teff* to lower the price of flour. Given the increasing global popularity of *teff*, the international demand for this grain has also increased. However, Ethiopian *teff* yields have not met the increased demands, thus leading to ever-increasing prices. This created hardships for many Ethiopian families who switched to other cereals as substitutes (Demeke *et al.*, 2013).

Current *teff* market is extremely underdeveloped, mainly due to fragmentation and price volatility. First, the market lacks large scale processing to capture economies of scale. Second, price volatility, caused by seasonal variation and a lack of standardization, negatively affects farmer liquidity and consumer consumption patterns (Rashid and Negassa, 2011). According to WFP (2015) *teff* (white, mixed and red) increased prices were observed where the highest increase (11 to 30%) was observed in Addis Ababa, Adama, Dire Dawa and Bahir Dar against the long term average. In other major markets, prices of *teff* increased at lower percentage (less than 15%). Brokers in regional markets work as agents of traders and negotiate prices and grade levels with farmers who often have limited bargaining power (Bekabil *et al.*, 2011). Urgessa (2011) reveals that *teff* producers took 78.7% of the consumer price while the assemblers, wholesalers and retailers shared the rest of the price. Further, the *teff* producers collected the highest net profit followed by the urban retailers, farmer traders, regional retailers, urban assemblers, and regional wholesalers in the descending order. Nonetheless, *teff* producers might not benefit from the price structure when profit per unit of time to produce *teff* is considered. As the crop is highly labor intensive with little mechanization. *Teff* is the only cereal crop that Ethiopia has a comparative trade advantage. It can be grown in a large part of the country. The current lack of opportunities for international markets discourages *teff* producers and traders to improve yields, reduce post-harvest losses, add more values, and develop standardized *teff* grading systems (FAO, 2015). The food security issue hardly justifies the present export ban; *teff* is not a staple for the most food insecure due to its relatively high price (Abraham, 2015). Thus, Ethiopia needs to reconsider the export ban in order to lead Ethiopian farmers to engage in the rise of *teff* popularity. Otherwise, the country would miss a good opportunity to enhance farmer income, livelihood as well as GDP. And once the global *teff* market is mature, Ethiopia would have to grapple with countries with

advanced farming technologies, a large-scale production system, and efficient market chain so as to capture the share of the *teff*.

2.5. *Teff* Production and Marketing Problems

In Ethiopia there are different researches conducted by different researchers at different time about problems and opportunities related to different agricultural commodities. According to Mohammed (2011), and Firdisa (2016) the major factors that adversely constrain *teff* production in their respective study area includes shortage of technical inputs, inadequacy of capital, serious pest attack at seedling stage, lack of efficient extension service and low selling price. On the other hand, poor market linkages or liaisons, collusion of buyers on price setting, high transport cost, unavailability and poor quality of packaging materials, adulteration, and inconvenient taxation system affects marketing of the listed agricultural commodities in Halaba and Horo and Jimma Geneti District of Ethiopia.

The traditional sowing method used for *teff* is also considered as one of the main reasons why *teff* yields are low in Ethiopia which in directly affects *teff* market (Vandecasteele *et al.*, 2016). Receiving inputs (as part of the promotion campaign) too late, rains arriving earlier than normal and harvesting *teff* earlier than normal are significant negative effect on *teff* productivity and profitability. *Teff* is susceptible to lodging and it is another problem which could account for up to 30% of the potential loss of *teff* yields (Fufa *et al.*, 2011).

2.6. Theoretical Framework

This study was based on a framework of the theories of utility; the utility maximization theory and random utility theory (Pryanishnikov and Katarina, 2003).

2.6.1. Utility maximization theory

The decision on the proportion of output to sell and the proportion to retain depends on the expected level of satisfaction derived from selling the output. This decision can be influenced

by the socio-economic characteristics of the producer. In the case of *teff*, it is also influenced by the rapid changes in the eating habit, where the majority of Ethiopians are turning to *teff* as a major staple. Those who use *teff* as a staple crop and have large household size may option to sell less in the market and retain more for home consumption. Those who borrowed credit for the purpose of farming may be forced to participate more in order to pay back. Those who participate in the market have to utilize marketing outlets that maximize their profits or expected utility such as convenience and relations.

2.6.2. Random utility theory

Whenever an individual is to choose amongst a group of options, they are rational if they choose the option that gives the greatest utility, or else equal utility. If, when everything is taken into account, the decision that provides the greatest utility is equivalent to that which is the most preferred, and then we would expect the individual to take that most preferred option. This implies that a rational individual will always select that option that they prefer the most. It is important to emphasize how rationality relates to a farmer's individual preferences. Farmers prioritize different marketing outlets. For example one farmer may prioritize government outlets while another farmer may value private sector outlets, based on convenience, prices or relation. Given their preferences, both make the economically rational choice.

Therefore, assuming that farmer i choose from a set of mutually exclusive marketing outlets, $j = 1, 2, \dots, N$, from which the farmer obtains a certain level of utility U_{ij} from the alternative outlet chosen. Assuming further that the intention of the farmer is to maximize utility from the choice made. The producer therefore makes a decision based on the utility achieved by selling to a given market outlet or to an alternative. In essence, producer i assign each alternative j in his choice set of supposed utility U_j and select the marketing outlet that maximizes his/her utility. A number of measurable attributes of the alternative outlets and the farmer's characteristics who is the decision maker determine the utility assigned to each choice.

$$U_j^i = U^i X_j^i \quad (1)$$

In equation (1), U^i is the supposed utility and X_j^i is a vector of attributes relative to alternative j and to decision maker i , utility is still unknown with certainty and must be represented in general by a random variable. It follows that the probability that the farmer selects alternative j conditional on his choice set I^i will be:

$$P^i = (j / I^i) = P^i(U_j^i > U_k^i) \quad \forall k \neq j \quad k \in I^i \quad (2)$$

Hence, the utility is decomposed into deterministic v_{ij} and random ε_{ij} part:

$$U_{ij} = v_{ij} + \varepsilon_{ij} \quad \forall_{ij} \in N = v_{ij} \quad (3)$$

With $V_{ij} = E(U_{ij})$, then $E(V_{ij}) = V_j$, $\text{Var}(V_j) = 0$ and $E(\varepsilon_{ij}) = 0$ $\text{Var}U_j = \sigma^2_{ij}$ this yields

$$P^i(j / I^i) = \text{Prob}(V_j^i - V_k^i > \varepsilon_k^i - \varepsilon_j^i) \quad \forall k \neq j \quad k \in I^i \quad (4)$$

Where P^i is the choice probability of the outlets. Equation 4 gives the likelihood of farmers selecting alternative j and further suggests that the choice of a given alternative depends on the systematic utilities of all competing alternatives and on the law of joint probability of random residuals ε_j . From equation (3), ε_{ij} denotes a random error which is specific to a producer's utility preference (McFadden, 1976). A farmer is thus expected to choose an alternative that gives higher utility among the alternatives.

2.7. Empirical Review

2.7.1. Factors affect market participation

Gebreslassie *et al.* (2015) using Tobit estimation found distance to local market, lack of labor, age of household, expensive fertilizer, training on marketing, family size, farm size, outstanding debt, crop harvested, off farm income and draft power as significant variables influencing intensity of crop out market participation. Moreover, Ele *et al.* (2013) found that; total quantity of food crops produced, farming experience, access to agricultural extension

service; size of land used for cultivation, membership in cooperatives and household family size are important factors determining the extent of participation of smallholder farmers.

Dirriba (2016) applied multiple linear regression model to identify determinants of market supply of barley and wheat. According to this, quantity produced access to information and price of other crops affect the amount of wheat and barley supplied to the market in Ethiopia. Efa *et al.* (2016) analyzed determinants of market participation and intensity of marketed surplus of *teff* producers in Bacho and Dawo districts of Oromia State, Ethiopia using double hurdle econometric model. Family size, credit access, farm size, agro-ecology and transport equipment affect the market participation of *teff* producers. On the other hand, proxy to nearest market, perception of farm gate price, Land holding, on/off farm income, agro-ecology and livestock ownership were found to be statistically significant factors of intensity of marketed surplus of *teff* producers.

Girma (2015) also conduct research on the same topic and the same study area with Efa *et al.* (2016), but Girma used OLS and shows only factors affecting volume of *teff* marketed. This makes Girma's (2015) research difference from Efa *et al.* (2016). His finding indicated that sex of the household head, land allocated for *teff*, market information and frequency of contact with extension agents on *teff* production and marketing had significant effect on volume of *teff* marketed in Bacho District of Oromia region.

Gebremedhin and Hoekstra (2007) studied cereal marketing and household market participation in Ethiopia, with respect to *teff*, wheat, and rice. The study aimed at analyzing the market participation of farm households, market actors, market channels, and determinants of household market participation for these crops. The study found that smallholder farmers' participation in agricultural marketing had a significant role in improving the use of agricultural inputs and enhancing productivity apart from increasing production. The result of the study revealed that important market places for buyers are either those located at the district urban centre or in the peasant associations within the district. This implied that markets outside the districts were not important for producers and the channels were wholesalers and urban collectors for the crops.

Benjamin (2013) using double hurdle estimation found that, likelihood of participation in maize market negatively affected by age of household head, while sex of households negatively influenced level of maize marketed. Tadele and Ashalata (2016) found that, experience in *teff* production increases quantity of *teff* supplied to market indicating the importance of farm experience in a market participation analysis. According to Aman *et al.*, (2014), education level of households motivate farmers market participation through improving the skill ability to utilize market information, which may in turn reduces marketing costs and make it more profitable to participate in the market. Firdisa (2016) also found as education level positively influence the likelihood of smallholder's participation decision. Mignouna *et al.* (2016) using double hurdle model indicated that price and non-price constraints played significant roles in determining decisions on participation in maize and cow pea markets. Total farm size, price, and ease of transportation through access to motorized equipment were positively related to decision to participate in the maize market while volume of sale was affected by location. Age and total farm size positively related to decision to participate in the cow pea market while access to mobile phone, price and location affected volume of cow pea sold positively

Mussema and Dawit (2012) evaluated the market chain of red pepper at HSD and Silti zone of Ethiopia by using Heckman two-stage model. The study found that the quantity of red pepper produced and extension service had positive and significant influence on market participation, while yield of cereals had negative and significant effect on market participation. The study also found that livestock numbers and non-farm income negatively and significantly influence the amount of red pepper supplied to the market. However, the results obtained for red peppers cannot be generalized to *teff* because pepper is produced for commercial purpose only whereas *teff* production is for both commercial and household subsistence.

Hlomendlini (2015) using double hurdle model sorted out factors affecting decision to participate in maize market. According to this finding, sex of household head, household size, household land size, access to credit, government transfers affected likelihood of market participation positively. Intensity of maize sold was positively affected by household size, household land size, extension services, and fertilizer use. According to Moono (2015),

decision to participate in rice market was positively affected by education level of household head, household size, output price, ownership of traction animal, price information, membership in farmer organization, and quantity of rice produced, while it was negatively affected by age of household. In his two step heckman estimation result, intensity of participation in rice market was affected by age of household head, size of land owned, access to credit facility, price information, membership in farmer organization, and quantity of rice produced.

Alelign *et al.* (2017) used heckman two step estimation procedure to identify factors affecting decisions to participate in crop output market and extent of participation. according to this finding, farm households' decision to participate in crop output markets were influenced by sex of household head, farming experience, livestock holding, cultivated land size, off/non-farm income, on-farm income, market distance, and crop diversification. On the other hand, dependency ratio, cultivated land size, education status, chemical fertilizer, and distance to market were factors influencing farm households' intensity of crop output market participation.

2.7.2. Determinants of market outlet choices

Engida (2017) employed multivariate probit (MVP) model to identify determinants of coffee market outlet choices in Gewata district, South West Ethiopia. The multivariate probit model results indicated that quantity sold, education level, frequency of extension contact, household size, years of farming experience, distance to nearest market, off/non-farm income, land area and transport access significantly influenced producers choice of market outlets.

Addisu (2016) used multivariate probit (MVP) model to identify determinants of onion market outlet choices in Ejere district of West Shewa Zone, Ethiopia. The result of MVP model indicated that quantity of potato sold, education level, sex of households head, family size, farming experience, distance to nearest market, off/non-farm income, trust in traders, ownership of motor pump, selling price of potato and area of land allocated for potato significantly influence potato producers choosing of market outlets for their produce.

Shewaye (2016) used multivariate probit (MVP) model to identify factors affecting haricot bean market outlet choices in Misrak Badawacho district, south Ethiopia. The result of MVP model revealed that distance to all weather roads and distance to the nearest district market positively affect the probability to choose rural assemblers market outlet whereas number of equine owned and use of credit has a negative effect. Number of equine owned positively affects the probability to choose direct consumers outlet. Number of equine owned, use of credit, membership in cooperative and price information positively affect the probability to choose urban traders outlet, whereas distance to the nearest district market negatively affect the probability to choose the urban traders outlet.

Oliyad *et al.* (2017) employed multivariate probit (MVP) model to identify factors affecting market outlet choice of Groundnut producers in Digga district of Oromia, Ethiopia. The multivariate probit model results revealed that variables like educational level, distance to the nearest market, access to extension service, size of land allocated for groundnut, quantity of groundnut produced, transport facilities, buyers' trust and access to off/nonfarm income affected the choice of appropriate market outlets of producers.

Takele *et al.* (2017) used multivariate probit (MVP) model to identify factors affecting market outlet choice of smallholder mango producers in Boloso Bombe district, Southern Ethiopia. The results from multivariate probit model indicated that variables such as family size, distance to the market, quantity of mango produced, price offered, access to market information and access to non-farm income determined the decision of choice of wholesaler, collector, retailer and consumer market outlets.

2.7.3. Determinants of Market Structure Conduct Performance

Debela (2013) have conducted onion market analysis in Fentalle Woreda, East Shewa zone to examine onion market structure-conduct and performance. The author applied concentration ratio and barrier to entry and exit to identify market structure; price setting strategy to measure market conduct and marketing margin analysis to measure the performance of onion market. The result of the finding indicated that concentration ratio for the top four onion traders were

34.7%, which is considered as a weak oligopolistic market structure. The author found that majority of producer's price was set through negotiation with traders and identified that lack of experience and level of education were barriers to entry in onion marketing. Both Debela (2013) and Alemayehu *et al.* (2016) found that capital was a key barrier to entry, while rules and regulations were not barrier to entry. In addition, the authors revealed that high traders marketing margin and low producers' margin in onion marketing.

Ayelech (2011) using SCP approach found that structure of the market indicates that licensing and years of avocado and mango trade experience did not hinder entry into avocado and mango trade, but capital, education and market information were barriers to enter into the trade. Toyiba *et al.* (2014) also analyzed the market chain of papaya (*Carica papaya*) in Dugda District, Eastern Shewa Zone of Oromia National Regional State by using the structure, conduct and performance approach as the basis to evaluate market chain analysis of papaya. The structure of the market indicated that licensing procedure, trade experience, access to credit and risk were barriers to enter into the trade.

Nega *et al.* (2015) conducted a study to analyze mango, avocado and banana market chain in Tembaro district, Kembata Tembaro zone SNNP of Ethiopia. The study pointed that fruit marketing in the area characterized by having large number of buyers and sellers (CR4 of 24.4% for avocado, CR4 of 23.3% for banana, and CR4 of 22.69% for mango market), free entry and exit and the majority of fruit price set by demand and supply of the fruits in the market. The author indicates that the marketing structure of fruit in the study area was competitive market. The study by Abrham (2009) in Lume woreda, the structural organization of the grain marketing system appeared to be competitive for *teff*. The study found the market conduct, the behavior that traders manifest in issues like price setting, was found to be influenced by factors like timing of loans return by farmer, the presence of informal traders, and uncertainties created by price fluctuations in the terminal markets.

According to Mohammed (2011), the average market concentration of wheat (CR4) in Alaba Qulito Market of Halaba Special Woreda, Southern Ethiopia, is 71.5%, which was oligopolistic market, indicating the existence of market imperfection. Similarly Sultan (2016),

found that the market concentration ratio of wheat in Sinana District, Bale Zone, Oromia Region, Ethiopia, was 88.7% of the total amount of wheat sold in market during peak production season at Robe town, indicated that the market structure is oligopoly market. In contrast to these, Hailu Negash (2010), found that the market concentration ratio (CR4) of wheat in Mekele market, Tigray, was 22.31%, indicates competitive market. Besides this other study reveal that the average market concentration was 27.54%, indicated that the market structure was weakly competitive markets (Gebremeskel *et al.*, 1998). According to Amentae *et al.* (2017), analysis market conduct of wheat result show that 82%, 14.7% and 3.3% of the respondent, in Arsi to Finfinnee, reported that the wheat price was set by buyers, the market through the interactions between supply and demand by negotiation and farmer respectively and Regarding to the attraction of their suppliers, the traders used different systems such as fair scale-weighing (81.2%), giving better price relative to others (8.24%), giving credit (7.06%), and visiting their suppliers (3.53%). The traders also used quality (good looking seed, free from foreign materials, well dried and preferred wheat varieties by their customers) as a strategy to attract buyers, which accounts about 88%.

Based on the above stated literatures, household (farmer) characteristics, financial and institutional factors, infrastructure and market issue, resource endowments, concentration ratio, barrier to entry, producer and trader buying and selling strategy, market margin, cost and profit variables are also the focus for this study.

2.8. Analytical Framework

Different analytical models have been employed to analyze the farm household decision problem. One of the method used Tobit model to analyze determinants of market participation. Tobit model based up on the assumption that both the decision to participate in activity and the extent of participation are determined by the same variables and with the same sign. This means, the decision to participate as a seller of a certain crop and the intensity of participation are jointly determined and influenced by the same parameters. This is the main weakness of the Tobit model in which it restricts the number of independent variables and coefficients in the two decisions (participation and the extent of participation decisions) to the same sign

(Wooldridge, 2002). In addition, Tobit model assume that zero values of participation associated with non-participation are the result of rational choice (i.e. non-participant farmers decides to sell zero in the market). This is the reason why recent empirical studies on marketable supply and market participation where two separate decisions is made have shown the inadequacy of the Tobit model.

In this regard, one alternative approach is to employ the double-hurdle model. This model assumes farmers face two hurdles in any agricultural decision making processes (Cragg, 1971; Humphreys, 2010). Accordingly, the decision to participate in an activity is made first and then comes the decision regarding the extent of participation in the activity. This model estimation procedure involves running a probit regression to identify factors affecting the decision to participate in the activity using all sample population in the first stage, and a truncated regression model on the participating households to analyze the extent of participation, in the second stage.

Opposed to Tobit model, in double hurdle model, there are no restrictions regarding the elements of explanatory variables in each decision stages. That means it is possible to separately analyze the determinants of market participation decision and the extent of participation decisions. Due to this separation, the estimates of participation decisions can be obtained by means of probit regression and that of the extent of participation decision can be analyzed by use of a truncated regression.

The other approach uses Heckman two step procedures. Sample selection model was first introduced by Heckman (1979). This model is based on the assumption that the decision to participate and the intensity of participation may not necessarily be jointly determined as in Tobit model (Humphreys, 2010; Geoffrey *et al.*, 2013). In this case, factors that determine the market participation decision and the decision on extent of participation could be different. However, the Heckman selection model is appropriate if there is a censoring process in measuring the intensity of market participation (Humphreys, 2010). The Heckman two step procedures assume there is some potential levels in the sample population, but are not observed due to sample selection problem (selectivity bias). In general, Heckman's sample

selection model is designed to account for the fact that the observed sample may be non-random. Heckman two step estimation procedures compared with double hurdle model on the basis of error terms and the assumption of dominance (potential source of zeros and how those zeros are treated). Heckman two step procedures assume that the error terms of the participation and extent of participation equations are correlated, and that the participation decision dominates the level participation equation which referred to as first hurdle dominance. The model implies that observed zero extent of participation are the result of participation decisions only (i.e. zero observation in the outcome equation is due to first hurdle dominance); it assumes that there are no zero observations in the second stage once the first-stage selection is passed (John, 2014). According to the Heckman two step models, only non-participants respondents can report zero intensity of market participation. The model further assumes that individuals who participate in the market do not report zero values at all. Again, Heckman two step procedures heavily basis itself on the assumption of bivariate normal distribution of error terms of selection and outcome equations which is represented by Inverse Mill's Ratio. The coefficient on the Inverse Mill's ratio will indicate if there is selection bias (Soderbom, 2011).

Conversely, double hurdle model assumes no first hurdle dominance (i.e. the double-hurdle model assumes that zero values can be reported in both decision stages). The zeros reported in the first-stage arise from non-participation and those in the second stage come from non-sales due to the respondents' deliberate decisions or random circumstances (Efa *et al.*, 2016). John (2014) state that double hurdle model can be thought of as a flexible version of both the Tobit and Heckman model. Likelihood ratio test (LR test) is a statistical test used for comparing the goodness of fit of Tobit model and Double-hurdle model. A test of the Tobit model against the double hurdle model comes from the fact that the hurdle model log likelihood can always be written as the sum of the log likelihoods of the a probit and a truncated model (Greene, 2000 cited in Hailemariam *et al.*, 2006). Therefore, whether a Tobit or a double hurdle model is more appropriate can be determined by estimating the Tobit and the double hurdle models (the truncated regression model and the probit model) separately and then conducting a likelihood ratio test that compares the Tobit with the sum of the log likelihood functions of the probit and

truncated regression models (Genanew and Alemu, 2010). The likelihood ratio test statistics Γ can be computed (Greene, 2000) as

$$\Gamma = -2\{\ln L_{Tobit} - \ln L_{Probit} + \ln L_{Truncated}\} \sim \chi^2 \quad (5)$$

Where, Γ = likelihood ratio statistic; $\ln$ = natural logarithm; L_{Tobit} , L_{Probit} and $L_{Truncated}$ = likelihood of Tobit, Probit and Truncated regression models, χ^2 = chi-square statistic and k are the number of independent variables in the equations. The null hypothesis in the equation (1) is that the tobit model provides a better fit than the double hurdle model. Null hypothesis is rejected if probability level predicted from chi-square distributed value of Γ is less than a given significance level. Thus, test statistic for log likelihood ratio ($\Gamma = 43.4$) was higher than the chi-square distribution (27.69) at 13 degrees of freedom. According to this test, tobit model was rejected at 5% (Appendix 3).

In addition to likelihood ratio test, the two competing models were compared using AIC model selection criterion. Akaike (1974) cited by Yibeltal (2014) proposed using Kullback Leibler information for model selection. He established a relationship between the maximum likelihood, which is an estimation method used in many statistical analyses, and the Kullback Leibler information. In essence, he developed an information criterion to estimate the Kullback-Leibler information, Akaike's information criterion (AIC), which he defined as:

$$AIC = -2(\log - likelihood) + 2k \quad (6)$$

Where, K is the number of estimated parameters included in the model, the log-likelihood of the model is derived by separately estimating each competing models readily available in statistical output. The model with the lowest AIC, taken as the best model among competing models specified for the data at hand (Mazerolle, n.d). Accordingly, in this study, double hurdle model had lowest AIC indicating fitness of this model (Appendix 3).

On the other hand, it is important to test heckman maximum likelihood estimation against double hurdle model using test for non-nested maximum likelihood estimators developed by

Vuong (1989). As a result of the weakness of the standard likelihood ratio test to test models of non-nested nature, Vuong (1989) proposed a modified likelihood ratio test for non-nested maximum likelihood estimators which are based on a transformed value of the log likelihood function, using a simple transformation as:

$$W_n = \left(\frac{1}{n} \right) [LR_1]^2 - \left[\left(\frac{1}{n} \right) LR_1 \right]^2 \quad (7)$$

where n is the number of observations, LR_1 is the likelihood statistic formed from the difference between the value of the log likelihood function for the DHM evaluated at its maximum and the Heckman model evaluated at its maximum and specified as: $LR_1 = LLDH - LLHeck$ with a test statistic which has a standard normal distribution specified as:

$$\sqrt{n} \frac{LR_1}{W_n} \quad (8)$$

The decision rule is that if the test statistic is greater in absolute value than a critical value from the standard normal distribution, then the DHM fits these data better than the Heckman model. If the test statistic is smaller in absolute value than a critical value from the standard normal distribution, then the test cannot discriminate between the two models given the data at hand. Also, based on the above statistical test result (Heckman maximum likelihood estimation against double hurdle model), double hurdle model remain accepted with the data at hand (Appendix 3).

Some studies conducted on market outlet choices have used multinomial logit model (MNL). Multinomial logit models are appropriate when individuals can choose independent outcome from among set of mutually exclusive alternatives. Multinomial logit models can be used to predict a dependent variable, based on categorical independent variables, where the dependent variable takes more than one forms (Griffiths *et al.*, 2001). In reality there may be several market outlets (wholesalers, collectors, cooperative and consumers) and farmers have

the possibility to select more than two outlets simultaneously to maximize the expected utility. So, using multinomial logit model for such outlet choice study is not viable due to the possibility of simultaneous choices of outlets and the potential correlations among these market outlet choice decisions. If simultaneity in decision-making exists, this approach yields biased, inefficient and inconsistent estimates (Maddala, 1992; Greene, 2003).

Multivariate probit model simultaneously models the influence of a set of explanatory variables on the choice of market outlets, while allowing for the potential correlations between unobserved disturbances, as well as the relationship between the choices of different market outlets (Belderbos *et al.*, 2004). Multivariate probit model is a preferred model because choosing one outlet can be affected by the relative risk of choosing the other (Greene, 2003). In this study, since many farmers were selling *teff* outputs to more than one market outlets. Multivariate probit model were used to identify factors affecting market outlet choices of *teff* producers.

2.9. Conceptual Framework

Smallholder farmers supposed to produce crops for two main purposes which are consumption and marketing purpose. Smallholder farmers could entirely consume their output, entirely market, consume a part of it and market the remaining depending on the commodity. If the smallholders entirely consume their produce, it means that they are not market-oriented and they can be said to be autarchic. Market participation is viewed as two stage phenomenon. In the first stage households decide whether to participate or not to participate as a seller in the market for commodity under consideration and in the second stage, he/she decide over extent of market participation. Most variables that affect market participation decision also affect the extent of participation. Farmer's characteristics such as farm experience, family size, education, resource allocation behavior, and price perception affect both market participation decision and extent of participation (Benjamin, 2013).

Factors related to private assets such as size of land holding, livestock ownership, size of output, and income, etc. and public assets such as extension contact, access to credit, and membership in farmers association also affect both market participation decision and extent of

participation and market outlet choice. Transaction cost related variables such as distance to market, access to communication assets, ownership of transport assets affect market participation decision and extent of participation; and it also affect market outlet choice of smallholder farmer (Asresu, 2014; Mmbando *et al.*, 2015; Addisu, 2016). Conceptual framework showing how these factors are related to market participation decision, extent of participation and market outlet choose of smallholder farmer is indicated in figure below.

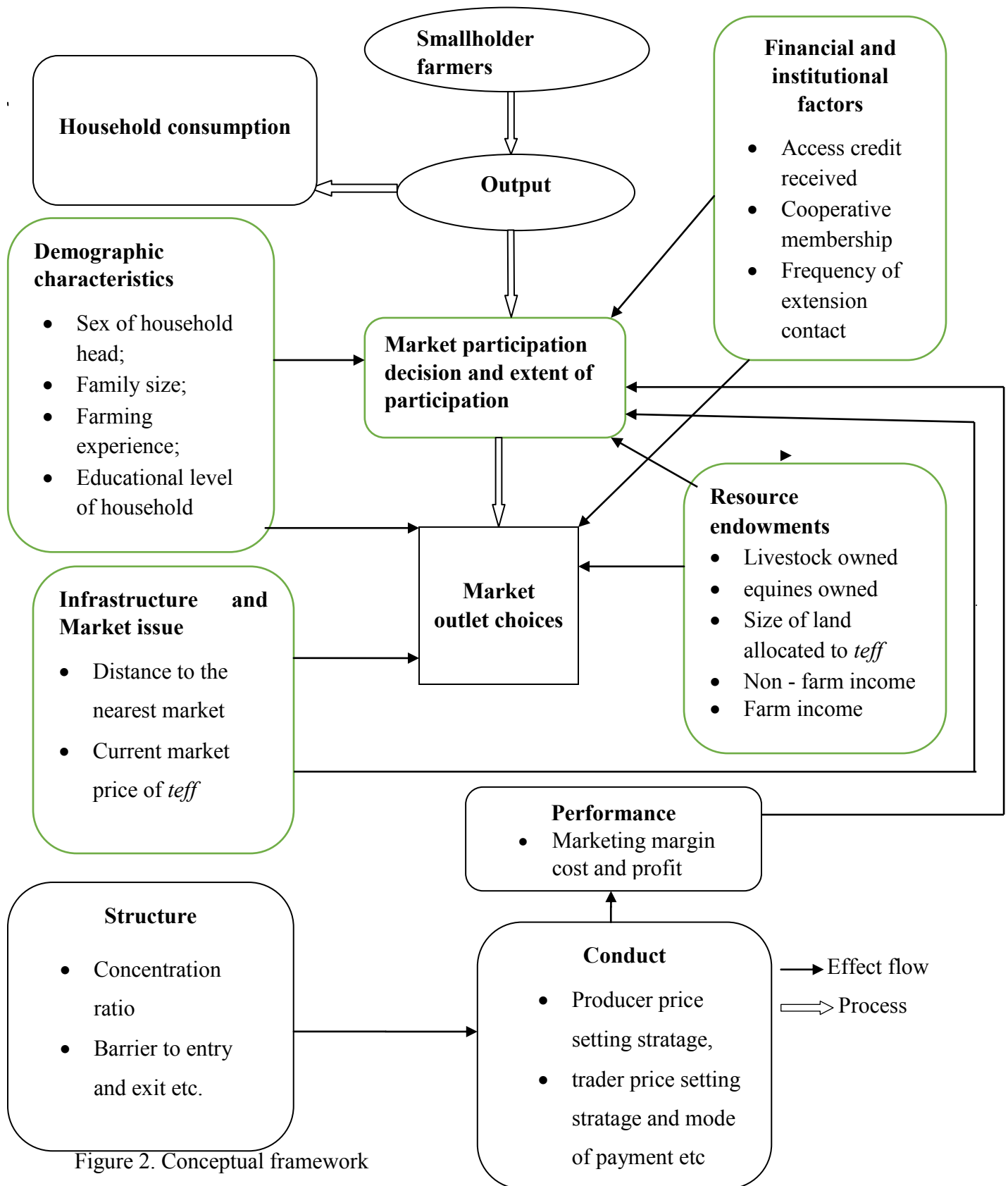


Figure 2. Conceptual framework

Source: Adopted from Benjamin (2013) and illustrated based on reviewed literature

3. RESEARCH METHODOLOGY

This chapter presents description of the study area where the research was conducted, data types, sources and methods of data collection, sampling procedure and sample size determination, methods of data analysis hypothesis and variable definitions.

3.1. Description of the Study Area

3.1.1. Location

The study was conducted in Shashamane District, West Arsi Zone of Oromia National Regional State, Ethiopia. Shashamane District is located at 250 Km south of Addis Ababa on the main road to Yabello. Astronomically, the location of the district is at latitude of 7° 12' north and a longitude of 38° 36' east and the altitude ranges from 1685- 2722 meter above sea level. The boundaries of the district adjoin Southern Nation Nationality and People and Wondo Woreda in the south, Arsi Negelle Woreda in the north, Kofale Woreda in the east and Shalla Woreda in the west (Shashamane District Agricultural Office, 2018). The total population of the District is estimated to be 241,311 of which 108,352 are males and 132,959 are females. All are in the rural dwellers. Geographical location of the study is shown in figure below.

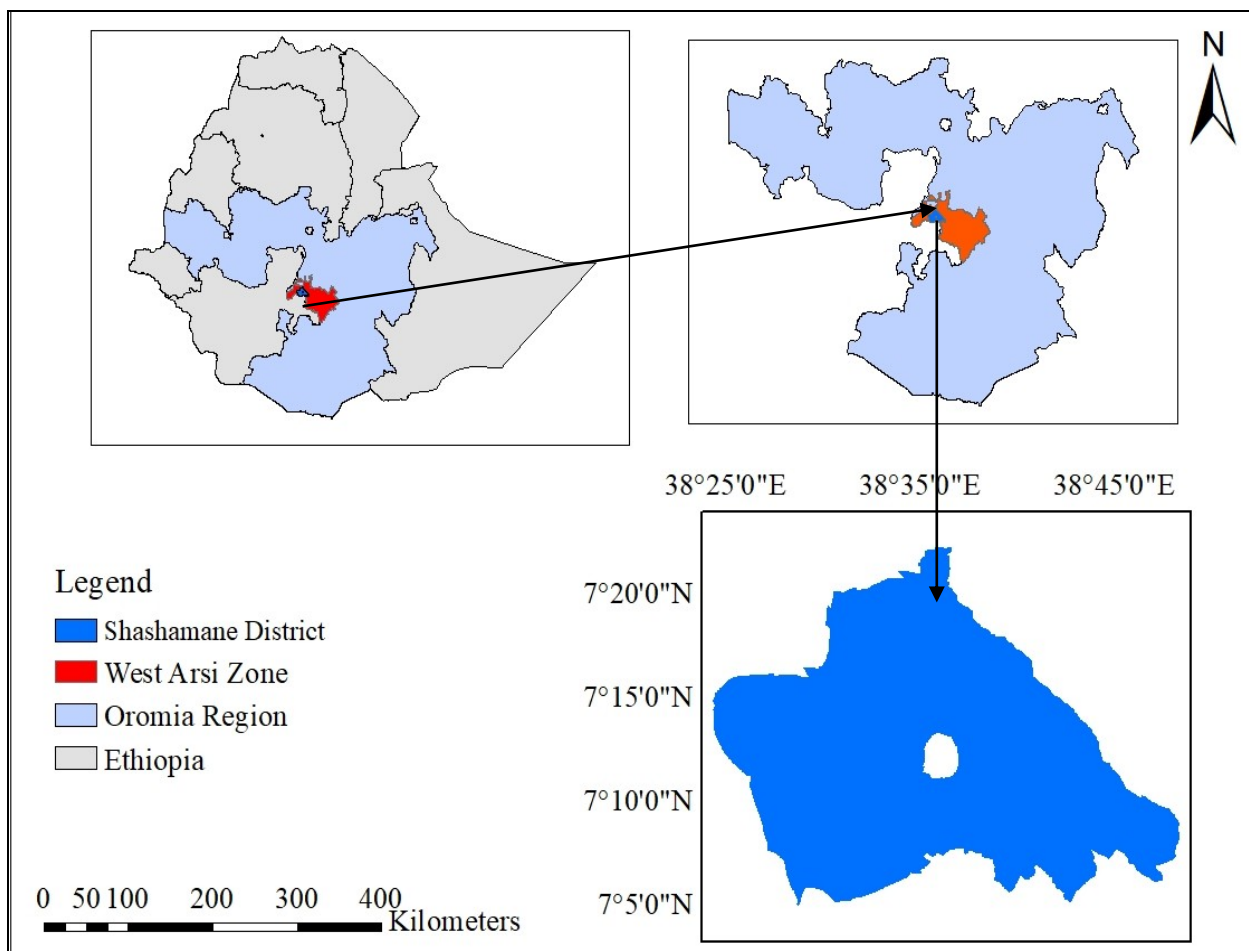


Figure 3. Geographical location of the study area

Source: Developed from Ethio-GIS (2006) and own sketch

3.1.2. Farming systems and agricultural practices

Like in many other parts of Ethiopia, the farming system in Shashamane district is still traditional with oxen (animal's power), and labor as the major means of production during land preparation, planting and harvesting as well as post-harvest processes. Rain-fed agriculture is a common practice for many farm households in this district. This district has 37 rural *kebeles* and one town administration. Shashamane district is characterized by similar agro-climatic zones, which is midland. The average annual rainfall for the area ranges from 700 to 1450 mm with a temperature range of 12 C° to 27 C°. The farmers of this district produce both in *meher* and *belg* seasons. They produce cereals such as *teff*, wheat, barley and

maize, sorghum; pulses such as haricot bean, groundnut, and vegetables in some amounts. Overall; *teff*, barley, maize, wheat and groundnut are the major crops cultivated by the farmers in the study area. Moreover, Livestock production is also an important sub-sector undertaken in line with crop production which play important role in the economy of smallholder farmers of the district. A district has a potential for livestock production which is witnessed by farmers ownership livestock such as cattle's, goats, sheep, horses, mules, donkey are livestock types that the district is endowed with (SHDAO, 2018)

3.1.3. Land utilization

Out of the overall land of the district, land has been distributed according to the use pattern and resource composition. The following table displays data indicating land allocation with respect to the cultivable land, forest, grazing, and other lands of the area. According to Shashamane District Agricultural Office (2018) annual report showed a total of 46718 hectares of land of which 40,840 hectares is used for crop production, 2,300 hectares used for grazing lands, 2,138 hectares used for forestry, 490 hectares used for marshy area, 482 hectares used for dwelling area and 468 hectares used for others purposes.

Table 1. Land utilization in Shashamane district

Land coverage type	Area (ha)	Percentage (%)
Cultivable land	40840	87.41
Grazing land	2300	4.92
Forest land	2138	4.57
Marshy area	490	1.05
Dwelling area	482	1.03
Others	468	1.01
Total	46718	100

Source: Shashamane District Agricultural Office (SHDAO), 2018

3.2. Sources, Types and Method of Data Collection

Both primary and secondary data were used for this study. Primary data were collected from randomly selected *teff* producers in the four rural Kebeles, as well as from *teff* traders and consumers in the district. The primary data collected from farmers were focusing on factors affecting the proportion of *teff* produce sold and determinants of market outlet choices. Moreover, the interview scheduled for *teff* traders includes: demographic characteristics of traders, capital requirements, buying and selling activities. The interview scheduled for *teff* consumers includes: demographic characteristics of consumers, source of income and buying activities.

Before the data were collected, the questionnaire was pre-tested on selected farmers to evaluate the appropriateness of the design, clarity, and relevance of the questions. The appropriate modification was made on the pre-tested questionnaire in order capture the relevant information related to the study objectives. Five enumerators were recruited and trained on the content of the questionnaire and interviewing process. Primary data were collected through the structured questionnaire by a team of five trained enumerators from 202 small-scale *teff* farmers.

Secondary data on socio-economic information of the district, prices, outputs, and market outlet choices, trends in agricultural production, opportunities and challenges of *teff* production and marketing were collected by reviewing secondary sources from published and unpublished documents of governmental institutions, including the central statistical agency (CSA), the agricultural and rural development office of Shashamane district, trade and industry office of district, and from journals and website.

3.3. Sampling Procedures and Sample Size Determination

Target populations for this study were smallholder *teff* producers, traders and consumers in Shashamane district. Two stage random sampling procedures were used for the selection of sample household heads. In the first stage, four *kebeles*; namely, Awasho Denku, Wandere, Jigessa and Kiraraa-filicha were selected from thirty seven *teff* producer *kebeles* using simple random sampling technique. Reasons of choosing four Kebeles were there was homogeneity

among each Kebeles in most cases, they were living in similar agro-ecology (midland) and produce for market and consumption purpose. Thus, the four selected Kebeles can be representative. In the second stage, from the total of 2545 households in the selected four Kebeles, 202 sample household heads were randomly selected using probability proportional to size of *teff* producer households in four Kebeles, by using a formula developed by Yamane (1967). Accordingly, the required sample size at 93% confidence level and level of precision equal to 7% were used to obtain a sample size required to represent the true population.

$$n = \frac{N}{1 + N(e)^2} \quad (9)$$

Where N = 22200 (Total number of households in the study *district*)

$$e = 0.07$$

$$n = \frac{22200}{1 + 22200(0.07)^2} = 202$$

Where, n is the sample size, N is the population size (population of interest) e is the level precision.

Table 2. Sample distribution of *teff* producer households in selected Kebeles

No	Kebeles	Total number of households	Proportion	Number of sampled Households
1	Awasho Denku	430	0.17	34
2	Wandere	565	0.22	45
3	Jigessa	850	0.33	67
4	Kiraraa filicha	700	0.27	56
Total		2545	1.00	202

Source: Shashamane District Agriculture Office, 2018 and own computation result

In addition, data were also collected from *teff* traders. Similarly, data were also collected from consumers. The sites for the trader surveys were market towns in which *teff* traders exist. On the basis of flow of *teff*, two markets (Shashamane and Hawaasa) were selected as the main *teff* marketing sites for the study areas. *Teff* traders (wholesalers, rural collectors and retailers) were collected from specified markets through observation in the market. As a result, 22 *teff* traders were interviewed for the purpose of the study. Both licensed and unlicensed traders were included in the traders' survey. Furthermore, 15 and 13 consumers were interviewed from Shashamane and Hawaasa, respectively to obtain information related to consumers.

Table 3. Distribution of *teff* traders

Traders	Shashamane	Hawaasa	Total
Rural Collectors	3	0	3
Retailers	7	5	12
Wholesalers	5	2	7
	15	7	22

Source: Own survey results, 2018.

3.4. Methods of Data Analysis

Descriptive statistics and econometric models were used for analyzing the data collected from smallholder *teff* producers, traders and consumers.

3.4.1. Descriptive statistical analysis

This method of data analysis refers to the use of mean, percentages, and standard deviations that were used in the process of examining and describing farm households' demographic characteristics, resource ownership, institutional and infrastructural service, production characteristics and farm input use, *teff* marketing channels, financial asset and demographic characteristics of *teff* traders and consumers.

Structure- conduct- performance (S-C-P) approach was used to examine relationship between market structure, conduct, and performance. Tadele *et al.* (2016) used this model to assess the overall structure-conduct and performance of *teff* and wheat marketing Dandi District of West Shewa. In this study also S-C-P approach were used to evaluate performance of *teff* market in the study area.

Market structure: the perfect competition market model is often used in economics as standard by which structure and conduct of markets can be compared and evaluated. Knowledge regarding structure can give indications about competitiveness. The variables used to explain market structure are the degree of concentration, vertical and horizontal integration, and condition of entry in the market and magnitude of product differentiation (Nambiro *et al.*, 2001).

A. Concentration Ratio (C): A market concentration ratio is a measure of the percentage share of the market controlled by a specified percentage of firms ranked in order of market share from the largest to the smallest (Karugaia, 1990). Thus, a four-firm concentration ratio is the total market share of the four firms with the largest market shares. The greater degree of concentration is the greater the possibility of non-competitive behavior existing in the market. The concentration ratio (market ratio) of individual was calculated using a formula:

$$C = \sum_{i=1}^r Si \quad i = 1, 2, 3, 4, \dots, r \quad (10)$$

Where, C= concentration ratio; Si = is the percentage market share of ith firm a r = is the number of largest firms for which the ratio is calculated

$$MS_i = \frac{V_i}{\sum V_i} \quad (11)$$

MS_i = Market share of buyer i $\sum V_i$ = Total amount of product handled by the r firms,

V_i = Amount of product handled by the buyer

B. Barriers to entry: a barrier to entry is simply any advantage held by existing firms over those firms that might potentially produce in a given market. The modes of entry into trade, means of building capital, means of acquiring marketing skills, the origins and levels of initial capital required for traders of different sizes, license procedure can be used as centre of data to see the barriers to entry (Timmer *et al.*, 1983).

Market conduct: Market conduct refers to the behavior of firms or the strategies used by the firms. In this study, market conduct used to identify sample *teff* producers and traders selling and buying strategies (price setting system, mode of payment, and source of information) used by sample chain actors.

Market performance: Market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output. Marketing margin and marketing cost are the important methods to determine whether the performance of the market is good or not. In this study to analyze *teff* market performance, marketing margins and

marketing costs of *teff* were calculated. The total marketing margin of chain actors was calculated by using the following formula.

$$TGMM = \frac{\text{consumer price} - \text{farmer price}}{\text{consumer price}} \times 100 \quad (12)$$

$$GMMP = \frac{\text{consumer price} - TGMM}{\text{consumer price}} \times 100 \quad (13)$$

Where; TGMM = Total Gross Marketing Margin

GMMP= Gross Marketing Margin of Producer.

3.4.2. Econometric analysis

3.4.2.1. Determinants of market participation decisions and extent of participations

So far, empirical studies on analysis of the smallholder market participation have used various analytical models depending up on their nature of dataset. This study have used double hurdle model to identify factors that influence smallholder *teff* market participation decision and intensity of *teff* sales in the study area. According to Cragg (1971), double-hurdle model evaluating two separate decisions regarding decision to participation in a *teff* output as seller and the extent of participation (intensity of *teff* sale) each of which is determined by a different set of explanatory variables can be specified as:

$$d_i^* = W_i' \beta + v_i \quad v_i \sim N(0, 1) \quad (14)$$

$$d_i = \begin{cases} 1 & \text{if } d_i^* > 0 \\ 0 & \text{if } d_i^* = 0 \end{cases}$$

$$y_i^* = X_i' \delta + u_i, \quad u_i \sim N(0, \sigma^2) \quad (15)$$

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \text{ and } d_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

Where, d_i^* is a unobservable variable describing *ith* households' decision to participate in the *teff* output market as seller (d_i), y_i^* is a latent (unobservable) variable describing *ith* household extent of participation in the *teff* output market, y_i is the observed variable (actual quantity of *teff* sold by household *i*), W_i' and X_i' are vector of variables explaining the participation decision and extent of participation decision respectively, β and δ are vectors of parameters to be estimated, v_i and u_i are respective error terms assumed to be independent and normally distributed. According to Cragg (1971), log likelihood function for the double hurdle model that nests a univariate probit model and a truncated regression model specified as follows.

$$\ln L = \sum_0 \ln \left[1 - \Phi(W_i' \beta) \left\langle \frac{X_i' \delta}{\sigma} \right\rangle \right] + \sum + \ln \left[\Phi(W_i' \beta) \frac{1}{\sigma} \phi \left\langle \frac{y_i - X_i' \delta}{\sigma} \right\rangle \right] \quad (16)$$

Where, Φ and ϕ represent standard normal probability and density functions respectively, W_i and X_i represent independent variables for the probit model and truncated regression model respectively β , σ , δ , and are parameters estimated from each model.

3.4.2.2. Determinates of market outlet choices

Multivariate probit model simultaneously model the influence of a set of explanatory variables on choice of market outlets, while allowing for the potential correlations between unobserved disturbances as well as the relationship between the choices of different market outlets (Belderbos *et al.*, 2004). In the study, smallholder *teff* producers face different choices of market outlets like: wholesalers, consumers, collectors and retailer since *teff* is one of the cash crops that enable producers to choose more than one outlet that are not mutually exclusive to get better price. Considering the possibility of simultaneous choices of outlets and the potential correlations among these market outlet choice decisions multivariate probit model (mvprobit) was appropriate and applied to capture household variation in the choice of market outlets and to estimate several correlated binary outcomes jointly. Therefore, to investigate

factors affecting market outlet choice of sample household's multivariate probit model was used.

The observed outcome of market outlet choice can be modeled following random utility formulation. Consider the i th farm household ($i=1, 2, \dots, N$), facing a decision problem on whether or not to choose available market outlets. Let U_o represent the benefits to the farmer who chooses wholesalers, and let U_k represent the benefit of farmer to choose the K^{th} market outlet. The farmer decides to choose the k market outlet if $Y_i^* k = U_i^* k - U_o > 0$

The net benefit that the farmer derives from choosing a market outlet is a latent variable determined by observed explanatory variable (x_i) and the error term (ε_i)

$$Y_i^* k = x_i' \beta k + \varepsilon_i \quad (17)$$

Using the indicator function, the unobserved preferences in the above equation translates into the observed binary outcome equation for each choice as follows:

$$Y_{ik} = \begin{cases} 1 & \text{if } x_i' \beta k + \varepsilon_i > 0 \\ 0 & \text{Otherwise} \end{cases} \quad (18)$$

Where: x' is a vector of explanatory variables

β denotes the vector of parameters to be estimated and

ε are random error terms distributed as multivariate normal distribution with zero mean and unitary variance.

Y_i is a set of binary dependent variables such as: Y_1 = Producer to retailer, 1 for the farmer who choose retailer, 0 otherwise; Y_2 = Producer to collector, 1 for the farmer who choose collector, 0 otherwise; Y_3 = Producer to consumer, 1 for the farmer who choose consumer, 0 otherwise and Y_4 = Producer to wholesaler, 1 for the farmer who choose wholesaler, 0 otherwise.

In multivariate probit model, where the choice of several market outlets is possible the error terms jointly follow a multivariate normal distribution (MVP) with zero conditional mean and

variance normalized to unity (for identification of the parameters) Where $(\mu y1 \ \mu y2 \ \mu y3 \ \mu y4) \sim MVN(0 \ \Omega)$ and the symmetric covariance matrix

$$\text{Give by: } \Omega = \begin{pmatrix} 1 & \rho y_1 y_2 & \rho y_1 y_3 & \rho y_1 y_4 \\ \rho y_2 y_1 & 1 & \rho y_2 y_3 & \rho y_2 y_4 \\ \rho y_3 y_1 & \rho y_3 y_2 & 1 & \rho y_3 y_4 \\ \rho y_4 y_1 & \rho y_4 y_2 & \rho y_4 y_3 & 1 \end{pmatrix} \quad (19)$$

Particular interest is off-diagonal elements in the covariance matrix, which represents the unobserved correlation between the stochastic components of the different type of outlets. This assumption means that the above equation generates a MVP model that jointly represents decision to choose particular market outlet. This specification with non-zero off-diagonal elements allows for correlation across error terms of several latent equations, which represents unobserved characteristics that affect the choice of alternative market outlets. Following the form used by Cappellari and Jenkins (2003), the log-likelihood function associated with a sample outcome is given by:

$$\ln L = \sum_{i=0}^N \omega_i \ln \Phi(\mu, \Omega) \quad (20)$$

Where ω_i is an optional weight for observation i and Φ is the multivariate standard normal distribution with arguments μ_i and Ω , where μ_i can be denoted as;

$$\mu = (\mathbf{K}_{i1}\beta_{i1}\chi_{i1}, \mathbf{K}_{i2}\beta_{i2}\chi_{i2}, \mathbf{K}_{i3}\beta_{i3}\chi_{i3}) \text{ While } \Omega_{ik} = 1 \text{ for } j = k \text{ and} \quad (21)$$

$$\Omega_{jk} = \Omega_{kj} = \mathbf{K}_{ij}\mathbf{K}_{jk}\rho_{jk} \text{ for } j \neq k, \quad k = 1, 2, 3 \dots \text{Whith } \mathbf{K}_{ik} = 2y_{ik} - 1 \quad (22)$$

3.5. Definition of Variables and their Hypothesis

To identifying the factors influencing market participation and extent of participation decision and market outlet choice of *teff* producers in the study area, the main task is exploring which factors significantly influence and how (the direction of the relationship) these factors are

related with the dependent variable is required. Hence, the following dependent and independent variables were hypothesized.

3.5.1. Dependent variables

Market participation decision: it is dummy variable, taking a value of 1 if the respondent participated in *teff* market and 0 if the respondent did not participant in market in (2017/18 production year).

Quantity of *teff* sold (QtSold): It is the quantity of *teff* actually supplied to market measured in quintal and it takes positive value for those households who supplied *teff* in the production year.

Market outlet choice (MKTOCH): It is a categorical dependent variable measured by a choice of outlets defined and measured as binary outcome. The multivariate probit model has a set of categorical binary dependent variables Y_i , such as: Y_1 = Retailer; Y_2 = Collectors; Y_3 = Consumers; and Y_4 = Wholesalers for the farmer who chooses retailer, collectors, consumers and wholesalers respectively.

3.5.2. Independent variables

Based on the literature reviewed, the independent variables expected to affect the dependent variable and their expected effect were the following:

Sex of the household head (SEXHH): It is a dummy variable taking a value of 1 if the household head is female and 0 otherwise. Male-headed households have better access to information which would provide them with better ability to manage their farms and produce more surpluses for market as compared to female headed households (Leykun and Jemma, 2014). Male have relatively better labor advantage to produce and supply more volume of *teff* and the need of cash for expenditure made them to supply higher volume of *teff* to the market (Tadele *et al.*, 2016). Mussema and Dawit (2012) found that male-headed households participated more in pepper market in Selti and Aalaba Special districts in Ethiopia than their female-headed counterparts. Male headed households have a better tendency in searching a

market alternative for the sale of produce than female headed household (Girma and Abebaw, 2012). Therefore, Sex of the household head (being female) was expected to affect proportion of *teff* sold negatively and it also influenced the market outlet choices decision either positively or negatively.

Educational level of the household head (EDUHH): It is a continuous variable that refers to the number of years of formal schooling the household head attended. Education increases the ability of farmers to get and analyze relevant market information which would improve the managerial ability of the farmers in terms of better formulation and execution of farm plans, and acquiring better information to improve their marketing performance (Aman *et al.*, 2014). Formal education is hypothesized to have positive influence on volume marketed. Chala and Chalchisa (2017) found that by making informed decisions educated farmers choose the best market outlets to sale their farm produce. The study by Nuri (2016) showed that education level of *bullaa* producers has a significant and positive effect on the chances of choosing wholesalers and Retailers market outlets and a negative relationship with collectors' market outlet choice. Enete and Igbokwe (2009) also argued that education will endow the household with better production and managerial skills which could lead to increased participation in the market. Hence, this variable was expected to positively affect *teff* market participation and extent of participation and it was also hypothesized to positively affect producer's decision to choose wholesalers and retailers market outlets and negatively affect producer's decision to choose collector's market outlet.

Family size (FAMSIZE): It is a continuous variable that refers to the total number of members of the household and measured in terms of adult equivalent. Having more household members reduces the proportion of output that going to the market because of households with large member tend to consume more of what they have produced and less is available for sales (Efa *et al.*, 2016). As the proportion of output consumed at home increased, the quantity of output sold decreased. The size of economically active family members within a given farming household affects the crop production activities positively. So, in this respect family size was expected to have positive impact on likelihood of participating in a market and sale volume. Takele *et al.* (2017) found that having large family size was good for delivering

output to the final market outlet. Addisu (2017) found that household size positively affect likelihood of choosing wholesalers outlet and negatively affect likelihood of choosing consumer and collector outlet. Chala and Chalchisa (2017) found that family size negatively affect likelihood of choosing retailer outlet. Therefore, family size was expected to positively or negative effect on *teff* market participation and extent of participation and it was hypothesized to positively affect producer's likelihood of choosing wholesalers and also a negatively affect producer's likelihood of choosing consumer, retailer and collector outlet.

Teff farming experience (FREXP): It is a continuous variable measured by number of years of experience the households have in *teff* producing and marketing at the time of interview. Farmers with longer production experience are expected to be more knowledgeable and have good weather forecasting ability, this improves the productivity and quantity of output sold. Having crop production and marketing experience leads the farmer to produce more output and the amount supplied to the market also increased. Alemnew (2013) found agricultural experience has positive and significant effect on household market supply of red pepper. Addisu (2016) found that farmers who had been growing onion for many years were found to sell onion by choosing outlet than those with less years of experience. More experienced farmers had better knowledge of cost and benefits associated with various onion market outlets, consequently they were chosen outlets that benefits by retailing at market day. (Bezabih *et al.*, 2015) found that likelihood of choosing collector and wholesaler was negatively and positively affected by farming experience respectively. Therefore, farming experience was expected to influence market participation and extent of participation positively and it was also affects the market outlet choices decision either positively or negatively.

Livestock owned (LIVOWN): This variable is a continuous variable and refers to the total number of livestock household owns excluding equines in terms of TLU. It is assumed that households with larger TLU would have better economic strength and financial position to purchase and use sufficient amount of fertilizer and other inputs that would help to improve his/her production (Teferi, 2003). According to Adam and Dawit (2015), crop output market participation increases with livestock possession. Study by Rehima (2007) on pepper

marketing showed that, TLU showed a negative sign on quantity of pepper sales. Therefore, this variable was expected to have a positive association with probability of market participation and extent of participation. Gizachew *et al.* (2018) revealed that those households producing high amount of *teff* output are more likely selling their *teff* produce to wholesaler outlet. Therefore, it was hypothesized to positively affect producer's likelihood of choosing wholesalers outlet.

Equines owned (EQUIO): It is a continuous variable measured in Tropical Livestock Unit (TLU) the household owned (includes: Donkey, Mule and Horse). Ownership of means of transport such as donkeys has a positive effect on market participation by reducing the cost of transporting inputs from the market to the farm and output from the farm to the market (Efa *et al.*, 2016). Ownership of equines (donkey) increased volume of *teff* sold, due to its contribution to transportation (Mebrahatom, 2014). Farmers who have equine transport go distant market, choose the best outlets to sale their produce and be able to achieve higher price (Shewaye, 2016). Therefore, number of equines owned was hypothesized to have positive effect on the proportion of *teff* sold and it was also influence the market outlet choices decision either positively or negatively.

Size of land allocated for *teff* production (SIZEATEF): It is continuous variable measured in terms of a hectare of land allocated for *teff* production by the households. It includes self-owned, rented in and shared in land. Land size cultivated has a positive significant outcome on being transition and commercial farmer (Leykun and Jemma, 2014). Oliyad *et al.* (2017) found an increase in land allocated to groundnut increases farmers' likelihood of choosing wholesaler outlet than consumers' outlet. Yaregal *et al.* (2019) found an increase in land allocated to potato increases farmers' likelihood of choosing retailer outlet. Mebrahatom (2014) found significant relationship between intensity of *teff* market participation and proportion of land allocated for *teff*. Efa *et al.* (2016) have also found positive and significant relationship between levels of *teff* marketed surplus and land allocated for *teff*. Therefore, land size allocated for *teff* production was hypothesized to have a positive effect on market participation and extent of participation and it was hypothesized to positively affect producer's

likelihood of choosing wholesalers and retailer and also a negatively affect producer's likelihood of choosing consumer outlet.

Distance to the nearest market (MRKTDIS): It is a continuous variable and measured in kilometer farmers travel to sale their *teff* produce to the market. Farmers located in a village or distant from the market is weakly accessible to the market, the closer to the market the lesser will be the transportation cost and time spent. Tadele *et al.* (2017) indicated that distance to market of selling wheat in kilometers from wheat producers homestead influence the level of commercialization negatively and significantly. Distance to the nearest market is significant determinant of choice of marketing outlets (Riziki *et al.*, 2015). Addisu (2016) found that market distance has negative relationship with wholesalers outlet. Addisu (2017) found that market distance has positively related with consumer and collectors' outlet. Berhanu and Moti (2010) found negative and significant effect of market distance on crop output market participation. Hence, distance from nearest market was hypothesized to be negatively related to *teff* market participation and extent of participation and it was also hypothesized to negatively affect producer's decision to choose wholesalers and also positively affect producer's decision to choose consumer and collectors' outlet.

Access to credit service (ACREDIT): It is a dummy variable that taking a value of 1 if a household head has access to credit service and 0 otherwise. Credit plays an important role in solving cash constraints needed in production and used to purchase inputs such as fertilizers, improved seed and herbicide that used to enhance wheat production and productivity, which in turn has a positive effect on marketable surplus (Tadele *et al.*, 2017). Access to credit has positive influence on volume of output supply, this indicate that those farmers who have access to formal credit are more probable to supply marketable surplus. Therefore, this variable was expected to have a positive influence on probability of market participation and extent of market participation.

Farm income (FARMINC): - It is a continuous variable which refers to total annual earnings of the family from agricultural activities measured in monetary value (ETB). This is believed to be the main source of capital for purchasing agricultural inputs. According to (Tsibuk,

2015) households with relatively higher income are more likely to adopt new *teff* varieties, purchase fertilizer and other agricultural technologies. Benjamin (2013) found that households with larger incomes are able to cultivate larger parcels of land than those with lower incomes. Consequently, larger parcels of land result in the ability to produce marketable surplus to participate in the market. Hence, farm income was hypothesized affect participation and extent of participation positively.

Frequency of extension contact (FRQEXT): It is a discrete variable measured in a number of days that development agent (DA) advice on *teff* production and marketing in that production year. It indicated that extension service helps in availing the information regarding the technology, which improves the production (Tadele *et al.*, 2016). Extension service was positively related to the volume of *teff* supplied to the market. Mekonin (2015) found that farmers' use of extension service increased the ability of farmers to acquire important market information as well as other related agricultural information, which in turn increases farmers' ability to choose the best market outlets for their produce. Oliyad *et al.* (2017) found that farmers' use of extension service had significant negative effect on the likelihood of choosing consumer outlets. Abraham (2013) found that negative impact of agricultural extension service on the probability of choosing collector and retailer outlets and positive effect wholesale outlet in vegetable market outlet choice. Hence, frequency of extension contact was hypothesized to have a positive influence on market participation and extent of participation and it was hypothesized to positively affect producer's likelihood of choosing wholesalers and also a negatively affect producer's likelihood of choosing consumer ,retailer and collector outlet.

Non-farm income (NONFARM): It is a continuous variable measured in monetary value (ETB) and shows the amount of income obtained from non-farm activities undertaken by household members in 2017/18. Involvement in non-farm income negatively affect the marketed surplus of haricot bean, farmers who had more cash from non-farm sources were not able to encouraged earning cash from sale of haricot bean and sold less output than those who did not have access (Shewaye, 2016). Farmers who gain more income may sale their products to the nearest market outlet. Abraham (2013) found income from non-farm activity decrease the probability to sell to the best market outlet. Likewise, more participation of households in

non-farm activities reduces agricultural production by reducing time required for management of agricultural activities that will in turn reduce marketed surplus. Yassin (2016) found negative effect of non-farm income on probability of potato market participation and level of potato sale. Hence, it was hypothesized that non-farm income influence market participation and extent of participation negatively and it was also influences the market outlet choices decision either positively or negatively.

Current market price of *teff* (CURPRICE): It is a continuous variable measured in monetary value in ETB per quintal in 2017/18 production year. Market price of *teff* varies among different market outlets and in the market day, farmers are motivated to sell their produce by selecting a particular market outlet that has higher price. This makes the supply to be directly related with a price offered. Addisu (2016) and Sultan (2016) reported own product price negatively affect the likely of selling to consumer and collector outlets. Fikiru *et al.*(2017) found that market price positively affect the likely of selling to wholesaler outlet. Therefore, current market price of *teff* was hypothesized to have negatively affect likelihood of choosing consumer and collector and positively affect the likely of selling to wholesaler market outlet.

Cooperative membership (COOPMEM): This is a dummy variable that taking a value 1 if a household head is a member of cooperatives and 0 otherwise. Being a member of a cooperative farm household can easily access agricultural inputs like seed, fertilizer and herbicide those required for crop production. Better access to agricultural input helps the farmer to produce and sell more output. Bizualem *et al.* (2015) found that those who are members of cooperative might be motivated with double payment (dividend payment besides actual price of commodity) than non-members and motivated to increase the quantity of coffee marketed. Therefore, membership to cooperative was hypothesized to positive influence on market participation and extent of participation.

Table 4 . Summary and hypothesis of independent variables

Variables	Type	Measurement	Expected effect
Dependent variables		Dummy	
Market participation decision		Quintal	
Quantity of <i>teff</i> sold			
Independent Variables			
Sex of the household	Dummy	1 if the household head is female; 0 otherwise	-
Educational level of the household	Continuous	No of years schooling	+
Family size	Continuous	Adult equivalent	+/-
<i>Teff</i> farming experience	Continuous	No of years	+
Equines owned	Continuous	TLU	+
Livestock owned	Continuous	TLU	+
Size of land allocated for <i>teff</i> production	Continuous	Hectare	+
Distance to the nearest market	Continuous	Kilometer	-
Farm income	Continuous	ET Birr	+
Access to credit	Dummy	1 if the household head has access to credit; 0 otherwise	+
Non-farm income	Continuous	ET Birr	-
Frequency of extension contact	Discrete	Frequency	+
Cooperative membership	Dummy	1 if the household head is Member of cooperatives; 0 otherwise	+

Source: Own computation based on reviewed literature 2018

Table 5. Summary and hypothesis of independent variables for market outlet choices

Variables	Type	Measurement	Expected effect			
			Wholesale rs	Consumers	Retailer	Collector
Sex of the household head	Dummy	1 if the household head is female;0 otherwise	+	-	+	-
Educational level of the household	Continuous	No of years of schooling	+	-	+	-
Family size	Continuous	Adult equivalent	+	-	-	-
Farming experience	Continuous	No of years	+	-	+	-
Livestock owned	Continuous	TLU	+	-	+	+
Equines owned	Continuous	TLU	+	+	+	+
Size of land allocated for <i>teff</i>	Continuous	Hectare	+	-	+	+
Distance to the nearest market	Continuous	Kilometer	-	+	-	+
Non-farm income	Continuous	ET Birr	-	-	-	+
Frequency of extension	Discrete	Frequency	+	-	-	-
Current market price	Continuous	ET Birr per quintal	+	-	+	-

Source: Own computation based on reviewed literature 2018

4. RESULTS AND DISCUSSION

In this chapter, the main findings of the study were presented and discussed. Under first section of this chapter, Descriptive statistics were employed to describe the general demographic and socio-economic characteristics of sampled *teff* producers, *teff* traders and consumers. Structure, conduct and performance analysis was used to evaluate whether *teff* market in the study area is efficient or not. Market outlets available in the study area and the existing *teff* marketing channels were also indicated. In the second section, econometric results such as factors affecting smallholder's decisions to participate in *teff* market, and the level of produce marketed and factors affecting market outlet choice of *teff* producers in the study area are presented and discussed.

4.1. Descriptive Results

4.1.1. Demographic and socio-economic characteristics of sample households

The result of the survey indicates that out of total 202 sample households, 148(73.27%) households were *teff* market participants and 54(26.73%) households were non participants of *teff* market. Group comparisons of *teff* market participants and non-participants was compared using *t*-test for continuous variables and χ^2 -test for dummy variables, and the results are presented in the consecutive tables.

As indicated in Table 6, out of total sample respondents, 152 (75.24%) were male-headed and 50(24.75%) were female-headed households. Among market participants, male headed and female headed households constitute 79.60% and 54% respectively. Out of non-participants, 20.39% were male headed while the remaining 46% were female headed households. Regarding cooperative membership, 95(47.02%) of the sample households were members of cooperatives and 107(52.97%) were not organized under cooperatives. The χ^2 (Pearson χ^2 (1)) test result among market participants and non-participants indicate the existence of significant difference between groups in terms of sex of household head and cooperative membership (Table 6). These indicate that market participants are more in number than non-participants in terms of the different categories and this relationship is real. The distribution of

marital status shows that out of the total sample respondents, 15(7.42%), 172(85.14%), 11(5.44%) and 4(1.98%) were single, married, widowed and divorced household heads, respectively.

Table 6. Dummy variables of sample household heads

Variables	Participant		Non-participant		Total		χ^2 – value
	N	%	N	%	N	%	
Sex of household head							
Female	27	54	23	46	50	24.75	12.5941***
Male	121	79.60	31	20.39	152	75.24	
Cooperative membership							
Yes	89	93.68	6	6.31	95	47.02	38.1696***
No	59	55.14	48	44.85	107	52.97	
Access to credit							
Yes	42	80.76	10	19.23	52	25.74	0.4422
No	106	70.66	44	29.33	150	74.26	

Source: Own survey result, 2018

Two-group mean-comparison test of continuous variables used in the study revealed that there was a significant mean difference between market participants and non-participants (Table 7). Accordingly, the average age of participants was 43.75 years, while for non-participants it was 42.89 years. With regards to the educational level of sample household heads, the average number of formal schooling years completed for participants was 4.56 years and for non-participants, 3.22 years and for the total sample 4.23 years. The mean difference in educational level of household head among market participant and non-participant is statistically significant at 1% significance level.

The average family size in adult equivalent for the market participants was found to be 3.28, while for non-market participants was found to be 6.33 and for total sample 4.02 which are slightly lower than national mean of 5 members per household (FAO, 2015). The mean

difference in family size among market participant and non-participant is statistically significant at 1% significance level.

Table 7. Continuous variables of sample respondents

Variables	Mean			Std. Dev.	t-value
	Participant	Non-Participant	Total		
	n = 148	n = 54	N=202		
Education level	4.56	3.22	4.23	2.39	-3.4903***
Family size	3.28	6.33	4.02	2.50	8.6827***
Farming experience	8.29	7.79	8.17	4.42	-0.6852
Livestock owned	4.82	3.46	4.49	2.51	-3.3678***
Equines owned	1.45	1.07	1.35	1.06	-2.1992***
Size of land under <i>teff</i> production	0.85	0.64	0.80	0.43	-3.0557***
Distance to the nearest market	5.63	8.34	6.29	2.17	9.0058***
Frequency of extension contact	2.18	1.18	1.94	1.08	-6.1149***
Non-farm income	4218.92	4157.40	4202.48	3930.2	0.0689

Source: Own survey result, 2018

Symbols: ***, **and * indicates significant at 1%, 5% and 10% levels, respectively

4.1.2. Resource ownership of sample households

Ownership of physical resources is an important factor that determines market participation decision of smallholder farmers and alternative market outlet choices. Land, labor, capital and other resources are the major resources that farmers used to enhance market participation of *teff* and to choose alternative market outlets of *teff* that provide a greater return.

The analysis of survey data depicts that the average size of land allocated under *teff* for market participants was 0.85 ha; while for non-participant was 0.64 ha. The T-test of variability between the groups showed that there was a statistically significant difference in terms of size of land allocated for *teff* between participants and non-participants at 1% significance level. The average area of land under *teff* production by sample households was 0.80 hectare with standard deviation of 0.43 (Table 7). The average total land size owned by the sample

households was 1.40 hectare with standard deviation of 0.96. This land holding size in the area is equal to average national land holding size of about 1.4 ha per household stated in CSA and WB (2013). In the district, mixed crop and livestock farming system is dominantly used by farm households. Livestock resources are useful in the livelihoods of smallholders; oxen are the major contributors to crop production by serving as a draft power. Farmers in the study area used oxen to undertake different agronomic practices, out of which ploughing and threshing are the major ones. The mean difference in livestock owned among market participant and non-participant is significant at 1% significance level. The mean livestock holding by sample households excluding equines in TLU for participant and non-participant was 4.82 and 3.46 respectively, and 4.49 for total sample households (Table 7). This livestock holding in the area is higher than average national livestock holding of about 2 TLU per household stated in FAO (2015).

In the study areas equines are used as a means of transport by smallholder farmers. Equines provide transport services for farm inputs from market to home, harvested farm produce from field to threshing center and for marketing of output. The mean difference in equines owned among market participant and non-participant is statistically significant at 1% significance level in (Table 7). The mean equines owned by sample households in TLU for participant and non-participant were 1.45 and 1.07 respectively, and 1.35 for total sample households.

4.1.3. Institutional and infrastructural services of farm households

Having institutional services and improved infrastructural services are important factors that encourage the market participation and market outlet choice of smallholder farmers through a positive effect on technology transfer, ease access to input and output markets. Sample households received different service regarding *teff* production and marketing that enables them profitable and improve their livelihood.

Agricultural extension service provisions on production and marketing have direct influence on the production and marketing behavior of the farmers. The agricultural extension service providers in the district are office of agriculture experts, development agents and researchers.

The major extension services provided in relation to *teff* production includes: improved varieties of *teff*, row planting, input use, soil and water conservation, harvesting, post-harvest handling and marketing of *teff*. The mean difference in extension contact among market participant and non-participant was statistically significant at 1%. The average frequency of extension service provided for participant and non-participant were 2.18 and 1.18 and for sampled households was 1.94 days/year (Table 7). The mean distance from the nearest market for the whole sample was 6.29 kilometers. The mean distance from the nearest market for market participants was 5.63 kilometers while it was 8.34 kilometers for non-participants. T-test result shows that, there was statistically significant difference between participants and non-participants in distance from the nearest market at 1% significance level (Table 7)

Statistically significant difference was not observed between participants and non-participants in terms of farm experiences, access to credit and non-farm income.

4.1.4. Farm income sources of sample households

As Table 8 shows, the major farm income sources of sample households in the study area were sale of crops, livestock and its product's sale. Farm income from livestock and its product's sale had the mean of 3706.08 Birr for the pooled sample, with participants having Birr 3923.85, while non-participants had 3109.26 Birr. There was a statistically significant difference between the participants and non-participants in terms of farm income from livestock and its product's sale at 5% significance level.

Farm income from all crop sales had the highest mean of Birr 6362.87 for the total sample households indicating that crop sale is the major income source of sample households in the study area. Market participants had the mean income from all crop sales of Birr 6531.35, while non-participants had Birr 5901.11. The farm income from *teff* sale has contributed 48.77% to the total income from all crop sales for the whole sample. Income from all crop sales was not significant between the participants and non-participants, while total average farm income was significantly different between the participants and non-participants at 5% significance level.

The total average farm income among sample households was 10069.44. The participants and non-participants had a total average farm income of Birr 10473.08 Birr and 9010.37 respectively.

Table 8. Farm income sources of sampled households

Variable	Participant	Non-participant	Total	T-value
	Mean	Mean	Mean	
Livestock & its product's sale(Birr)	3923.85	3109.26	3706.08	-2.1584**
Income from all crop sale other than <i>teff</i> (Birr)	6549.62	5901.11	6362.87	-1.035
<i>Teff</i> contribution (%)	60.8	-	48.77	-6.7742***
Total average farm income	10473.08	9010.37	10069.44	-2.11**

***, and ** indicate significance at 1%, and 5% respectively

Source: Survey result, 2018

4.1.5. Crop production characteristics of sample households

Allocation of land resources and other farm inputs for crop production is a common practice by smallholder farmers. As seen from Table 9, out of total land they have sample households in the study areas allocated 90.77% of land for crop production, 4.25 % for livestock grazing, and 4.96% for eucalyptus and homestead. This is an indicator that the agro-ecology of the district is conducive for crop production. The mean area of land allocated for crop production by sample households was 2.33 hectares with standard deviation of 1.42.

Table 9. Allocation of land resources by sample households

Land allocated	Total areas (hectare)	Proportion (%)	Mean	Std. Dev.
Crop production	445.3	90.77	2.33	1.42
Grazing for livestock	20.873	4.25	0.10	0.100
Eucalyptus and homestead	24.378	4.96	0.12	0.104
Total	490.55	100		

Source: Survey result, 2018

The major cereal crops grown in the district include *teff*, wheat, barley, sorghum and maize. The major pulse crops grown are groundnut. Potato and cabbage were grown from vegetable crops. Crop rotation (cereal with pulse crops) is common agronomic practices used by smallholder farmers to increase productivity and to maintain soil fertility status. As shown in Table 10, *teff* stands first in terms of cultivated area coverage (36.58%) and groundnut occupies the second (23.71%)

Table 10. Area coverage of major crops of sampled households.

Crops cultivated	Areas cultivated in 2017/18 (ha)	Area proportion (%)	Mean	Std. Dev.
<i>Teff</i>	162.88	36.58	0.81	0.44
Wheat	93.92	21.09	0.46	0.43
Maize	34.75	7.80	0.17	0.22
Barley	13.62	3.06	0.08	0.18
Sorghum	3.75	0.84	0.13	0.23
Groundnut	105.62	23.71	0.52	0.43
others(cabbage, potato etc)	30.75	6.9	0.15	0.40
Total	445.3	100		

Source: Survey result, 2018

4.1.6 Farm inputs used in *teff* production by sample households

The common farm inputs used in *teff* production includes: fertilizers, improved seed, and herbicide. The use of improved agricultural inputs increases output side market extent of market participation and improve smallholders' livelihood. Farmers in the study area used different types of inputs for *teff*. The major agricultural inputs and technologies used by sample households include inorganic fertilizer (DAP and Urea), improved *teff* seed, herbicide and row planter. The survey result indicate that even if it's not at full recommendation rate out of total sample households 100% of them used improved seed and Herbicide and 63.14%; 36.85% of them use DAP and Urea fertilizer in *teff* production, respectively. Describing of

farm inputs used by sample households in *teff* production are important point because market participation of the output side is often realized with the precondition on market participation in the input side (Berhanu and Moti, 2010). Adoption of improved high-yielding varieties (HYVs) and chemical fertilizer have a positive effect on smallholders' marketed surplus (Tigist, 2015).

Additionally, farmers in the study area used leased-in and shared-in land; shared-out land; hired and daily laborer for *teff* production in 2017/18 production year. As seen from Table 11, by individual households the mean improved seed, DAP fertilizer and herbicide used per hectare was 26.01kg, 77.06kg and 0.76 litter, respectively. The mean leased-in, shared-in and shared-out land used by sample respondent was 0.35, 0.18 and 0.83 ha respectively.

Table 11. Farm input use of sample households for *teff* in 2017/18 production year

Inputs used	Mean	Std. Dev.
Improved seed (kg)	26.01	12.25
DAP fertilizer (kg)	77.06	33.86
Urea fertilizer (kg)	44.97	21.93
Herbicide 2-4-D (litter)	0.76	0.50
Leased-in land(ha)	0.35	0.48
Shared-in land (ha)	0.18	0.33
Shared-out land (ha)	0.83	0.62

Source: Survey results, 2018

Out of improved seed used by sample households *Quncho teff* variety is a popular one which most of households 140(69.31%) of them cultivated *Quncho* variety in 2017/2018 production year; *Adilo* 58(28.71%) is second one and *Businet* (local read) 4(1.98%). This was indicated by Kebebew *et al.* (2011) as the good performance of *Quncho* brought together the coordinated efforts of researchers, extension personnel, district administrators and others involved in the process of seed multiplication and distribution, and technology promotion.

4.1.7. *Teff* production and marketing problems in the study area

Table 12 discloses households' perception on production and marketing problems of *teff* in the study area. As observed from the table 12, 14.35% of the households reported that Poor market linkage. Poor market linkage as serious problem for *teff* marketing in the study area. Pest and disease are another major problem in the study area according to the percentage response of the households (19.3%). They complain that, stem rust (locally known as *Gugufa* or *Wagi*) in particular destroying their *teff* on farm thereby contributing low harvest of output. Another binding constraint in production and marketing of *teff* in the study area reported by sample households is high input cost. About 16.83% of the households responded as they are suffering from high input cost. According to their response, as volatility in market prices of fertilizer, seed and labor highly discouraging them. A relatively low market price of *teff* was also among production and marketing problems reported by about 4.95% of the households. Poor road infrastructure, inadequate means of transportation, and weather change were also identified as constraints in *teff* production and marketing in the study area by 19.8%, 14.35%, and 10.39% sample respondents respectively.

According to respondents, poorly developed road infrastructure in the area made them face difficulty in transporting their output and incur significant transportation cost. In this regard, a study by Firdisa (2016) also demonstrated that poor infrastructure being one of major problems of *teff* production of rural areas. Also, there is poor facility in public means of transportation. Inadequate public means of transportation could be associated with poor road infrastructure both of which force farmers sell their produce at farm gate price. Weather change was also reported as a critical problem in production of *teff* in the study area. According to respondents, variability in rainfall occurring at time of sowing and harvesting was highly reducing their production potential due to deterioration of yields.

Table 12. *Teff* production and marketing problems identified by sample respondents

Problems	Total (%)	Participant (%)	Non participant (%)
Poor market linkage	14.35	72.41	27.58
Poor road infrastructure	19.8	27.5	72.5
Low price	4.95	80	20
Pest attack at seedling stage	19.3	66.7	33.3
Weather change	10.39	71.42	28.57
High input cost	16.83	76.47	23.52
Inadequate transportation service	14.35	20.68	79.31

Source: Survey result, 2018

4.2. Demographic and Socio-economic Characteristics of *Teff* Traders

Demographic characteristics of sample *teff* traders were summarized in terms of sex, marital status, age, educational level, experience and family size. As indicated in Table 13, out of the total sample traders, 15(68.18%) were male-headed and 7(31.82%) were female-headed. Regarding marital status of sample traders 5(22.73%) and 17(77.27%) were single and married, respectively.

The mean age of sample *teff* traders was 36.86 years with standard deviation of 7.93. The average family size of sample trades was 4.8 persons with standard deviation of 2.667. Concerning educational status of *teff* traders, the average number of years of schooling completed was 5.31 years with a standard deviation of 1.98. The traders have an average of 5.54 years of experience with a standard deviation of 4.37 in *teff* trading. The initial and working capital could be one of the indicators of the financial position of a given through it does not necessarily show the financial progress of the firm. The mean initial working capital of sample *teff* traders was 5545.455ET birr. The minimum and maximum initial capital of *teff* traders were 1000 ET birr and 30000 ET birr, respectively. And mean current working capital of sample *teff* traders was 63318.18 ET birr with standard deviation of 43636.36. The

minimum and maximum working capital of sample *teff* traders were 8000 ET birr and 200000 ET birr, respectively.

Table 13. Demographic characteristics of sampled traders

Variable	Shashamane N = 15		Hawaasa N = 7		Total N = 22	
	Ferq	%	Ferq	%	Ferq	%
Sex						
Female	5	71.42	2	28.57	7	31.82
Male	10	66.66	5	33.33	15	68.18
Marital Status						
Single	4	80	1	20	5	22.73
Married	11	64.7	6	35.29	17	77.27
	Mean		Mean		Total Mean	
	Std. Dev.		Std. Dev.		Std.Dev	
Age	36.2	8.16	38.28	7.93	36.86	7.93
Education level	5.53	1.93	4.85	1.93	5.31	1.93
Experience	6.06	5.22	4.42	4.37	5.54	4.37
Family size	4.14	2.01	6.42	3.17	4.86	2.66
Financial asset ownership of sampled traders						
	Mean		Std. Dev.		Min	Max
Initial working capital	5545.455		6912.565		1000	30000
Current working capital in 2018	63318.18		43636.36		8000	200000

Source: Own survey results, 2018.

Note: Std.Dev = standard deviation

As indicated in Table 14, most of traders working capital originated from internal source than external sources. About 59.09% of sample traders were using their own capital while about 27.27% through loan and 9.09% were function by share. The smallest proportions about 4.55% source of traders working capital were through gift. Further, the survey results revealed that about 46.15% of traders borrowed working capital from relatives/family while about 38.46% borrowed from Bank and 15.38% of traders borrowed from other traders.

Table 14. Source of working capitals and source of loan of sampled traders

Source of capital	Frequency	Percent
Own	13	59.09
Loan	6	27.27
Gift	1	4.55
Share	2	9.09
Total	22	100
Source of loan		
Relative/family	6	46.15
Other traders	2	15.38
Bank	5	38.46
Total	13	100

Source: Own survey results, 2018.

4.3. Demographic Characteristics of Sample Consumers

Demographic characteristics of sample *teff* consumers were summarized in terms of sex, marital status, educational level and family size. The sample consumers earn their income from different sources and the purchasing power of the consumer depends on his/her monthly income. The survey results indicated in Table 15, showed that the majority of sampled consumers were female; 23(82.41%) and the remaining 5(17.86%) were male. This shows that females' involvement in the *teff* purchasing activities was high. Regarding marital status of consumers, the majorities 25(89.29%) were married and 3(10.71%) were single. As indicated in Table 15, the mean family size of consumer was 6.39 persons with standard deviation of 3.34.

Regarding the educational level of consumers, the survey result showed that the mean number of years of schooling completed was 8.93 with a standard deviation of 3.31. The mean age of sample consumer was 36.03 years with standard deviation of 9.19.

Table 15. Demographic characteristics of consumers

Variable		Shashamane		Hawaasa		Total	
		Ferq	%	Ferq	%	Ferq	%
Sex	Female	11	47.82	12	52.17	23	82.14
	Male	4	80	1	20	5	17.86
Marital status	Single	3	100	-	-	3	10.71
	Married	12	48	13	52	25	89.29
Age	Mean	33.2		39.3			36.03
	SD	8.69		8.97			9.19
Education Level	Mean	8.93		7.79			8.93
	SD	2.84		3.81			3.31
Family size	Mean	5.66		7.23			6.39
	SD	3.45		3.13			3.34

Note: Ferq. =frequency (number) of consumers, % =percentage and SD=standard deviation

Source: Own survey results, 2018.

4.4. *Teff* Marketing Outlets

The survey result indicated that sample households in the study area sold their *teff* produce at different marketing center. The sample households sold varying proportion of their *teff* output to different market outlets in the district which include: wholesalers, consumers, collectors and retailers. Result of the survey in Table 16, indicated that 93(62.84%) of households sold their *teff* output to wholesalers whereas 72(48.65%), 46(31.08%) and 52(35.14%) of the sample households sold their *teff* output to retailers, consumers and collectors, respectively. Based on this result, *teff* producer's choice of wholesaler market channels than other market outlet of marketing the *teff* produced in the study areas.

Table 16.marketing the *teff* produced in the study area

Outlet choices	Wholesaler		Retailer		Consumer		Collector	
	Freq	%	Freq	%	Freq	%	Freq	%
Yes	93	62.84	72	48.65	46	31.08	52	35.14
No	55	37.16	76	51.35	102	68.92	96	64.86

Source: survey result, 2018

Table 17 indicated that, on average, size of land allocated under *teff* for farmers who choose to selling their *teff* to wholesaler was 0.84 ha; while for farmer choose to selling their *teff* to retailer was 0.83 ha. The T-test of variability between the groups showed that there was a statistically significant difference in terms of size of land allocated for *teff* between farmers choose wholesaler and retailer at 1% significance level. This impels that size of land allocated under *teff* highest for household who had sell their product to wholesaler while lowest for household who had sell their product to retailer market outlet. The mean current market price of *teff* farmer selling their *teff* to collector was 6.51ETB. The T-test result show that there was a statistically significant difference in terms of current market price of *teff* between farmers choose collector market outlet at 10% significance level (Table17).

The mean frequency of extension contact for farmers choose to sell their *teff* to wholesaler was 2.23 day per year; while the mean frequency of extension contact farmer choose to sell their *teff* to collectors was 2.2 days per year. The T-test of variability between the groups showed that there is significant difference between the farmers selling *teff* to wholesalers and collectors at 1% and 10% level of significance respectively. It mean that contact of extension agent highest for household who had sell their *teff* to wholesaler market outlet while lowest for household who had sell their *teff* to collector outlet. The mean distance from nearest market for farmers selling their *teff* to wholesaler was 6.22 kilometer; while the mean distance from nearest market for farmer selling to collector was 5.97 kilometer. The T-test show that there is significant difference between the farmers selling *teff* to wholesalers and collectors at 10% and 5% level of significance respectively. This impels that distance travelled to the nearest market highest for household who had access to wholesaler while lowest for household who had access collectors market outlet.

The mean difference in equines owned among farmer chooses wholesaler market outlet was statistically significant at 5% significance level in (Table 17). The mean equines owned in TLU for farmer choose wholesaler was 1.58. In terms of the mean difference in farm experience among farmer choose wholesaler was 7.18 year. The T-test result show that there was a statistically significant difference in terms of farm experience between farmer choose wholesaler at 1% significance level. In terms of family size mean farmers selling their

products to retailer was 3.73; while the mean family size farmer selling to collector was 4.33. The T-test show that there was a statistically significant difference in terms of family size between farmer chooses retailer and collectors at 1% significance level. On average education level of household selling their *teff* to wholesaler were 6.53 while for farmer selling to retailer was 6.18 and for farmer selling to consumer and collector was 3.47 and 3.92 respectively. The T-test results show that there is significant difference among the farmers selling *teff* to wholesalers, retailers consumer and collector market outlet at 1%, 5% and 10% level of significance respectively.

Table 17. Demographic and socio-economic characteristics of *teff* producers

Variable	Wholesaler		Retailer		Consumer		Collector	
	Mean	T/Chi ²	Mean	T/Chi ²	Mean	T/Chi ²	Mean	T/Chi ²
Size of land under <i>teff</i>	0.84	-3.49***	0.83	-2.69***	0.83	-0.08	0.83	0.14
Non-farm income	21.51	0.016	21.51	0.31	21.51	0.14	21.52	-1.09
Current market price	6.77	-1.28	6.77	-1.44	6.77	-0.84	6.51	-1.73*
Frequency of extension	2.23	-2.78***	2.01	-0.89	2.01	-0.06	2.20	-1.77*
Distance from nearest market	6.46	1.708*	6.46	0.48	6.46	0.43	5.97	1.99**
Ownership of equine	1.58	-2.01**	1.85	0.54	1.58	0.67	1.58	-1.21
Livestock ownership	4.72	-1.51	4.72	0.85	4.72	-2.03	4.72	-1.02
Farming experience	7.18	-2.66***	7.18	0.03	7.18	-0.27	7.18	0.07
family size	4.33	0.49	3.73	2.64***	4.31	0.50	4.33	2.91***
Education level	6.53	-2.82***	6.18	-2.54***	3.47	2.15**	3.92	1.73*
Sex of household	N	%	N	%	N	%	N	%
Female	37	25	37	25	37	25	37	25
Male	111	75	111	75	111	75	111	75

***, ** and * indicate significance at 1%, 5% and 10% respectively

Source: Survey result, 2018

4.5. *Teff* Market Actors and Their roles

In the study area, these market participants involved in different production and marketing activities. Those identified market participants and their roles are discussed below:

Producer: Producers start from input preparation to produce *teff* for the purpose of cash earnings and household consumption. *Teff* producers in Shashamane district supply their produce to the market by using equine transport and sold to wholesalers, collectors, consumers and retailers.

Collectors: Collectors are marketing actors those who collect *teff* from farmers and deliver to wholesalers and also sell to retailer in the district. Some collectors in the district do not have sufficient capital to purchase *teff*, they operate with advances that they received from wholesalers.

Wholesalers: Wholesalers reside in district market purchase *teff* directly from farmer, farmer trader, and rural collector. They also sell to the other deficit terminal markets outside the district markets like Hawaasa, Dilla and Addis Ababa. The result indicated that, mostly wholesalers purchased more amounts of *teff* from rural collector and sell large amount of *teff* to processor.

Retailers: Retailers purchased *teff* directly from producers, collector and wholesalers. The selling system of retailers is somewhat different from other actors. They do not sell *teff* in large volume rather they sell through dividing large shipment in to small quantity locally known as “*Chrcharo*”. In the district retailers purchased large amount from collector and wholesalers and sell directly to consumers.

Processors (millers): Processors process *teff* grains into *Injera* before selling to end consumers. Their processing activities create some value on the final processed products (*injera*). This enables them to sell quintal of *teff* with higher price than other market chain actors. Most of the time processors purchased from wholesalers and sell directly to consumers

Consumers: Individual households and they bought the commodity for their own consumption only. In the district like other chain actors, consumers also had various alternatives to purchase raw *teff* or final processed products accordingly in study area, consumers purchased large amount of *teff* from retailers and they do not perform reselling activities.

4.6. *Teff* marketing channels

Six alternative *teff* marketing channels through which *teff* produce flows to the final consumers were identified. It was estimated that 3552 quintals of *teff* were supplied to market by sampled farmers. From Figure 4, one can understand that the main receivers of *teff* from the producers were rural collector, wholesalers, and retailers who possess estimated percentage of 46.36%, 29.9% and 13.83% respectively. But consumers received only 9.90%. The market channels identified during the survey were:

Channel I. Producer - consumer: This channel is the shortest channel at which producers directly sell to consumers at market day. It represented 9.90% of the total *teff* marketed which amounted to 352 quintals of *teff* during the survey period.

Channel II. Producer – rural collector – retailer – consumer: Rural collectors are buying *teff* from producers in the study area and they sell to retailer. It accounted for 14.74% of total *teff* marketed 523.5 quintals during the survey period.

Channel III. Producer – retailer –consumer: Retailers are buying *teff* from producers in the study area and they sell to consumer. It accounted for 13.83% of total *teff* marketed 491.25 quintals during the survey period. The channel was found to be the second least important in terms of volume.

Channel IV. Producer-wholesaler- retailer -consumer: Wholesalers are buying *teff* from producers in the study area and they distribute to district retailers. It accounted for 15.4% of total *teff* marketed 547 quintals during the survey period.

Channel V. Producer-rural collector-wholesaler-central wholesaler-processor-consumer:

rural collector buys from producer than, sold to wholesaler and wholesaler sold to central wholesaler and central wholesaler sold to hotels, café or institutions. It accounted for 31.62% of total *teff* marketed 1123.25quintals during the survey period.

Channel VI. Producer- -wholesaler-central wholesaler—processor-consumer:

wholesaler buys from producer than, sold to central wholesaler and central wholesaler sold to hotels, café or institutions. It accounted for 14.5% of total *teff* marketed 515 during the survey period.

These market channels with the proportion of *teff* outputs flow through the channels are indicated in the following Figure 4.

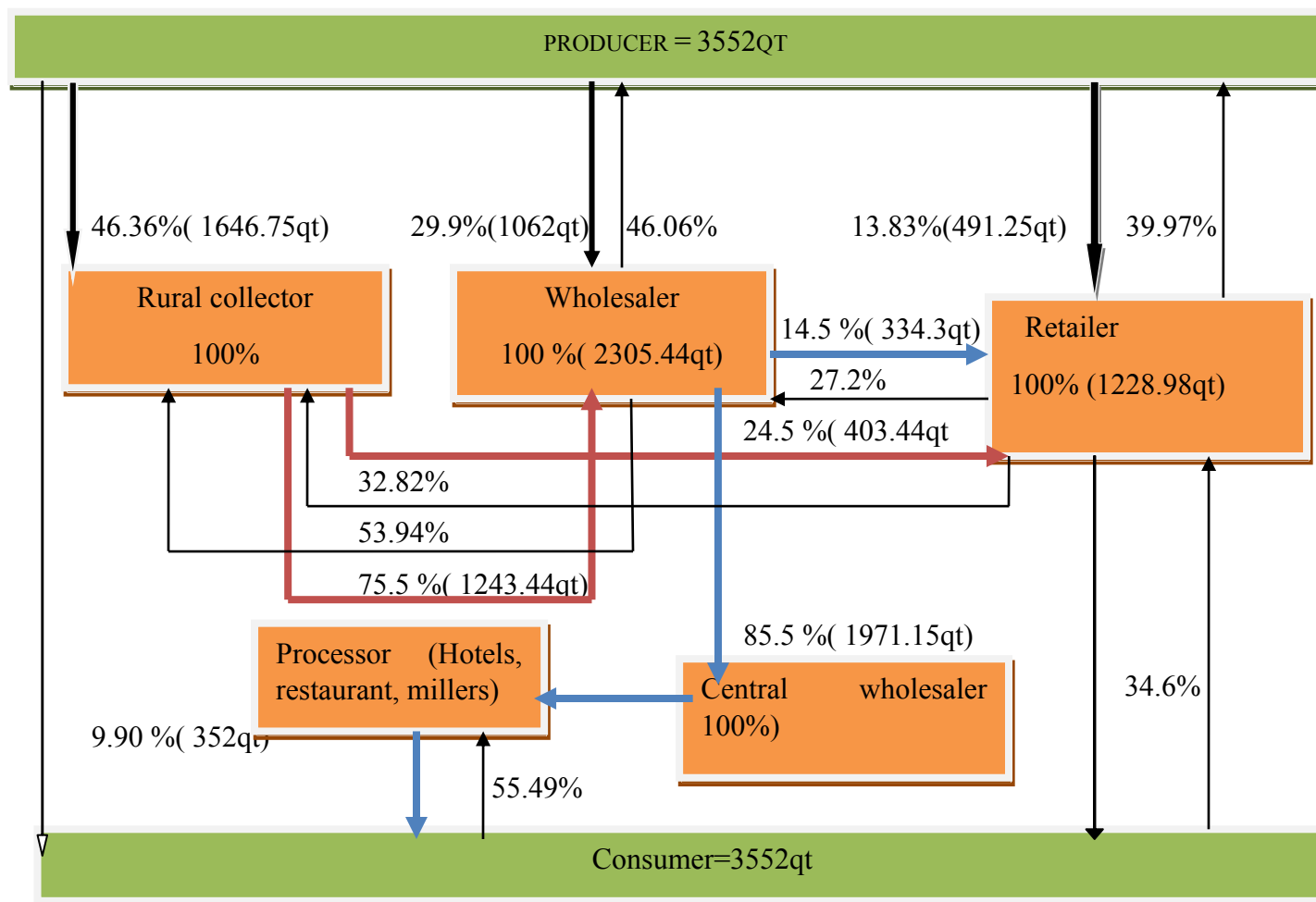


Figure 4. *Teff* marketing channel

Source: own sketch (survey result, 2018)

4.7. Structure, Conduct and Performance of *Teff* Market

4.7.1. *Teff* Market Structure

Market structure in this study has been described using concentration ratio, and barriers to entry (Capital requirement, trade experience and licensing procedure).

4.7.1.1 Market concentration ratio

The concentration ratio is expressed in terms of CR_x which stands for the percentage of the market sector controlled by the biggest X firms. The result of sample market *teff* traders' concentration ratio CR₄ was found to be 36.78 percent. Kohls and Uhl (1985) suggested, as a rule of thumb, a four largest enterprises concentration ratio of 50 percent or more as an indication of a strongly oligopolistic industry and CR₄ between 25% and 50% is generally consider a weak oligopoly and a CR₄ of fewer than 25% is no oligopoly at all. Hence, the *teff* market concentration ratio in the study area was 36.78 percent suggesting a weak oligopoly market type.

Table 18. *Teff* trader's concentration ratio in the sample market centers

Number of traders (A)	Cumulative frequency of traders (B)	% of Traders (C)	Cumulative % of Traders (D)	Quantity purchased in quintal/year (E)	Total quantity purchased (F)=E*A	% share of purchases (G)	% cumulative purchases (H)
1	1	4.55	4.55	900	900	13.13	13.13
1	2	4.55	9.1	600	600	8.75	21.88
1	3	4.55	13.65	540	540	7.9	29.78
1	4	4.55	18.2	480	480	7	36.78
2	6	9.09	54.54	360	720	10.5	47.28
3	9	13.64	122.76	312	936	13.66	60.94
1	10	4.55	45.5	300	300	4.37	65.31
1	11	4.55	50.5	264	264	3.85	69.16
2	13	9.09	118.17	252	504	7.35	76.51
2	15	9.09	136.35	240	480	7	83.51
3	18	13.64	245.52	216	648	9.45	92.96
2	20	9.09	181.8	180	360	5.25	98.21
1	21	4.55	95.55	120	120	1.75	100
1	22	4.55	100		6852	100	
22							

Source: Own computation, 2018

4.7.1.2. Barriers to Entry in *Teff* Market

Barriers are those factors that hindered individuals from participating in *teff* trading. Capital requirement, trading experience, and licensing procedure have been discussed under this sub-topic.

Capital requirement: It is known that lack of working capital discourages entry into a given business. About 59.09% and 31.82% of sample traders respond that they were using their own capital and loan and gift respectively. Only 9.09% received from the share. In addition, the sample traders reported that lack of access to credit in the district has been the single most critical constraint in the start-up and expand the existing business. As per the survey data, 81.82% of the total sampled traders have responded that they did not receive credit for *teff* trading and argued that they would have expanded the business and new entrants have come to the business if there had been credit provided. Therefore access to capital was one of the barriers to enter into *teff* trading in study area.

Licensing procedure: As per the survey data, 22.73% of the total traders have no licenses to trade *teff* and the rest 77.27% have licenses (Table 19). Currently the *district* Trade and Industry Development Coordination Unit (TIDCU) are licensing anyone who wants to join *teff* marketing as per *district* TIDCU experts. According to the survey data, since unlicensed traders were paying no taxes, they refused to be licensed to avoid expenses in terms of tax. These unlicensed traders were charging competitive/predatory prices and discouraging the licensed traders. Therefore though licensing procedure was not barrier to enter to *teff* trading business, pricing strategy of unlicensed traders had been one of the constraints in marketing of *teff* in the study area.

Skill (Experience): Trade experience in this study refers to the number of years that *teff* trader engaged in trading activity. As per the survey data, the mean experience of *teff* traders in Shashamane *district* was 5.54 years (Table 19). This shows that there were new entrants in to the *teff* trading business in the study *district* which implied that experience was one of barrier to enter in the business.

Table 19. Source of information and entry barriers for trader

Variables	N=22	%
Source of market information		
Telephone	7	38.82
From other traders	15	68.18
Entry barriers		
Yes	16	72.73
No	6	27.27
Access to credit		
Received	4	18.18
Not Received	18	81.82
License procedure		
Licensed	17	77.27
Unlicensed	5	22.73
Source of capital		
Own capital	13	59.09
Loan	6	27.27
Gift	1	4.55
Share	2	9.09

Source: Own survey, 2018

Therefore, as compared to perfectly competitive markets where there are many buyers and sellers, and free entry and exist, *teff* market structure in Shashamane district was somewhat deviated in that it showed weak oligopoly and capital requirement (credit) ,experience and pricing strategy of unlicensed traders were barriers to entry.

4.7.2. Conduct of *teff* market

In this section the conduct of *teff* market is analyzed in terms of producer and traders buying and selling strategies.

4.7.2.1. Producers price setting strategy

Teff producers in study area used demand-based pricing strategy, accordingly in the study, about 24.26% and 20.30% of respondents' market price was set through negotiation with

buyers and by market (i.e. by interaction of market demand and supply) respectively. The remaining 55.45% of their produce selling price was set by buyers only (Table 20). The study indicates, in the district the buyers take the highest share in determining farmers selling price. This limits the bargaining power of farmers regarding the selling price of their product. As a result producers were price takers in all the market chain as per the survey data.

Table 20. Farmers selling price strategies

Variable	N=202	%
Through negotiation	49	24.26
By themselves	-	-
By buyers only	112	55.45
By the market	41	20.30

Source: Own survey (2018)

4.7.2.2. Buying and selling strategy of traders and their mode of payment

Out of 22 sample traders 31.82% of them are wholesalers; 54.55% of them are Retailers and 13.64% of them are collector. Out of the total sample traders, 59.09%(the buyers) argued that the buying price was set by themselves, 22.73% argued that it was set by negotiation and the rest 18.18% replied that it was set by market (Table 21). All traders argue that the selling price was set by sellers (54.55%), negotiation (27.27%) and by market (18.18%).

Table 21. Selling and buying strategies of traders and mode of payment

Variables	Traders	
	N=22	%
Types of traders		
Wholesalers	7	31.82
Retailers	12	54.55
Collector	3	13.64
Traders selling price strategies		
Through negotiation	6	27.27
By themselves(trader)	12	54.55
By buyers only	-	-
By market	4	18.18
Traders buying price strategies		
by themselves(trader)	13	59.09
Through negotiation	5	22.73
By market	4	18.18
By seller	-	-
Traders mode of payment		
In cash	7	31.82
In cash and credit	15	68.18
Using partners for trade		
Alone	19	86.36
Partnership	3	13.64

Source: Own survey (2018)

With regarding using partners for purchase, only 13.64% of sample traders purchase *teff* with partners (friends). And about 86.36% of sample traders purchase by themselves. The survey indicated that, 31.82% of sample traders used cash mode of payment to buy and sell their product. The rest 68.18% of sample traders used combination of the two (in cash and in credit) (Table 21). Traders attract buyers 31.82% by giving credit about 27.27% and 22.73% by using correct measure and paying reasonable price respectively and the rest 4(18.18%) are by providing quality *teff* And attract their suppliers 72.73% by giving better price relative to other about 27.27% by using fair scaling (weighing)

Therefore, as compared to competitive market norms where price is set by the interaction of market demand and supply and where both buyers and sellers are price takers, market conduct in Shashamane *district* was deviated in that 54.45 % of selling price of producers was set by buyer only, 54.55 % of the selling price of traders was set by seller themselves and 27.27% of

the selling price of traders was set by negotiation. i.e., some sellers were price makers as per the survey result (Table 21) while they are supposed to be price takers. There was also predatory pricing which was affecting *teff* market in the *district* which is in contradiction to competitive market where no individual buyer/seller can affect the market price. Free entry and exit was also constrained by capital requirement (access to credit) and *teff* trading experience.

4.7.3. Performance of *teff* market

Market performance of *teff* was analyzed by estimating the marketing margin, by taking into consideration associated marketing and production costs. Based on production costs and purchasing prices of the major market actors along the chain, margin at producers, village collectors, and wholesalers, retailers, and central wholesaler levels was analyzed.

4.7.3.1. Profitability analysis at producers' level

To analyze the profitability of *teff*, both production and marketing cost which the farmers incurred was included. Table 22 below depicts those different types of costs which the farmers incurred during production process.

Table 22. Average cost of production of *teff* in 2017/18 year (Birr/ha)

Production cost items	Birr per ha
Land clearing(Birr)	320
Plowing(Birr)	485
Seed(Birr)	460.50
Fertilizer(Birr)	1200.67
Sowing(Birr)	280
Weeding/herbicides(Birr)	301.06
Harvesting/collection(Birr)	600
Threshing/winnowing(Birr)	450
Land rent(Birr/year)	3500
Labor(Birr)	500.25
Total production cost(birr/ha)	8097.48
Yield(qt/ha)	14.65
Production cost(cost Birr/qt)	552.729
Average selling price (Birr/qt)	1750

Source: Own survey (2018)

The labor cost given in Table 22 was estimated based on the price or wage of labor in locality per man day. Family labor was evaluated at the prevailing wage rates of hired labor at the village level. Urea and DAP were valued at Birr 1400 and 1600 per qt, respectively. Land clearing, Sack Plowing, Chemical costs, seed cost, sawing, harvesting/collection, threshing/winnowing, and, rental value of land were reported by the sampled respondents.

The mean productivity of *teff* was 14.65 qt/ha which were reported by sample households. Rental value of land was imputed by taking into account the prevailing rents in the study area per hectare per year for *teff*. Average *teff* output were valued at farm gate price of households which were on average about Birr 1750 and the total average cost of production of *teff* is Birr 552.729 per quintal.

4.7.3.2. *Teff* marketing cost and margin analysis

Marketing costs are estimated to compute the share of profit captured by key actors in the marketing chain. Table 23 shows the average marketing costs incurred by every actor during transaction. The highest marketing cost was incurred by the wholesaler (103.5 birr/qt) followed by central wholesaler (99 birr/qt). The main reason for this is that wholesaler and central wholesaler purchase *teff* with highest price than others transport costs is higher to reach terminal market and specialized labor for the packing, loading and unloading is relatively expensive. Average production cost of producers was (74.5 birr/qt) when they sold to consumers and retailers while 45.5 birr/qt when they sold to collectors because no transportation cost

Table 23. *Teff* average marketing costs for different marketing agents

	Producer	Collector	Retailer	Wholesaler	Central wholesaler
Sack price(packaging materials)	10	10	0	10	-
Loading /unloading	12	8	10	12	12
Telephone cost	-	5	5.5	7.5	10
Loss in transport and storage	9.5	6	7.5	10.5	6.75
Transportation	40	30	-	30	30
Storage	-	5.75	8.5	10.75	10.75
temporary workers	3	10	5.5	7.25	10.75
Guard	-		5	5	5.25
Tax and license	-	4	5	5	5
Other cost	-	5	6.5	5.5	8.5
Total cost	74.5	83.75	53.5	103.5	99

Source: Own survey (2018)

Table 24. *Teff* marketing margin for different channels (Birr/qt).

		I	II	III	IV	V	VI
Producers	Purchase price						
	Production cost	552.72	552.72	552.72	552.72	552.72	552.72
	Marketing cost	74.5	45.5	74.5	-	45.5	-
	Selling price	1750	1300	1400	1600	1300	1600
	Market profit	1122.78	701.78	772.78	947.28	747.28	1147.28
	GMP (%)	100	52	56	64	50	61.5
Rural Collectors	Purchase price		1300			1300	
	Production cost						
	Marketing cost		83.75			83.75	
	Selling price		1850			1850	
	Market profit		466.25			466.25	
	GMM _{RC} (%)		22			21.15	
Wholesaler	Purchase price				1600	1850	1600
	Production cost						
	Marketing cost				103.5	103.5	103.5
	Selling price				2400	2400	2400
	Market profit				696.5	446.5	696.5
	GMM _W (%)				32	21.15	30.76
Retailer	Purchase price		1850	1400	2400		
	Production cost						
	Marketing cost		53.5	53.5	53.5		
	Selling price		2500	2500	2500		
	Market profit		596.5	1046.5	46.5		
	GMM _R (%)		26	44	4		
Central Wholesaler	Purchase price					2400	2400
	Production cost						
	Marketing cost					99	99
	Selling price					2600	2600
	Market profit					101	101
	GMMCW (%)					7.69	7.69
	TGMM (%)	0	48	44	36	50	38.46

Source: Own survey result, 2018

Teff producers market profit was highest when they direct sell to wholesaler in channel VI (producer-wholesaler-central wholesaler-consumer) which is 1147.28 birr/qt. While take lowest market profit when they direct sell to rural collector 701.78birr/qt in channel II (producer- rural collector –retailer-consumer). This implies producers are more profitable if they sold to wholesalers. From traders retailers shared the highest profit 1046.5 birr/qt when they made direct purchase from producers in channel III and they sold to consumers. *Teff* rural retailer made a lowest profit of 46. 5 birr/qt when they made direct purchase from wholesalers in channel IV and they sold to consumers. This implies that retailers were received the highest remuneration from *teff* marketed in the study area and also retailers took the smallest profits shares from *teff* market chain when purchase from wholesaler (Table 24).

Total gross marketing margin (TGMM) is highest in channel V (producer-rularcollector-wholesaler-central wholesaler-consumer) which was 50% and lowest in channel IV(producer-wholesaler- retailer -consumer) which was 36%. Producers share (GMMp) is highest in channel IV which account 64% from the total consumer price and lowest in channel V which was 50%. This difference might support the theory that as the number of marketing agents increases the producers share decreases. The reason being, the higher number of middlemen in the commodity market, the more profit they retain for their services whether they add value to the item or not. The results also shows that the maximum gross marketing margin from traders was taken by retailers, which accounts 44% of the consumers price in channel III(producer-retailer-consumer).This implies share of market intermediaries in the consumer price was substantial and there was a need to reduce market intermediaries to minimize the marketing margins and there by enhance the producers income. The minimum gross margin is taken by retailer in channel IV (producer-wholesaler-retailer-consumer) which was 4 % (Table 24).

4.8. Econometric Results

According to Reddy *et al.* (2013), a commonly appearing problem in most of the econometric data is the correlated input variables or problem of multicollinearity. This problem arises due to the choice of several input variables which are having high correlation among themselves and it leads to less précised estimates and huge forecasting errors. To detect whether the data

at hand exhibits multicollinearity problem or not, two tests were used: Variance Inflating Factor (VIF) and Contingency Coefficient. The Variance Inflation Factor (VIF) shows how the variance of an estimator is inflated by the presence of multicollinearity. With increased multicollinearity, the VIF approaches infinity and in the absence of multicollinearity, VIF will be equal to 1. Variance Inflating Factor for each explanatory variable (X_i) can be calculated as stated in Reddy *et al.* (2013) and Gujarati (2004):

$$VIF(X_i) = \frac{1}{1 - R^2} \quad (19)$$

Where, R^2 is the coefficient of correlation derived when one of explanatory variable regressed over all the other explanatory variables. As an alternative, the inverse of VIF ($1/VIF$) called Tolerance (TOL) can be used as a measure of multicollinearity. The closer is TOL of one explanatory variable (X_i) to zero, would signify the greater the degree of collinearity of that variable with the other explanatory variable. On the other hand, the closer TOL of X_i is to 1, the greater the evidence that X_i is not collinear with the other explanatory variables (Gujarati, 2004)

In this study, the mean VIF of continuous explanatory was 1.33, indicating that there was no serious problem of multicollinearity (Appendix 4). Finally, to account for heteroskedasticity, robust standard error was estimated.

4.8.1. Factors affecting the decision to participate in *teff* market in the study area

The results for the factors affecting market participation decisions (first hurdle) are displayed in Table 25. Out of the thirteen variables fitted into first hurdle, seven variables affected market participation decisions of households in the study area (Table 25). These variables are; land allocated for *teff*, distance to the nearest market, livestock owned, and education, and family size, sex of household and frequency of extension contact. The Wald chi-square value of 67.17 for market participation decision model is statistically significant at 1% indicating that at least one of the explanatory variables included in the model jointly explain the

probability of participating in *teff* output market. An average household had a 94.47% predicted probabilities of market participation.

Sex of the household head: Sex of the household head being female was found to negatively influence the *teff* market participation at 10% significance level. The marginal effects showed that being female headed household decrease the probability of being participant by 5.77% as compared to male headed households. This result was due to the fact that activities accomplished at home like cooking, washing and child care fall upon the females. This specifies that empowering of female household head by proving a continuous and practical training on *teff* production and marketing is crucial to improve *teff* market participation. This result is in line with the findings of Leykun and Jemma (2014) and Tekalign (2014) which found that male headed households have a better access to information that would provide them with better ability to manage their farms and produce more output for market as compared to female headed households.

Education level of households: As expected, education level affected probability of market participation positively and significantly at 1% significance level. One year increases in household head's education increase the probability of participation in *teff* output market as seller by 3.45%. The result is consistent with the findings of Aman *et al.* (2014) and Yalew (2016) that states educated household head can have better market networking and bargaining power and good managerial skill of enterprises and their tendency to accept different agricultural technologies is high, so that they can produce more surpluses for market.

Family size: Family size measured as adult equivalent was found to have negative and significant influence on *teff* market participation at 1% significance level. The marginal effect shows that as the member of household increased by one adult equivalent decrease the probability of being market participant by 2.72%. This result is expected because households with more family size tend to consume more of *teff* output produced and less is available for sales. This result is similar with findings of Efa *et al.* (2016) and Girma (2015) that showed that the larger household size consumes more output of *teff* produced, have the lower marketed surplus and less is available for sales.

Size of land under *teff* production: Size of land under *teff* production was positively and significantly affects the *teff* market participation at 10% significance level. The marginal effect shows that allocating one additional hectare of land to *teff* production would increase the probability of being market participant by 15.7%. This result implies that those households allocating one more additional hectare of land from self-owned, by rented-in or shared-in land raises the probability of market participation. This show that larger area allocated to production increases the quantity of produce available for sale. The result of Efa *et al.* (2016) a Leykun and Jemma (2014) and Chanyalew *et al.* (2011) confirm this result.

Livestock owned: Number of livestock owned measured in TLU was positively and significantly contribute to the *teff* market participation at 1% significance level. The marginal effect indicates that excluding equines, increasing the number of livestock by one TLU increase the probability of being market participant by 2.4%. This is due to the positive impact of livestock on the crop production enterprises by providing cash to purchase improved seed and in-organic fertilizer for *teff* production, and oxen serve as a traction power. This result is in line with Adam and Dawit (2015) and Tadele *et al.* (2017) found that the positive effect of livestock ownership on the crop output market participation increases due to significant effect on production.

Frequency of extension contact: The result shows that frequency of extension contacts significantly and positively related with probability of *teff* market participation at 1% significant level. The marginal effect shows that an increase in frequency of extension contact by one day would increase the probability of being market participation by 4.18%. This result implies that the technical advice provided for farmers by development agent, experts of agriculture and researchers on *teff* production (on improved seed, fertilizer application, row planting) and *teff* marketing. This indicates the importance of professional advice on being commercial farmer. This result is consistent with the findings of Tekalign (2014) and Girma (2015) who found that extension contact and advice significantly and positively influence crop commercialization and marketed surplus of *teff*, respectively.

Distance to the nearest market: Distance to the nearest market negatively and significantly influences household's decision to participation in *teff* output market at 1% significant level. Distance to the market proxies accessibility of the markets to smallholders. The size effect implies that, when the household is located one kilometer away from the nearest market, the probability of participation in *teff* output market decreases by 2.63%. As Martey *et al.* (2012) cited in Benjamin (2013), distance to market is an indicator of travel time and cost. The longer the distance of the market, it is more costly and time consuming to travel with output forcing smallholder farmers to hold more output particularly which is common in rural areas where transportation facility is poorly developed. Alternatively, as the distance from the nearest market increases, transport costs increase and this discourages smallholder farmers and their probability of participation in a market decreases. This result is consistent to findings of Gani and Adeoti (2011) who studied market participation among farmers which found being closer to nearest market enhances probability of market participation. The finding is also in agreement with findings of Berhanu and Moti (2010), Aman *et al.* (2014), Agwu *et al.* (2013), Yaynabeba and Tewodros (2013), and Berhanu *et al.* (2009).

Table 25. Factors influencing farmers' market participation decision

Variable	Coefficient	Robust Std. Err.	Average Marginal effect
Land allocated for <i>teff</i> (ha)	1.415	0.785	0.1579*
Sex of household	-0.659	0.352	-0.0577*
Education level of household	0.312	0.0815	0.0345***
Family size	-0.244	0.0731	-0.0272***
Farm experience	-0.0144	0.0299	-0.016
Livestock owned(TLU)	0.215	0.0697	0.024***
Equines owned (TLU)	0.0627	0.1663	0.0702
Distance to nearest market(Km)	-0.236	0.0710	-0.0263***
Access to credit	-0.303	0.318	-0.0338
Frequency of extension contact	0.375	0.141	0.04183***
Non-farm income(ETB)	0.0152	0.0129	0.0169
Farm income(ETB)	0.0381	0.0866	0.042
Cooperative membership	0.0223	0.0199	0.0179
Constant	0.613	1.132	
Number of observations		202	
Pseudo R ²		0.6043	
Wald χ^2 (13), Pr > χ^2		67.17***	
Log likelihood		-44.28	
Predicted probabilities		0.9447	

***, ** and * indicate significance at 1%, 5% and 10% respectively

Source: Survey result, 2018

4.8.2. Factors affecting the level of *teff* market participation in the study area

Results of extent of market participation model (2nd hurdle) shows that, out of thirteen variables included in the model, three variables affect extent of market participation (Table 26). These variables are; size of land allocate for *teff* production, family size and non-farm income. Wald chi-square value is strongly significant indicating acceptance of alternative hypothesis of at least one explanatory variable in explaining extent of participation.

Size of land under *teff* production: Size of land under *teff* production was positively and significantly affects the level *teff* market participation at 1% significance level. This showed that allocating one additional hectare of land to *teff* production would increases the quantity of *teff* marketed by 6.33 quintal. This result implies that those households allocating one more additional hectare of land from self-owned, by rented-in or shared-in land raises the quantity

of *teff* marketed. This result is consistent with the findings of Efa *et al.* (2016) and Leykun who reported that land size cultivated has a positive significant outcome on being transition and commercial farmer and the larger area allocated to production increases the quantity of produce available for sale.

Family size: Family size was also among the factors affecting extent of market participation negatively and significantly at 10% significance level. For every increase in family size of a household, quantity of *teff* marketed decreases by 0.247 quintal. This relationship is as expected, since larger family size could potentially retain a significant portion of the produce to home consumption needs so that they remain with small amount of *teff* and hence, low market share as compared to smaller family size. The result confirms the results of Omiti *et al.* (2009), Benjamin (2013), Adam and Dawit (2015), Muricho *et al.* (2015), Gebreslassie *et al.*, (2015) and Yalew (2016) that state households with large family size need to meet their family consumption requirement first and take the surplus to the market that make them end up with low extent of participation depending up on households' consumption pattern and the nature of the crop under consideration.

Non-farm income: As expected income obtained from non -farm activities influenced the extent of market participation negatively and statistically at 1% significant level. This shows that an increase in the amount non-farm income by one thousand ET birr, quantity of *teff* marketed decreases by 0.0791 quintal. This result is due to the reason that households obtained income from non-farm activities were not encouraged to cultivate *teff* on more area of land and they used the amount produced for home consumption. This result is supported by the findings of Yassin (2016) who found negative effect of non-farm income on probability of potato market participation and level of potato sale.

Table 26. Factors affecting the level of *teff* market participation

Variables	Coefficient	Robust Std. Err.
Land allocated for <i>teff</i> (ha)	6.333***	0.808
Sex of household	0.162	0.818
Education level of household	-0.00164	0.107
Family size(adult equivalent)	-0.247*	0.140
Farm experience(No of year)	-0.201	0.237
Livestock owned(TLU)	0.128	0.0949
Equines owned (TLU)	0.338	0.207
Distance to nearest market(Km)	-0.116	0.153
Access to credit	-0.585	0.388
Frequency of extension contact	-0.182	0.238
Non-farm income(ETB)	-0.0791***	0.0116
Farm income(ETB)	0.0215	0.0182
Cooperative membership	-0.0387	0.421
Constant	-0.484	1.342
Sigma	2.453***	0.336
Number of observations	148	
Truncated observations	54	
Wald χ^2 (13), $Pr > \chi^2$	445.05***	
Log likelihood	-323.19	

***, ** and * indicate significance at 1%, 5% and 10% respectively

Source: Survey result, 2018

4.8.3. Determinants of market outlet choices of *teff* producers

Multivariate probit model is used to estimate several correlated binary outcomes jointly. In this study the decisions of *teff* producers choosing wholesalers, consumers, collectors and retailer outlets are correlated. Thus, an econometric approach was employed to test effects of the explanatory variables on the selection of a particular market outlet. The Wald χ^2 (44) = 103.56 is significant at 1% significance level, which indicates that the subset of coefficients of the model is jointly significant and that the explanatory power of the variables included in the model is acceptable. In this study samples are drawn 100 times to increase the accuracy, since higher number of draws increases the precision level. The results of likelihood ratio test in the model shows that likelihood ratio test of χ^2 (6) = 50.237, $Prob > \chi^2 = 0.000$ is statistically significant at 1% significance level, indicating the null that choices of the four market outlets is independent is rejected and there are significant joint correlations for two estimated coefficients across the equations in the models (Table 27). The likelihood ratio test of the null

hypothesis of independency between the market outlet decision ($\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$) was significant at 1%. which implies that outlet choices are mutually inclusive. So, there are differences in market outlet selection behavior among smallholders marketing *teff*, which are reflected in the likelihood ratio statistics.

Separately considered, the ρ values (ρ_{ij}) indicate the degree of correlation between each pair of dependent variables. The ρ_{21} (correlation between the choice of collector and retailer outlet), ρ_{31} (correlation between the choice of consumer and retailer outlet), ρ_{41} (correlation between the choice of wholesaler and retailer outlet) are positive and statistically significant at 1% significance level and ρ_{42} (correlation between the choice of wholesaler and collectors outlet) ρ_{43} (correlation between the choice of wholesaler and consumer outlet) are negative and statistically significant at 1% significance level, and ρ_{32} (correlation between the choice of collectors and consumers outlet) are positive and statistically significant at 1% level. This result indicates that farmers selling their *teff* produce to the wholesaler outlets are less likely to deliver to consumers and collectors outlets. Similarly, those farmers marketing *teff* to the retailer outlet are less likely to deliver to consumers and collectors market outlets (Table 27).

The likelihood of choosing consumer outlet (30.51%) is relatively low as compared to the probability of choosing collector outlet (36.93%), retailer outlet (49.18%) and wholesalers' outlet (49.49). This is an indicator that wholesaler is the most likely chosen market outlet by farmers and the low capacity of consumer outlet to purchase more *teff* produce at a time and the limited capacity of consumer outlet. The joint probabilities of success or failure of choosing four outlets suggests that the likely of households to jointly choose the four outlets is low. The likelihood of households to jointly choose the four outlets was 4.0% which is relatively lower compared to their failure to jointly choose them (14.9%). The result in Table 24, indicated that out of explanatory variables used in the multivariate probit model, educational level of household head, household size (adult equivalent), livestock owned (TLU), equines owned (TLU), size of land under *teff* production, distance from the nearest market, and current market price of *teff* were found to significantly affect the market outlet choice behavior of *teff* producers.

Education level of the household head: Education level of the household head has positive and significant effect in choosing wholesaler and retailer outlet at 1% probability level. In addition, education level of the household head has negative relationship with the likelihood of choosing consumer and collector outlet at 10% and 5% level of significance, respectively. The positive relationship between education level and selling to wholesaler and retailer outlets, and the negative relationship between education level and selling to consumer and collector outlets shows the fact that being educated enhances the capability of farmers in making informed decisions with regard to the choice of *teff* marketing outlet to sell their *teff* produce based on the benefit they obtain. These results are in line with the findings of Nuri (2016) who found that education level of *bulla* producers has a significant and positive effect on the chances of choosing wholesalers and Retailers market outlets and a negative relationship with collectors' market outlet choice.

Family size: Family size has positive and significant relation with the likelihood of choosing wholesalers outlet at 5% significance level, and negative and significant relation with the likelihood of choosing consumer and retailer outlets at 5% and collector at 1% significant level. This result indicates that, having large family size positively correlate with the likely of choosing wholesalers outlet and has negative relation with likely of choosing consumer, collector and retailer outlets. This finding is consistent with the finding of Addisu (2017) and Chala and Chalchisa (2017) who found household size positively affect likelihood of choosing wholesalers outlet and negatively affect likelihood of choosing consumer, collector and retailer outlet.

Table 27. Multivariate probit estimations of *teff* producers' market outlet choices

Variables	Retailer	Collector	Consumer	Wholesaler
Size of land under <i>teff</i>	-0.0143(0.304)	-0.276(0.266)	-0.207(0.256)	1.185*** (0.363)
Non-farm income	0.00269(0.00891)	0.00594(0.00766)	0.00396(0.00752)	0.00109(0.00931)
Current market price	0.0901(0.0785)	0.0305(0.0462)	-0.161*** (0.0518)	0.0429(0.0518)
Frequency of extension	0.111(0.122)	0.155(0.102)	0.139(0.0972)	-0.00618(0.115)
Distance from market	-0.235*** (0.0810)	0.00796(0.0561)	0.0573 (0.0537)	-0.222*** (0.0737)
Ownership of equine	-0.00131(0.106)	0.0608(0.0888)	-0.0378(0.0864)	0.244** (0.111)
Livestock ownership	0.0172 (0.0467)	-0.00332 (0.0392)	0.0332(0.0380)	0.0894* (0.0489)
Farming experience	-0.00289(0.0265)	-0.0141(0.0226)	-0.0150 (0.0216)	0.0212(0.0261)
Family size	-0.133** (0.0603)	-0.111*** (0.0420)	-0.0856** (0.0396)	0.140** (0.0549)
Education level	0.220*** (0.0541)	-0.0960** (0.0440)	-0.0828* (0.0434)	0.179*** (0.0547)
Sex of household	-0.314(0.318)	-0.129 (0.237)	0.204(0.229)	-0.0140(0.291)
Constant	-3.443(8.398)	0.138(0.756)	-0.0192(0.725)	-16.58(12.00)
Predicted probability	0.4918	0.369	0.3050	0.4949
Joint probability success				0.040
Joint probability of failure				0.149
Number of draws (SML, # draws)				100
Number of observations				148
Log Likelihood				-402.39
Wald chi2 (44)				103.56
Prob > chi2				0.0000
Estimated correlation matrix				
	ρ_1	ρ_2	ρ_3	ρ_4
ρ_1	1			
ρ_2	-0.0607	1		
ρ_3	-0.0934	0.335***	1	
ρ_4	0.293***	0.0173	-0.242***	1
Likelihood ratio test of $\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$				
chi2 (6) = 50.23 Prob > chi2 = 0.0000				

Source: Own computation from survey result, 2018

Note: Coefficient and in the parentheses standard errors

Symbols: ***, ** and * indicates significant at 1%, 5% and 10% levels, respectively

Equines owned: Ownership of means of transport (equines) measured in TLU has positively and significantly related with the likelihood of choosing wholesaler outlet at 5% significance

level. The result depicts that having equines positively correlate to the likely of choosing wholesalers outlet, due to the fact that those households who have equine transport will go distant market in order to sale their *teff* produce to the market that offer better price than other outlets having low price. Since there is no vehicle transport service in the rural study area, ownership of means of transport (equine) offers a greater opportunity in market outlet choices. This result was similar with the finding of Shewaye (2016) who found that number of equines owned has positive and significant influence on probability of choosing the best outlets to sell outputs produced and to achieve higher price.

Livestock owned: Number of livestock owned measured in TLU has significant and positive relationship with the likelihood of choosing wholesaler outlet at 10% significance level. This is due to the positive impact of livestock on the *teff* production by providing cash to purchase improved seed and in-organic fertilizer for *teff* production, and oxen serve as a traction power this increases the amount of *teff* produced and the management of livestock makes the household to select nearby market outlet that benefits them. Gizachew *et al.* (2018) revealed that those households producing high amount of *teff* output are more likely selling their *teff* produce to wholesaler outlet.

Size of land under *teff* production: The likelihood of choosing wholesaler outlet was positively and significantly related with the size of land allocated for *teff* production at 1% significance, level. The result indicated that those households who allocated large size of land for *teff* production would produce more output and they likely to sell to wholesaler outlets. The result is consistent with the findings of Oliyad *et al.* (2017) who found an increase in land allocated increases farmers' likelihood of choosing wholesaler outlet than consumer outlet.

Distance from the nearest market: Distance from the nearest market is negatively and significantly associated with likelihood of farmers selling to wholesalers and retailer outlet at 1% significance level. The implication of this finding is that households located far away from the nearest market faces difficulty in delivering *teff* produce to wholesaler and retailer outlet due to lack of transport service in the study area. This result is supported by the findings of

Addisu (2016) who found that market distance has negative relationship with wholesalers and positively related with collectors' outlet.

Current market prices of *teff*: Current price of *teff* is negatively and significantly associated with the likelihood of choosing consumer outlets at 1% level of significance. This implies that the market price of *teff* shows some fluctuation at market day and due to fear of consumer offer lower price for *teff* than other market outlet farmers are not likely to deliver to consumer outlet. The survey result indicates that consumers in the study area have a limited financial capacity and wants to purchase smaller quantity of *teff* at lower price, due to this farmer are less likely sell to consumer outlet and *teff* producers prefer other market outlets having higher prices. This result is consistent with the findings of Addisu (2016) and Sultan (2016) who found own product price negatively affect the likely of selling to consumer and collector outlet

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

The study was aimed at identifying *teff* market chain actor and their role; analyze *teff* market structure conduct and performance, identifying factors affecting smallholders' *teff* market participation decisions and intensity of *teff* sales and market outlet choice. This study has used cross sectional data collected from 202 randomly selected households, 22 *teff* traders and 28 consumers in Shashamane district for 2017/18 production year. Both descriptive and inferential statistics have used to characterize households' market participation decisions and extent of market participation and market outlet choices of *teff* producers. Structure conduct performance model was used to identify market efficiency of *teff* in study area. Double hurdle model was employed to identify factors affecting households' market participation decision and extent of market participation and multivariate probit model (MVP) was used to identify the factors affecting *teff* market outlet choices of *teff* producers.

Descriptive results revealed that, out of surveyed sample households, 26.73% of households were non-participants and 73.27% were participants. Market participants identified in the transaction process of *teff* includes farmers/producers, village collectors, wholesalers, central wholesalers, retailers, processors and consumers. These market participants are involved in different activities like producing, wholesaling, retailing, collecting, and processing. Sample farmer supplied 3552 quintals of *teff* to the market. From this total quantity marketed, 46.36%, 29.9%, 13.83% and 9.9% of *teff* was sold to, village collectors, wholesalers, retailer's, and consumers respectively. The largest four traders in the total yearly volume of *teff* purchased, was 36.78 percent indicated a loss (weak) oligopolistic market structure. Lack of capital, access to credit, skill (experience) and computation with unlicensed traders are the major barriers in *teff* marketing.

Regarding conduct, the selling price of producers was set by the market 20.30% and through negotiation 24.26% between seller and buyer. The remaining 55.45% of their produce selling price was set by buyers. Traders argued that 59.09% buying price was set by themselves and

22.73% and 18.18% was set by negotiation and market respectively. 27.27 % of the selling price of traders was set by negotiation and 54.55% of the selling price was set by sellers themselves and the rest it was set by market 18.18%. The survey indicated that, 31.82% of sample traders used cash mode of payment to buy and sell their *teff*. The rest 68.18% of sample traders used combination of the two (in cash and in credit).

Teff producers market profit is highest when they direct sell to wholesaler in channel VI (producer-wholesaler-central wholesaler-consumer) which was 1147.28 birr/qt and lowest in channel II (producer-rural collector –retailer-consumer) which was 701.78 birr/qt. Total gross marketing margin is highest in channel V (producer-rural collector-wholesaler-central wholesaler-consumer) which was 50% and lowest in channel IV (producer-wholesaler-retailer-consumer) which was 36%. Producers share is highest in channel IV which account 64% from the total consumers price and lowest in channel V which was 50%.

This study also identified factors affecting smallholders' market participation decision and their extent of participation in *teff* output market. Educational level of household head, livestock owned (TLU), size of land under *teff* production and frequency of extension contact were found to have positively and significant effect on likelihood of *teff* market participation, whereas sex of household head and family size (adult equivalent) were found to negatively and significantly affect it. Households' extent of participation was also affected positively and significantly by size of land under *teff* production while it was negatively and significantly affected by family size (adult equivalent) and non-farm income.

The result of multivariate probit model revealed that the likelihood ratio test in the model is statistically significant at 1% significance level, implying choices of the four market outlets is interdependent. The probability of choosing wholesaler market outlet was significantly affected by education level of household head, family size, ownership of equine (TLU), land area allocated to *teff* production, and distance from the nearest market and livestock owned (TLU). The probability of choosing consumer market outlet was significantly affected by educational level of household head, family size and current market prices of *teff*. The probability of choosing collector market outlet was significantly affected by education of

household head and family size. Likewise, the probability of choosing retailer market outlet was significantly affected by educational level of household head, distance from the nearest market and family size.

The probability of choosing wholesalers market outlet is 49.49% whereas the probability of choosing consumers, collectors and retailer outlet is 30.51%, 36.93% and 49.18%, respectively. This shows wholesalers are the most likely chosen market outlet while consumer outlet is less likely chosen. The joint probabilities of households to jointly choose the four market outlets is 4.0% which is lower than the likely of not choosing all outlet which is 14.9%. The correlation between each pair of dependent variables implies that farmers selling *teff* grain to retailer and wholesaler outlet are less likely to deliver to consumer and collector outlet.

5.2. Conclusion and Recommendations

From the findings of this study the following conclusion and relevant recommendations are drawn, in order to help design appropriate intervention strategies to improve the smallholder farmers market chain of *teff* and to correct marketing problem through creating conducive production and marketing environment in the study area.

In study area structure conduct performance of *teff* market were analysed. Analysis of structure conduct performance indicates that, the *teff* market in study area deviated from competitive market nature.

Household decision to participate in *teff* market positively and significantly affected by educational level, livestock owned, land under *teff*, number of contact with agricultural extension agents Moreover, factors such as sex of household head and family size (adult equivalent) were found to negatively and significantly effect on probability of *teff* market participation. Households extent of participation was also affected positively and significantly by size of land under *teff* production while it was negatively and significantly affected by family size (adult equivalent) and non-farm income.

Probability of choosing wholesaler market outlet was significantly affected by education level of household head, family size, ownership of equine (TLU), land area allocated to *teff* production, and distance from the nearest market and livestock owned (TLU). The probability of choosing consumer market outlet was significantly affected by educational level of household head, family size and current market prices of *teff*. The probability of choosing collector market outlet was significantly affected by education of household head and family size. Likewise, the probability of choosing retailer market outlet was significantly affected by educational level of household head, distance from the nearest market and family size. Based on finding of study following recommendations were under taken:

To enhance bargaining power of farmers and other interested traders who want to enter in *teff* trading, trade and industry office attentively follow up *teff* traders. This is important to get fast and quality service which can save time, money and labor for both service providers and customers. This will also ultimately foster competition and favors sustainable supply of *teff* at reasonable price. Creating access to flexible credit system for traders is also a necessary condition which targets at reducing the oligopolistic market structure in the Shashamane district. The enhancement of *teff* producers bargaining power through cooperatives is the best measure that should target increasing farmer's share of benefit from their marketable produce. Strengthening horizontal and vertical linkages of the *teff* market chain actors in the study area is also an important input that improves the marketing system of the crop in the study area.

The result of the study showed that being female household head negatively affect the likelihood of market participation as compared to male household head. Support given to female household head and empowering of female household head through training and supply of improved technology that encourage them to participate in *teff* marketing is indispensable.

Education level of the household head was found to have positive effect on the likelihood of market participation. Designing of policies that encourage provision of adequate and effective formal education to the rural farming households and to the study area in particular enhances households' likelihood of market participation. This can be done by regional and local

government through strengthening the existing education provision system. Family size had negatively affect likelihood of market participation and extent of market participation. So, in order to enhance households' market participation, rural health extension should be strengthened on promoting family planning based on interest of farmers by showing its negative impact is important in the study areas. In addition, provision of rural employment opportunities is essential to reduce high dependence on farm output and to increase the proportion outputs sold.

Livestock owned in TLU contribute to the likelihood of market participation positively. Efforts are required in improving number of livestock ownership is essential for smallholder farmers as source of cash to purchase improved seed and inorganic fertilizers and provide a traction power to enhance market participation of *teff* producers. Increasing the size of landholding was impossible since land is a limited resource. Therefore, interventions are needed to increase productivity of *teff* per unit area of land through delivering appropriate and improved *teff* production technology that increase smallholder farmers market participation and extent of participation. Proper utilization of land resource requires intensifying the farm practices through provision of sustainable and timely supply of inputs, increasing the farmers' awareness on agronomic practices like row planting and proper application of inputs helps the farmer to produce and supply more *teff* to the market.

Extension contact is a significant contributor to the likelihood of market participation. Therefore, joint effort of development agent, agricultural experts, researchers and other stakeholders on identifying and solving problems, availing of new agricultural technology, transfer of improved technology and information to farmers are compulsory to enhance market participation.

Income earned from non-farm activities had negatively influenced extent of *teff* market participation. Thus, Interventions intended at raising the efficiency of farmers to reduce farmer's involvement in non-farm activities and changing the attitudes of farmers to use cash income obtained from non-farm activities to strengthen their agricultural production and market orientation is crucial.

Multivariate probit model result showed that *teff* producers were influenced by different factors to choose appropriate market outlets to sell their *teff* produce. The finding suggests that an adjustment in each one of the significant variables can significantly influence the probability of choice of market outlets. Attending of formal education by household head is better in searching appropriate market outlets, thus the concerned authority should be able to increase the awareness of households about the importance of adult and formal education to choose appropriate market outlet in selling outputs.

Expanding equal accessibility of road infrastructures and availing transportation services needs government intervention to promote the effective marketing of *teff* through best market outlet. Households who live far from the nearest market without their own means of transport are unlikely to sell to wholesales outlet, indicating the importance of adequate road facilities, transportation services and equines in providing options for marketing *teff* produce to attain a better price. Therefore, improving of existing road infrastructure and creating conducive environment for transport service would reduce transportation costs as well as time spent to reach the market and enhance farmers to sell their produce to the outlet that results higher returns.

Concerned body has to advice farmers to efficiently utilize land resources and efforts are required in strengthening the existing livestock by providing improved health services, better livestock feed, targeted credit and adopting agro-ecologically based on high-yielding breeds and disseminating through artificial insemination in the area. Lastly Actual market price of *teff* is also an important factor to influence choice of appropriate market outlets. Increasing production alone is not enough without reasonable selling price, offering better price for *teff* produce can inspire farmers to produce more and in selling through the best market outlets. Hence, delivering of updated market price information is essential for farmers to make informed decision in marketing of *teff* output.

6. REFERENCES

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7. APPENDIX

Appendix Tables

Appendix Table 1. Conversion factors of number of family members into adult equivalent

Age group	Male	Female
Less than 10	0	0
10-13	0.2	0.2
14-16	0.5	0.4
17-60	1	0.8
Above 60	0.7	0.5

Source: Bekele hundie, 2001

Appendix Table 2 Conversion factor used for computing tropical livestock units

Type of livestock	TLU
Ox and Cow	1
Heifer	0.75
Young Bull (Woyefen)	0.34
Calf	0.25
Sheep and Goat (Young)	0.06
Sheep and Goat (Adult)	0.13
Chicken	0.013
Donkey (Young)	0.35
Donkey (Adult)	0.70
Horse and Mule	1.1

Source: Storck, *et al.* (1991) cited in Yalew (2016)

Appendix Table 3. Model specification tests

Candidate model		Hypothesis	Test statistic
Likelihood Ratio Test	Tobit Vs Double Hurdle	Ho: Tobit best fits data H1: Double Hurdle best fits data	(27.69)** $\Pr > \chi^2 (13, 27.69) = 0.05$
Vuong's Test	Double Hurdle Vs Heckman model	Ho: No difference between Heckman model and DHM	Vuong statistic = 8.91 $Z_{0.005} = 2.578$
Model	AIC		
Tobit	725.05		
DHM	703.32		

Source: Based on model output, 2018

Appendix Table 4. Collinearity statistics for continuous variables used in the model

Variable	VIF	1/VIF
Land allocated for <i>teff</i>	1.76	0.568002
Total annually Farm income	1.53	0.655130
Frequency of extension contact	1.45	0.688325
Distance to nearest market	1.44	0.694220
Family size	1.35	0.738685
Cooperative membership	1.28	0.780929
Equines owned	1.28	0.781734
Sex of household	1.25	0.802816
Education level of household	1.22	0.816758
Livestock owned	1.16	0.864218
Farm experience	1.11	0.899328
Non-farm income	1.08	0.929742
Mean	1.33	

Source: Computed from model result, 2018

Appendix Table 5. Heckman two-step result for sample selection bias

Variables	1 st stage (Probit)	Std. Err.	2 nd stage	Std. Err.
	Coefficient		(OLS) Coefficient	
SIZEATEF	0.00140	0.0357	6.379***	2.305
SEXHH	0.0490	0.0356	-0.403	0.628
EDUHH	0.0136**	0.00576	0.141	0.148
FAMSIZE	0.00616	0.00864	-0.574***	0.170
FREXP	0.00878	0.00550	0.387***	0.148
LIVOWN	0.000523	0.0120	0.612	0.389
NEQUIO	-0.0137	0.00973	-0.727***	0.194
MRKTDIS	0.00772	0.0153	0.510*	0.307
ACREDITR	0.0389	0.0270	0.459	0.595
FRQEXT	0.00153*	0.000896	0.0497**	0.0207
COOPMEM	0.00125	0.00103		
FARMINC	0.00398	0.00327	0.0304	0.0615
NOFINCOME	-0.00380	0.0273	-1.060	0.753
Constant	0.969***	0.107	2.352	2.451
IMR			(0.67) ^{NS}	
Number of observations			202	
Censored observations			54	
Uncensored observations			148	
Wald χ^2 (13), Pr > χ^2			226.26***	

***, ** and * indicate significance at 1%, 5% and 10% respectively. NS shows non-significance.

Source: Model output, 2018.

Survey questionnaire for each market chain actors

Market Chain Analysis of *Teff (Eragrostis teff)*: The Case of Shashamane District of Oromia National Region State, Ethiopia

A. General information

Questionnaire code _____

Name of Enumerator: _____

Phone number _____ Date _____

1. Shashamane District 2. Kebele _____ 1. Awasho Denku 3. Jigessa
2. Wandere 4. Kirara-filicha

B. Household demographic Characteristics

3. Name of household head _____.

4. Phone number of household head _____.

5. Sex of household head: 0. Male 1. Female 6. Age of household head_____ years

7. Marital status of household head 1. Married 2. Single 3. Widowed 4. Divorced

8 Education level (completed years of formal schooling) _____ (grade)

9. Farming experience: _____ years

10. Size of Family members

Age group	No	Male	Female
Less than10			
10-13			
14-16			
17-60			
Above 60			

11. Total amount of hired labor for the production year (2017/18)

12. Cost of a unit of labor

Resource endowments

11. Livestock ownership and utilization in 2017/18

No	Type of Livestock	Local			Cross-breed		
		Numbers owned in 2017/18	Number sold in 2018	Average selling price (Birr)	Numbers owned in 2017/18	Number sold in 2017/18	selling price (Birr)
1	Ox and Cow						
2	Heifer						
5	Young Bull (Woyefen)						
6	Calves						
7	Sheep and Goat (Young)						
8	Sheep and Goat (Adult)						
9	Chicken						
10	Donkey (Young)						
11	Donkey (Adult)						
12	Horse and Mule						

12. Land ownership and use particulars in 2017/18 production year

No	Land Use particulars	Area cultivated in 2017/18 cropping season (in ha)
1	Total land owned	
2	Leased-in land	
3	Shared-in land	
4	Leased-out land	
5	Shared-out land	
6	Land allocated for grazing	
7	Land covered by Eucalyptus	
8	Others (specify)	

13. Land resource allocation and crop production in 2017/18 production year

No	Land use particulars	Area cultivated in 2017/18 E.C (in ha)	Area cultivated in main season of 2017/18 E.C (in ha)	Total quantity produced in 2017/18 E.C (in qt)	Quantity sold in 2018 E.C (in qt)	Unit selling price/qt (Birr)
1	<i>Teff</i>					
2	Wheat					
3	Barley					
4	Maize					
5	Sorghum					
6	Chickpea					
12	Vegetables					
13	others					

Production and marketing of *teff* by the household

Teff production in 2017/18

14. How long have you cultivated *teff*? _____ years.

15. Size of land allocated to *teff* production during 2017/18 cropping season?

Plot ID	Plot location name	Area cultivated (in ha)	Land ownership (Codes E)	Varieties grown (Codes F)	Name of varieties (Codes G)	Soil fertility status (Codes H)	Plot distance from home (minutes of walk)

Codes E: 1. Own land 2. Rented-in 3. shared-in 4. Gift
Codes F: 1. Improved 2. Local
Codes G: 1. Quncho 2. Gololisa 3. Kora 4. Boset 5. Bunise (local red) 6. Adilo
Codes H: 1. Good 2. Medium 3. Poor

16. Inputs used in *teff* production and cost of these inputs in 2017/18?

	Amount of Seed used (in kg)	Total cost of seed (in birr)	Amount of fertilizers used (in kg)		Purchase price per kg	Did you used compost 1. Yes 2. No	Did you used Animal waste? 1. Yes 2. No	Herbicide used (in liter)
			DAP	Urea				

17. What are the major sources of Improved seed for *teff* in 2017/18?

1. Own 2. Local market
4. Research center 3. Cooperatives/unions 6. Others (specify)

18. What are the major sources of Fertilizers for *teff* in 2017/18?

1. Local market 2. Cooperatives /Unions 3. Others (specify)

19. What are the major sources of Herbicide for *teff* in 2017/18?

1. Local market 2. Cooperatives /Unions 3. Others (specify)

20. Would you like to expand *teff* production in future? 1. Yes 2. No

21. If yes, why? 1. Main source of income 2. Main consumption crop

3. Resist water logging 4. Resist insect pests 5. Others (specify)

22. If no, why?

1. Shortage of land 2. Cash constraints for input
3. Lack of improved seed 4. Lack of fertilizers 5. Others (specify)

23. What is the total quantity of *teff* produced in 2017/18 production year? fill the following table.

	Quantity of <i>teff</i> (in quintal)					
	Total Produced	Consumed at home	amount Sold to Market	Gift for others	Stored	Kept for seed
White						
Red						
Mixed						

***Teff* marketing in 2018**

24. Did you sell *Teff*? 1. Yes 0. No

25. If your answer for Q24 is No, why you did not sell? _____

26. If your answer is 'Yes', how long have you been selling products? _____ Years

27. What is the distance from home to market you mainly sale your *teff* produce? _____ Km

What is the distance from your home to the market for the following activity 2017/18?

No	Market place for	To nearest market(Km)	To alternative market (Km)
1	<i>Teff</i> produce (to sale)		
2	<i>Teff</i> seed (to purchase)		
3	Fertilizers (to purchase)		

28. Did you incurred costs to in production and marketing activities of *teff*? 1. Yes 2. No

29. If you say yes, what type of cost you incurred? Fill the following table properly

List of expense	Cost incurred(birr/ha)
Land clearing	
Plowing	
Seed	
Fertilizer	
Sowing	
Weeding/herbicides	
Harvesting/collection	
Threshing/winnowing	
Sack	
Land rent	
Labor	
Transportation	
Loading/unloading	

30. Did you know market price before you transport *teff* produce to the market? 1. Yes 2. No

31. If yes Q30 what is current market price of *teff* in _____ ETBirr/100kg

32. How much quantities and to whom did your sale last year *teff* produce (2017)?

Type of <i>teff</i>	Quantity of <i>teff</i> sold (quintal)	selling price (Birr/quintal)	*To whom	1. Wholesalers 2. Retailers(rural 3. Consumers 4. Collectors 5. Institutions (hotels, Universities, etc) 6. Processers 7. Brokers 8. Others (specify)	*Where (place of sale)	1. local market, 2. Woreda market, 3. Zonal(major) market, 4. Addis Ababa, 5. Other (specify)
White						
Red						
Mixed						

Note: If you sold to more than one market outlet please indicated the quantity sold to each

33. If you did not sale *teff* in 2010 E.C, why?

1. Doesn't have cash constraint 2. *Teff* produced is low & kept for home consumption
 3. Shortage of land 4. Others (Specify)

34. In 2017 in selling your *teff* produce, which market outlet do you select primarily?

1. Wholesalers 2. Retailers 3. Collectors
 4. Consumers 5. Cooperative 6. Others (specify)

35. Why do you prefer the selected market outlet (what factors do you consider)?

1. Better price offered 2. Fairness of scaling (weighing) 3. Closeness in distance
 4. Transport availability 5. Others (specify) _____

36. Do you stored last year *teff* produce to get better price? 1. Yes 2. No

37. If no, what is the reason? _____

38. When did you sold large proportion of *teff* produced in 2017/18? _____

1. December 2. January 3. February 4. March 5. April

6. May 7. June 8. July 9. August

39. If you, sale immediate after harvest (in December/ January), why you did that?

1. Cash constraints 2. Storage problem
 3. Better price 4. Others (specify)

40. Who usually sets the selling price of *teff*?

1. Yourself 2. Set by demand and supply 3. Buyers 5. Other (specify) _____ 38. Is there a difference in price due to differences in buyer? 1. Yes 2. No

41. If yes, what is the reason for difference? _____

Means of transportation of *teff* produce

42. What are means of transport you used last year in transporting *teff* produce to market?

1. Manpower 2. Equines 3. Animal cart
 4. Public transport 5. Others (specify) _____

43. If you used your own Equines, what is the advantage over others?

1. Good to select best market outlets 2. Accessible
 3. No cost 4. Others (specify)

44. Do you used others (Equines or Animal cart) as a means of transport? 1. Yes 2. No

45. If yes, what was the cost of transport per 100kg of *teff* up to market place? _____ Birr

46. Do you used vehicles as a means of transport of *teff* produce to market? 1. Yes 2. No
47. If yes, what was the cost of transportation per 100kg up to market place? _____Birr
48. If you did not used vehicles, why?
1. Using own equines 2. Unavailable 3. High cost 4. Others (specify)

Extension contacts

49. Did you receive extension services in relation to *teff* production in 2017/18?
1. Yes 2. No
50. If no, why?
1. The service is general/not specific to *teff* 2. The advice is not related to *teff*
3. Do not have time to get the service 4. No service provider 5. Others (specify)___
- 51.If yes how often the extension agent contacts you last year (frequency)? _____ days in a year?
- 52.What type of extension advice you get specifically on *teff* production?

No	Reason (type of visit) (Codes M)	How many times during the year
1	Using of improved varieties	
2	Plowing; sowing methods	
3	Fertilizer; Compost application	
4	Weeding; Herbicide application	
5	Harvesting; post-harvest handling	
6	Marketing of <i>teff</i>	
7	Soil conservation	
8	Others (specify)	

Credit Service

53. Did you receive credit for *teff* production purpose in 2017/18? 1. Yes 2. No
54. If yes how much you received for *teff* production in 2017/18? __Birr, at interest rate of __%.
55. If you received credit in kind (like: seed) specify the amount? _____ kg
56. If you received credit in kind (like: fertilizer) specify the amount? _____ kg
57. For what purpose did you take the credit in relation to *teff* production?
1. To purchase improved seed of *teff* 2. To purchase fertilizer for *teff*

Note: Non/off-farm incomes are incomes generated by excluding income from own farming.

65. What is the reason to be engaged in non-farm activities?

1. Attractive income from non-farm activities
2. Shortage of land
3. Excess family labor
4. Other (specify)_____

66. If you did not participate in non-farm income activities last year what is the reason?

1. Self-sufficient
2. No non-farm income activity
3. Not interested to participate
4. Other specify____

Total Annualy Farm income

67. How much income you received from any agriculture activity in 2017/18_____ETBirr

No	Source of income	Any yearly income ET Birr
1	Crop Sales	
2	Livestock and their by product sales	
3		
4		
	Mining	
	others (specify)	
TOTAL		

68. What are the major challenges you faced in production and marketing of *teff*?

1. Poor market linkages
2. Poor road infrastructure
3. Low price
4. pest attack at seedling stage
5. Weather change
6. High inputs cost
7. Inadequate means of transport
8. Of others (specify).

Thank you for your patience and time allocation to respond!

Questionnaire for *Teff* Traders

I. Socio-demographic characteristics of traders

1. Questioner number _____
3. Name of traders: _____ Phone number _____ Date: _____
4. Name of Market _____
5. Age of trader: _____ years
6. Family size: Male _____ Female _____ Total _____
6. Sex of trader: 1. Male 0. Female
7. Marital status of trader: 1. Single 2. Married 3. Widowed 4. Divorced
8. Education level (completed years of formal schooling) ____ (grade)

9. Type of business? 1. Wholesalers 2. Retailers

3. Collectors 4. Others (specify) _____

10. How long have you been operating in *teff* trade _____ years

11. Trade type 1. Alone 2. Partnership 3. Others (specify) _____

12. Did you have grain trade license? 1. Yes 2. No

13. If yes, how much did you pay for grain trade license? _____ Birr

14. If yes, how much is the grain trade license renewal payment/year? _____ Birr

II. Capital

15. How much is your initial working capital _____ Birr, current working capital _____ Birr

16. What is your source of working capital?

1. Own 2. Loan 3. Gift 4. Share 5. Others (specify) _____

17. If your source of working capital is loan, who is your source of credit?

1. Relative/family 2. Micro finance institution 3. Other traders

4. Bank (specify) 5. Others (specify) _____

18. What was the reason behind the loan?

1. To build store 2. To purchase a car 3. For working capital

4. Others (specify) _____

19. Are there any entry barriers for grain trading? 1. Yes 2. No

20. If yes, what are these barriers?

1. Social barriers 2. Legal barriers 3. Discrimination

4. Financial barriers 5. Competition of unlicensed traders 6. Others (specify) _____

III Purchasing activities

21. How much amount of *teff* did you purchase? In 2017/18 _____ qt.

How much was the purchased price? _____ Birr/qt

22. How much amount of *teff* did you sold? In 2017/18 _____ qt.

How much was your selling price? _____ Birr/qt

23. What was the main reason for your *teff* choice to purchase?

1. High supply 2. High demand 3. High selling price 4. Long storage life

5. Others (specify) _____

24. Who purchase *teff* for you?

1. Myself 2. Friends 3. Through brokers 4. Family members

5. Commission agent 6. Others _____
25. If you used brokers and commission men, what was the advantage of using them?
1. You could get enough quantity 3. Reduce transaction cost 5. Save your time
 2. You could get quality *teff* 4. Purchased at low price
 6. Other (specify) _____
26. How did you attract your supplier?
1. By giving better price relative to others
 2. By fair scaling (weighing) 3. Other (specify) _____
27. How did you attract your buyers?
1. By giving better price relative to others 3. By fair scaling 4. By giving credit
 2. By providing Quality *teff* 5. Other (specify) _____
28. Who were your major buyers?
1. Wholesalers 3. Retailers 5. Urban assembler
 2. Millers/processors 4. Urban consumers 6. Gov't organizations 7. Others _____
29. Who were your major suppliers? Rank
1. Wholesalers 2. Village collectors 3. Retailers 4. Urban assemblers
 5. Farmers 6. Gov't organizations 7. Others _____
30. How is your usual purchasing price compared to your competitors?
1. Higher 2. Lower 3. The same
31. If it was higher in Q. 30 what was the main reason?
1. To attract more supplier 3. To get better quality *teff*
 2. To buy more quantity 4. To kick out your competitor from the market
 5. Others (specify) _____
32. Who set your purchasing price?
1. Myself 2. The seller 3. By market 4. Negotiation with suppliers
 5. Discussion with other traders 6. Others (specify) _____
33. When did you set your purchasing price?
1. Early in the morning of the market day 3. At the time of purchase
 2. One day before the market day 4. Other (specify) _____
34. Who decided on your selling price?
1. Myself 2. Buyers 3. By negotiation with buyers 4. By the market 5. By discussed

with traders 6. Other (specify)_____.

35. When did you set selling price?

1. Early in the morning of the market day 3. At the time of selling
2. One day before the market day 4. Others (specify)_____

36. How was the supply of *teff* in 2017/18 compared to the previous year?

1. Increased 2. Decreased 3. No change.

37. What is the reason behind your response?_____

38. What is your mode of buying and selling strategy?

1. In cash 2. In credit 3. In combination of both cash and credit.

39. How was the price of *teff* in 2017/18 compared to the previous year?

1. Increased 2. Decreased 3. No change.

40. What is the reason behind your response?

1. _____

2. _____

41. What was the major problem to enter *teff* trade?

1. License 2. Lack of starting capital 3. Government policy 4. Trading experience
5. Other (specify)_____

42. Are there restrictions imposed on unlicensed traders? 1. Yes 2. No

43. What are the main criteria's to be licensed *teff* traders? 1. Initial capital 2. Interest

3. *Teff* Trading experience 4. Others (specify)_____

44. How do you see the procedure to get the license? 1. Complicated 2. Easy

45. How much amount Birr is required to get the license?_____Birr.

How much is the yearly renewal payment for the trading license? _____

IV. Selling activities

46. Did you incur cost for *teff* trading? 1. Yes 2. No

47. If Q43 Yes indicate your average cost incurred in *teff* trading activities in 2017/18?

Marketing cost component in the chain	Costs incurred (Birr/qt)
Sack price (packaging materials)	
Loading loading /unloading	
Processing	
Telephone cost	
Loss in transport and storage	
Transportation	
Storage	
temporary workers	
Wage for permanent employee	
Tax and License	
Personal travel	
Infrastructure (road, electricity, etc)	
Others(specify)	
Total cost	

48. To whom do you sale the purchased *teff* grain?

1. Consumers 2. Retailers 3. Wholesalers 4. Processors 5. Others (specify)

49. If you sold to more than one outlet indicate the average quantity sold to each _____

50. What percent of the total purchased *teff* is sold on domestic market (Nagel, Kofale, Hawassa, Addis Ababa, Others (specify))? _____ percent

51. What are the average price per 100kg of *teff* when you resale it _____ Birr

52. What are prices of reselling 100kg of *teff* at scarce season? _____, abundant season? _____ birr

53. What is the term of payment at time of reselling purchased *teff*? 1. Cash 2. Credit 3. Both.

54. If you sold on credit, for how long do you wait the payment? _____ days

55. Do you know the market price of *teff* in different markets (village market and other areas) before you sold the purchased *teff*? 1. Yes 2. No

56. What is your source of market price information? 1. Mobile phone 2. other trader 3. Others (specify) _____

57. Are there any problems on *teff* marketing? 1. Yes 2. No

58. If yes, what are these problems? 1. Lack of credit 2. Supply shortage

3. Storage problem 4. Quality problem 5. Capital shortage 7. Problem of road access

8. Competition with unlicensed traders 9. Others (specify) _____

59. What interventions is needed to solve these problems? _____

60. Quantity sold to Wholesaler _____ qt, Consumer _____ qt, Universities _____ qt, Processor (Hotels, Restaurant, Millers) _____ qt, retailer _____ qt, Others _____ qt.

Questionnaires for *Teff* Consumers

Questionnaire number: _____

Name of Enumerator: _____ Phone _____ Date _____

1. Name of respondents _____ 2. Age of respondents: _____ years
3. Sex of respondents: 0. Male 1. Female
4. Marital status: 1. Single 2. Married 3. Widowed 4. Divorced
5. Family size: Male _____ Female _____ Total _____
6. Education level (completed years of formal schooling) _____ grade
7. Distance from home to the nearest town? (km) _____
8. Means of income generation? _____; incomes earned per month? _____
9. What proportion of your income was spent on purchasing *teff* in 2018? _____ percent
10. What quantity of *teff* you do you purchased last year per month (in kg) _____
11. From whom do you purchase *teff* last year? 1. Farmers 2. Collectors
3. Retailers 4. Wholesalers 5. Others (specify) _____
12. Do you think traders of *teff* marketing are efficient and competitive? 1. Yes 2. No
13. If no, what is the problem of traders? 1. Price setting problem 2. Supply poor quality
3. Cheat scaling weighting 4. Others (specify) _____
14. What type of *teff* do you purchased for consumption? 1. White *teff* 2. Red *teff* 3. Mixed *teff*
15. Why do you prefer the selected one? _____
16. As a buyer, do you have difficulty in obtaining sufficient supplies? 1. Yes 2. No
17. As a buyer, do you have a particular seller? 1. Yes 2. No
18. If yes, how do you attract the sellers? _____
19. What should be done to improve the quality of *teff* produce? _____
20. Do you think the price of *teff* reduced if the chain actors linkage is improved? 1. Yes 2. No
21. If no, why? _____
22. If yes, what intervention will be needed _____?

Thank you for your patience and time allocation to respond!