American Journal of Theoretical and Applied Statistics
2022; 11(6): 200-218
http://www.sciencepublishinggroup.com/j/ajtas
doi: 10.11648/j.ajtas.20221106.14
ISSN: 2326-8999 (Print); ISSN: 2326-9006 (Online)

Analysis of Honey Value Chain: In Case of Mesela District, West Hararghe Zone, Ethiopia

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To cite this article:
Kemer Omer Yuya. Analysis of Honey Value Chain: In Case of Mesela District, West Hararghe Zone, Ethiopia. *American Journal of Theoretical and Applied Statistics*. Vol. 11, No. 6, 2022, pp. 200-218. doi: 10.11648/j.ajtas.20221106.14

Received: July 29, 2022; **Accepted**: September 13, 2022; **Published**: November 22, 2022

Abstract: The purpose of this study was to analyze honey value chain with special emphasis to Mesela District, West Hararghe zone, Oromia, Ethiopia. The main objectives of the study were to identify the actors, activities, the distribution of costs and benefits among them and to identify factors affecting farmers' participation in honey marketing and volume marketed in the study area. Both primary and secondary data were used and a total of 160 honey producing sample households from four potential honey producing kebeles of the District were surveyed. The result of regression analysis revealed that the beekeepers, collectors, processors, local brewery houses and retailers. Results from Heckman's procedure shows among fourteen explanatory variables hypothesized to affect honey market participation decision sex of the household head, number of beehives owned, market information, household's beekeeping experience, tropical livestock unit (TLU), and type of beehive used were found to be significant. Four variables, sex of the household head, number of beehives owned, credit access for honey production, type of beehive used were also found to be significantly influence the volume of honey sold by the participants of honey marketing. More evidence is needed on honey value chain before any generalization of the results can be made. In addition, the empirical tests were conducted only on 160 honey producer since 2015. Therefore, the results of the study cannot be assumed to extend beyond this group of honey producer to different study periods. The study might help the honey producer in addressing honey value chain raising awareness and capacity building of both farmers and District's agricultural development agents through provision of appropriate training on how to manage bees and incorporate new technologies, and formation of beekeeper unions and cooperatives to address problems like lack of access to credit, market information and modern inputs are the actions to be taken to strengthen the sector's contribution to the District's development.

Keywords: Honey Value Chain, Tobit Model, Beekeeping, Access to Credit

1. Introduction

1.1. Background

Ethiopia, whose economy is mainly based on agriculture, has a favorable natural resource endowment for the production of various types of agricultural outputs. Owing to its varied ecological and climatic conditions, Ethiopia is home to some of the most diverse flora and fauna in Africa. Its forests and woodlands contain diverse plant species that provide surplus nectar and pollen to foraging bees. Beekeeping is one of the oldest farming practices in the country. There is an ancient tradition for beekeeping in Ethiopia which stretches back into the millennia of the country's early history [1]. Of all countries in the world probably no country has a longer tradition of beekeeping than Ethiopia [2].

Honey is mostly produced at household level by beekeepers that are often the poorest and most marginalized in society, and these people are highly disadvantaged in the market place. Poor roads, remote locations, lack of knowledge of the final market, lack of containers and infrequent interactions with traders mean the potential of the honey trade to bring income benefits to producers remains unexploited [3].

Despite the fact that the quantity of honey product in Oromia takes the major share in the country, the region has been unable benefit from the sector. Mesela District is one of the areas that have considerable potential of honey production in Oromia. Though many governmental and

nongovernmental organizations have been introducing beekeeping as one of marketable commodities and tried to improve the existing traditional apiculture production system in the District, lack of institutional linkages and lack of organized markets for honey still hinder the development of the sector in that area. Besides the major constraints of the sector, particularly in the District are lack of beekeeping knowledge, shortage of trained manpower, shortage of beekeeping equipments, pests and predators, and inadequate research and extension services to support apiculture development program.

1.2. Statement of the Problem

Even if apiculture presents an opportunity for small producers, for many African beekeepers the potential to create a significant livelihood from selling honey remains out of reach. Some of the issues facing small honey producers are similar to those facing other small commodity producers, while some aspects are specific to the honey trade. Beekeeping is often promoted as being a pro-poor income generating activity because it is accessible to marginalized members of communities, has low start up costs and requires little land or labor. However, without access to a market, these benefits cannot be utilized [4].

Ethiopia is a leading honey producer in Africa and one of the ten largest honey producing countries in the world. Despite the favorable agro-ecology for honey production and the number of bee colonies the country is endowed with, the level of honey production and productivity in the country in general and in Oromia in particular is still low. Despite its considerable potential of honey production in the region, farmers couldn't optimize the benefit from the sector.

Even though many parts of the country are well known for fruits, horticulture and floriculture production and integration of apiculture development in the agriculture production system has huge advantage for pollination, there is no compiled and rigorous analysis on honey value chains in the area. The set of actors and activities, and organizations and the rules governing those activities in the honey production system of the areas are also not well known. Thus, the purpose of this study is to investigate honey value chain actors and their role in the chain and factors affecting farmers' participation in honey marketing in Mesela District.

1.3. Objectives of the Study

The general objective of this study is to analyze honey value chain in the study area.

The specific objectives of the study

1. To identify the actors, activities, and the rules governing the activities in the chain;
2. To identify the distribution of costs and benefits of the actors in the chain and;
3. To identify factors affecting farmers' participation in honey marketing and volume marketed in the study area.

1.4. Scope and Limitations of the Study

Value chain analysis includes from producers to the end users covering wide range of geographical areas stretching from local to global markets. However, in this study the value chain analysis focuses only on Mesela District. Regarding the limitation of the study, due to shortage of logistics the study doesn't represent the whole value chain of honey in the country and only focus on the honey value chain that originates from major honey producing peasant associations (PAs) in the District. Hence, the generalizations of the finding are limited to the study area and locations with similar socio-economic characteristics.

1.5. Significance of the Study

The smallholder producers have currently limited access to market due to low level of productivity; poor product quality and market barriers, such as poor infrastructure, lack of favorable trade policy and shortage of finance and lack of collective bargaining power. Thus, there is a strong need to help small producers in Ethiopia to achieve sustainable and fair access to honey market in order to increase their income and secure their livelihoods. The implication is that there is a need to undertake research and generate information to identify alternative mechanisms in which the honey producers and other actors can overcome the trade barriers, improve and add value to their products, and become stronger negotiators in local, regional, and international markets, thereby improving their income. The information generated from this research can be used by local practitioners and be used as input in the formulation of honey development strategies and policies.

2. Literature Review

This chapter gives theoretical highlights for the study. It is intended to provide insights on definition and concept of value chain, literatures on value chain analysis and review of recent empirical findings on honey value chain analysis.

2.1. Definitions and Basic Concepts of Agricultural Value Chain

2.1.1. Agricultural Value Chain

An agricultural value chain is usually defined by a particular finished product or closely related products and includes all firms and their activities engaged in input supply, production, transport, processing and marketing (or distribution) of the product or products. Defines the value chain as 'the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers, and final disposal after use [5].' An agricultural value chain can, therefore, be considered as an economic unit of analysis of a particular commodity or group of commodities that encompasses a meaningful grouping of economic activities that are linked vertically by market relationships. The emphasis is on the relationships between

networks of input suppliers, producers, traders, processors and distributors [6].

2.1.2. Value Addition

Value-addition is a measure for the wealth created in the economy. Referring to the definition used in systems of national accounting, total value-added is equivalent to the total value of all services and products produced in the economy for consumption and investment (the gross domestic product - GDP), net of depreciation. To arrive at the value-added generated by a particular value chain, the cost of bought-in materials, components and services has to be deducted from the sales value [7].

2.1.3. Value Chain Development and Up-grading

A first step to chain development is to support chain actors /farmers to improve their farming skills. This helps them produce higher yields of higher, more consistent quality, and produce which is better suited to the market. This enables them to make more money and improve their livelihoods [8].

In developing a growth strategy for the sub-sector under analysis, it is important to distinguish between product and labor markets. It may not always be optimal or feasible to upgrade 'en masse', but rather it is important to take into account that when zooming in on a particular sub-sector, that growth strategies will likely involve "winners" who create jobs for "losers", either directly or indirectly (through increased need for service firms and the multiplier effect).

According to research, upgrading can be classified in to different types [9]:

Process upgrading: Increasing the nature of internal processes such that these are significantly better (differentiated) or more cost-efficient than those of rivals, both within individual links in the chain (for example, increased inventory turns, lower scrap), and between the links in the chain (for example, more frequent, smaller and on-time deliveries).

Product upgrading: Introducing new products or improving old products, with increased value to end-consumers, faster than rivals. This involves changing new product development processes both within individual links in the value chain and in the relationship between different chain links;

Functional upgrading: Increasing value added by changing the mix of activities conducted within the firm (for example, taking responsibility for, or outsourcing accounting, logistics and quality functions) or moving the locus of activities to different links in the value chain (for example from manufacturing to design).

Channel upgrading: Moving existing products into a new pathway leading to a new end-market (for example, moving from domestic markets to export markets).

Chain upgrading: Moving to a new value chain for the production of a different product.

2.1.4. Value Chain Actors

According to research, the term "value chain actors" summarizes all individuals, enterprises and public agencies related to a value chain, in particular the value chain operators, providers of operational services and the providers of support services. In a wider sense, certain government agencies at the macro level can also be seen as value chain actors if they perform crucial functions in the business environment of the value chain in question [7].

2.1.5. Value Chain Governance

Governance in a value-chain refers the structure of relationships and coordination mechanisms that exist between actors in the value-chain. Governance is important from a policy perspective by identifying the institutional arrangements that may need to be targeted to improve capabilities in the value-chain, remedy distributional distortions, and increase value-added in the sector [10].

According to research, governance implies that interactions between firms along a value chain reflect organization, rather than randomness [11]. The various activities in the chain, within firms and between firms, are influenced by chain governance. Value chains are characterized by repetitiveness of linkage interactions. The governance of value chains emanate from the requirement to set product, process, and logistic standards, which then influence upstream or downstream chain actors and results in activities, actors, roles and functions. Therefore, power asymmetry is central in value chain governance. In other words, some key actors in the chain shoulder the responsibility to allocate roles (inter-firm division of labor) and improve functions. Power in value chain governance can be categorized into three: setting basic rules for participation in the chain, monitoring the performance of chain actors in complying with the basic rules, and assistance to help chain actors adhere to the basic rules.

2.1.6. Marketing Costs and Margins

Marketing Costs: all marketing activities generate costs. These costs vary widely across agricultural commodities, depending for example on the extent of processing or the distance between production areas and consumption centers. Agricultural marketing costs are costs incurred between the moment an agricultural product leaves the farm and the moment it is purchased by end users of consumers. This includes market research and promotion, product preparation, packaging, handling, transport, product losses, storage, processing, and fees and unofficial payments [12].

Marketing margin: Marketing margin is the difference between the value of a product or a group of products at one stage in the marketing process and the value of an equivalent product or group of products at another stage. Measuring this margin indicates how much has been paid for the processing and marketing services applied to the product(s) at that particular stage in the marketing process [13].

2.1.7. Mapping the Value Chain

Mapping a value chain facilitates a clear understanding of the sequence of activities and the key actors and relationships involved in the value chain. This exercise is carried out in qualitative and quantitative terms through graphs presenting

the various actors of the chain, their linkages and all operations of the chain from pre-production (supply of inputs) to industrial processing and marketing. the mapping diagrams are prepared through an iterative process which can be divided into two stages: First, an initial map is drawn which depicts the structure and flow of the chain in logical clusters: the main actors and the activities carried out at the local level, their links to activities at other domestic or foreign locations, the supporting services and their interactions, the links to the final market, and some initial indications of size and importance. The second stage is quantifying the value chain. This involves adding detail to the basic maps drawn initially (structure and flow). Depending on the level of detail needed for the research entry point, this exercise may focus on elements such as size and scale of main actors; production volume; number of jobs; sales and export destinations and concentration [14].

A supply chain is an integrated manufacturing process where in raw materials are converted in to final products, then delivered to customers, at its highest level, a supply chain is comprised of two basic integrated process: 1) the production and inventory control process, 2) the distribution and logistics process [15]. In value chain the production stages entail a combination of physical transformation and the participation of various producers and services, and the chain includes the product's disposal after use. As opposed to the traditional exclusive focus on production, the concept stresses the importance of value addition at each stage, there by treating production as just one of several value-adding components of the chain [14].

2.2. Value Chain Analysis and Its Importance

Value chain analysis disaggregates the international structure of production, trade and consumption of commodities and allows for identification of actors and geographical division [16].

Value chain analysis also reveals the dynamic flow of economic, organizational and coercive activities involving actors within different sectors. It shows that power relations are crucial to understand how entry barriers are created, and how gain and risks are distributed. It analyses competitiveness in a global perspective. By revealing strengths and weaknesses, value chain analysis helps participating actors to develop a shared vision of how the chain should perform and to identify collaborative relationships which will allow them to keep improving chain performance. The latter outcome is especially relevant in the case of new manufacturers – including poor producers and poor countries – that are seeking to enter global markets in ways that can ensure sustainable income growth. In sum, the concept of value chain provides a useful framework to understand the production, transformation and distribution of a commodity or group of commodities. With its emphasis on the coordination of the various stages of a value chain, value chain analysis attempts to unravel the organization and performance of a commodity system. The issues of coordination are especially important in agricultural value chains, where coordination is affected by several factors that may influence product characteristics, especially quality [17].

A value chain concepts, there are four levels; namely, micro, meso, macro and meta levels in which relevant survey topics for the analysis of a value chain are embedded. At the *Micro level*, value chain operators perform basic functions in the value chain be it as input suppliers, primary producers, processors or distributors (wholesalers, retailers, transporters, exporters). At the *Messo level*, one finds public and private *service providers'* e.g. regional associations, rural banks, agricultural government institutions, local civil society organizations. At the *Macro level* such as national, policymakers, regulatory bodies, federations of associations provide *enabling framework conditions* for businesses that may be pro-poor. This may relate to legislation, standards, infrastructure etc. Finally, the *Meta level* describes *Socio-cultural factors* facilitating or hindering business linkages, business attitudes and trust among the value chain actors [7].

2.3. Review of Empirical Studies

Some empirical evidence used value chain analysis to identify the constraints hindering the growth of the honey subsector and the opportunities in Nepal. The key issue during the analysis stage was to find the most pressing bottlenecks for sub sector growth first and address them in a systemic manner. Referring the key findings of the study, large number of people is already involved in beekeeping, honey collection, processing and marketing of honey and other bee products. However, honey entrepreneurs in Nepal cannot harness that niche market due to Nepal's inability to meet legal requirements for export. There is limited support for addressing market and quality related issues and value-adding activities. Assurance of quality is the first prerequisite for enhancing export opportunities and improving access to international markets [7].

A honey value chain analysis found that a large, complex distribution network, dominated by middlemen, moves honey to the market from distant areas, especially during periods of scarcity. The markets are both formal and informal, though the informal market is larger. Most of the few existing producer groups are not organized properly. Most buyers are unable to meet the demands and volumes required by the supermarkets [18].

3. Methodology

3.1. Description of the Study Area

Mesela District, one of the 10 District in West Hararghe zone of Oromia region, is located about 45 km south-east of the capital Addis Ababa and is very close to the other major urban centers. It is located in the eastern part of the zone having the total area of 625 KM^2 it shares a boundary line with Mesela is one of the District in the oromia region of Ethiopia part of the West hararghe zone mesela is bordered on the south west. Galeti river which separates it from chiro, on the North west by Tulo, on the east by the East hararghe

zone Melka-belo. The human population in Chiro, Adama and Bishoftu Cities creates a large market for most agricultural commodities of the District.

The altitude of Mesela District ranges from 1000 and 2900 meters above sea level. Annual temperature and rainfall vary between 10°C to 28°C; and 700 mm-1000 mm, respectively. The dominant soil types of the District are black clay and red light soils. According to the District's Agriculture and Rural Development Office, total population of the District was about 193,959 out of which agricultural household accounts for the year 2015 was estimated at 21,320 and the total number of honey producing households was 1630. A total of 28 PAs are available in the District.

Regarding the farming system and land use system of the area, the high altitude area has been identified as greatest agricultural and market potential area and the farms in the area are small in size (1-2.5 ha) and farming is operated less of them with help of ox power. Farms are mixed in terms of crops and livestock. Major crop components are teff, wheat (mainly bread variety), pulses of which the main one is chick peas which grows at mid altitude, followed by field peas and faba beans (at higher altitudes). Livestock on the farms in the mid/high altitude zone consists of cattle/oxen, poultry and small ruminants. There are also a number of rivers and creator lakes that are being used for irrigated agriculture, particularly for horticultural crops production.

3.2. Data Requirements and Sources

In order to get the overall picture of honey value chain in the study area, the study used both primary and secondary data. Primary data was collected through administering a structured questionnaire to sample respondents and participatory data collection tools like, group and individual discussions and key informant interview was utilized. The key informants' interviewed includes: collectors, retailers, processors, and end users, the staffs of NGOs working in the study area, local staff of Office of Agriculture and Rural Development, association of honey processors. Secondary data was also collected from relevant governmental and non-governmental offices as deemed necessary. Moreover, different and relevant published and unpublished reports, bulletins and websites were reviewed to strengthen and secure the study.

3.3. Sample Size and Method of Sampling

To select representative honey producing households in Mesela District, two stages sampling method was conducted. In the first stage, four major honeys producing PAs (kebeles) found in the study District (Aba Selama, Ifa Bas, Messela and Aba Cabsi) were selected purposively based on information obtained from the District's Agriculture and Natural Resource Office. In the second stage using probability proportional to size technique, producers of honey were selected from each selected PA. A total of 160 sample honey producers were selected from the four PAs.

In addition to farm households, sample respondents were also selected from the other value chain actors on the basis of their size and availability and interviewed based on their respective functions in the chain. By preparing questionnaires six collectors, processors (table honey and local brewery makers), four retailers, and supporting actors were interviewed in the study area.

3.4. Methods of Data Analysis

This study used different categories of data analysis; namely descriptive, value chain and econometric analyses.

3.4.1. Descriptive Analysis

Descriptive statistics was used to analyze and explain different characteristics of the sample households and used to clearly compare and contrast the role and functions of chain actors along with the econometric model. Tests like chi-square and t-test statistics were also used to complement or testify significance of results obtained from the model specified.

Marketing margin: Once the basic structure of a marketing channel is established, it is relatively easy to collect information on the price at which the product is bought and sold at each stage in the production process [13]. Knowledge of marketing costs and margins in a chain will enable us to identify how revenues and margins are distributed over the actors in the value chain in order to conclude whether they can increase margins in a value chain.

Total gross marketing margin (TGMM) is the final price of the produce paid by the end consumer minus farmers' price divided by consumers' price and expressed as a percentage.

$$TGMM = \frac{Consumers' Price - Farmers' Price}{Price\ Paid\ by\ the\ Consumer} \times 100 \quad (1)$$

The Net Marketing Margin (NMM) is the percentage over the final price earned by the marketing middleman as his/her net income once his/her marketing and transaction costs are deducted. From this measure, it is possible to see the allocative efficiency of markets. Higher NMM or profit of the marketing intermediaries reflects reduced downward and unfair income distribution, which depresses market participation of the smallholder. An efficient marketing system is where the marketing costs are expected to be closer to transfer costs and the net margin is near to normal or reasonable profit.

$$NMM = \frac{TGMM - Marketing\ and\ Transaction\ Cost}{Price\ paid\ by\ the\ Consumer} \times 100 \quad (2)$$

Where: TGMM = Total Gross Marketing Margin;

NMM = Net Marketing Margin.

It is useful to introduce here the idea of "producer participation", "farmer's portion" or "producer's gross margin" (GMM) which is the portion of the price paid by the end consumer that belongs to the farmer as a producer. It should be emphasized that growers that as middlemen also receive an additional marketing margin. The producer's margin or share in the consumer price (GMMp) is calculated as:

$$GMMp = \frac{EndBuyerPrice - MarketingGrossMargin}{EndBuyerPrice} \times 100 \quad (3)$$

Where GMMp is the producer's share price.

The consumer price share/portion of market intermediaries is calculated as:-

$$MM = \frac{SellingPrice - BuyingPrice}{FCP} \times 100 \quad (4)$$

Where: MM = Marketing margin (%);
SP = Selling price at each level;
BP = Buying price;
FCP = Final consumer price.

3.4.2. Value Chain Analysis

Value chain analysis is the process of breaking a chain into its constituent parts in order to better understand its structure and functioning. The analysis consists of identifying chain actors at each stage and discerning their functions and relationships; determining the chain governance, or leadership, to facilitate chain formation and strengthening; and identifying value adding activities in the chain and assigning costs and added value to each of those activities [14].

3.4.3. Econometric Analysis

Econometric model was used to identify the factors that affect farmers' participation decision in honey marketing in one hand and determinants of the volume of honey marketed in the other hand. Most recent literatures adopt 'Tobit and Heckman's two-stage models' to identify factors that affect producers to participate in the marketing of honey (sale of honey) or not and also identify factors that determine the quantity of honey marketed. Ideally, the Ordinary Least Square (OLS) model is applicable when all households participate in the market. In reality not all households participate in a specific commodity market. Some households may not prefer to participate in a particular market in favor of another, while others may be excluded by market conditions. If the OLS regression is estimated excluding the nonparticipants from the analysis, a sample selectivity bias is introduced into a model. Such a problem can be overcome by following a two-step procedure as suggested by Heckman (1979). Tobit model can also be used to address the above mentioned problem; but its assumption that both the participation decision and level of supply determined by the same variable in the same way introduces inconsistency bias into the model. But in reality all producers may not be potential suppliers of a product and a variable that affect participation decision may or may not have similar effect on the volume of a produce supplied to the market. Hence, Heckman's procedure would be used in this study.

Heckman has developed a two-step estimation procedures model that corrects for sample selectivity bias. The first stage of the Heckman model a 'participation equation', attempts to capture factors affecting market participation decision. This equation is used to construct a selectivity term known as the 'inverse Mills ratio' which is added to the second stage 'outcome' equation that explains factors affecting value of honey sales. The inverse Mill's ratio is a variable for controlling bias due to sample selection Heckman. The second stage involves including the Mills ratio to the value of honey sales equation and estimating the equation using Ordinary Least Square (OLS). If the coefficient of the 'selectivity' term is significant then the hypothesis that an unobserved selection process governs the participation equation is confirmed. Moreover, with the inclusion of extra term, the coefficient in the second stage 'selectivity corrected' equation is unbiased.

Specification of the Heckman two-equation procedure, which is written in terms of the probability of Honey Market Participation (HMP), and Volume of Honey Marketed (VHM), is:

The participation equation/the binary probit equation

$$Y_{1i} = \mathrm{X_{1i}}\beta_1 + \mathrm{u_{1i}}; u_{1i} \sim \mathrm{N}(0,1)\mathrm{i} = 1,2,\dots,\mathrm{N} \quad (5)$$

$$HMP = 1 \; if Y_{1i} > 0$$
$$HMP = 0 \; if Y_{1i} \leq 0$$

Where: Y_{1i} is the latent dependant variable,

X_{1i} is vectors that are assumed to affect the probability of sampled household honey market participation.

β_1 = a vector of unknown parameter in participation equation.

u_1 = residuals that are independently and normally distributed with zero mean and constant variance.

The observation equation

$$VHM = \mathrm{Y_{2i}} = X_{2i}\beta_2 + \alpha\lambda_i + u_{2i}; \mathrm{u_2} \sim N(0, \delta^2)\mathrm{i} = 1,2,\dots,\mathrm{N} \quad (6)$$

Y_2 is observed if and only if HMP = 1. The variance of u_1 is normalized to one because only HMP, not Y_1 is observed. The error terms, $u_1 and\ u_2$ are assumed to be bivariate and normally distributed.

Y_2 is regressed on the explanatory variables, $\mathrm{X_{2i}}$, and the vector of inverse Mills ratios (λ_i) from the selection equation by ordinary least Squares (OLS).

Where: Y_2 is the observed dependent variable.

X_{2i} = factors assumed to affect the volume of honey marketed.

β_2 = vector of unknown parameter in the volume of honey marketed equation.

u_{2i} is residuals in the observation equation that are independently and normally distrusted with zero mean and variance δ^2.

$$\text{Mills ratios}(\lambda_i) = \frac{f(X_1\beta_1)}{1 - F(X_1\beta_1)} \quad (7)$$

$f(X\beta)$ is a density function and $1 - \mathrm{F(X_1\beta_1)}$ is distribution function.

However, even if Heckman's two-step procedure is widely used, it has problems like; the estimators cannot be calculated if $\mathrm{x_{1i}}$ contains all variables that belong to $\mathrm{x_{2i}}$ and the estimator is not efficient even if it can be calculated. The absolute values of the t-values of the

simultaneous maximum likelihood (ML) estimators were generally larger than those obtained by Heckman's two-step estimator. The reason for this finding is that the simultaneous ML estimator is asymptotically efficient, suggesting usefulness of the simultaneous ML estimators [19]. In general the two-step estimator will not be efficient, but computationally simple and consistent [20]. Therefore it is reasonable to use the Heckman's ML estimators to estimate the model. Heckman's ML procedure combines the estimation of the selection (binary) and outcome equation in a single system. In this case, Heckman's ML procedure estimates equations (5) and (6) simultaneously and present consistent estimates of β and δ by numerically maximizing the log-likelihood function and estimates (5) and (6) as a system of equations using maximum likelihood estimation methods, and allows us to directly interpret the estimate of rho [21].

Heckman (1974) proposed ML estimation as an appealing procedure to account for sample selection bias. He stated the following assumption:

u_1 And u_2 are independent of X_{1i}, and independently and identically distributed (iid) over the entire population (participants and non-participants) with the bi-variate Normal distribution N(0, Σ), where:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{bmatrix} \quad (8)$$

The phrase "over the entire population", inserted in the assumption is crucial. Basically, it discriminates the selection models from the mixture-distribution models where the distribution of u_{1i}; $i = 1\ldots N$ is defined only for a sub-population of the sample (participants). Under the assumption the parameters of the model can be estimated by Maximum Likelihood method. The log-likelihood to be maximized is:

$$L = \frac{1}{N}\sum_{i=1}^{N}\left\{Y_1 \times \ln\left[\int_{-X_{1i}\beta_1}^{\infty} \emptyset_{u_1u_2}(Y_2 - X_{2i}\beta_2, u_{1i})du_1\right] + (1 - Y_1) \times \left[\ln \int_{-X_{1i}\beta_1}^{\infty}\int_{-\infty}^{\infty} \emptyset_{u_1u_2}(u_1, u_2)du_{2i}\, du_{1i}\right]\right\} \quad (9)$$

Where $\emptyset_{u_1u_2}$ denotes the probability density function for the bivariate normal distribution of (u_{1i}, u_{2i}). Maximum Likelihood method is easy to be implemented while it yields consistent and fully efficient parameter estimates given the assumption [22].

3.5. Hypothesis and Definition of Variables

In the course of identifying factors influencing honey supply, the main task is to analyze which factor influences and how? Therefore, potential variables, which are supposed to influence honey market participation and volume of honey marketed, need to be explained. Accordingly, the major variables expected to have influence on both the farmers' participation decision and quantity supply are explained as follows:

3.5.1. Dependent Variables

Market Participation Decision (MPD): is the dummy variable that represents the market participation of the household in the market that is regressed in the first stage of two stages estimation procedure. For the respondents who participate in market take the value of one where as it takes the value of zero for the respondent who did not participate in market.

Volume of Honey Marketed (VHM): It is continuous dependant variable in the second step of Heckman selection equation. It is measured in kilogram and represents the actual volume of honey marketed by farm households which is selected for regression analysis takes of positive value.

3.5.2. Independent Variables

Age of Household Head (AGH): It is a continuous variable and measured in years. Age is a proxy measure of farming experience of household head. Aged households are believed to be wise in resource use, on the other hand young household heads have long investment horizon and it is expected to have either positive or negative sign effect on market participation and volume of honey marketed.

Sex of the Household Head (SHH): This is dummy variable (takes a value of 1 if the household head is male and 0 otherwise). The variable is expected to have a positive relation with honey market entry decision and volume of honey marketed.

Family Size (FS): This variable is a continuous explanatory variable and refers to the total number of family in the household. In this study it is assumed that any family member might decide to participate in honey production and marketing. Hence it is expected to have positive relationship with the dependent variable.

Education status of the Household Head (EDH): This is a dummy variable with a value of one if a household head is literate and zero otherwise. Education plays an important role in the adoption of innovations/new technologies. Literate beekeepers are expected to be early adopters. Therefore, in this specific study, education is hypothesized to affect market participation decision and volume of honey marketed positively.

Distance to Nearest Market (DNM): It is the location of the beekeeping household from the nearest honey market and is measured in kilometer**.** The closer the honey market to beekeeping household, the lesser would be the transportation charges, loss due to handling and better access to market information and facilities. This improves return to labor and capital; increases farm gate price and the incentives to participate in economic transaction. Therefore, in this study, distance from nearest honey market is hypothesized to be negatively related to market participation decision and marketable honey surplus.

Land size in hectare (LAND): This is the total cultivated land holding measured in hectares. No sign could be expected with regard to this variable it can have either direct or inverse relationship.

Market Information (MI): It is a dummy variable. Farmers marketing decisions are based on current information available on the market. Therefore, it is hypothesized that access to current and updated market information is positively related to honey market participation and volume of honey marketed. Study conducted on food marketing behavior identified better information significantly raises the probability of market participation. Access to information, provided through mass media or from extension agents, reduces risk perceptions of farmers [24]. Credit Access (CA): This is a dummy variable, which indicates credit taken for honey production. Access to credit would enhance the financial capacity of the farmer to purchase the bee colony and the beehives. Therefore, it is hypothesized that access to credit would have positive influence on level of production and sales [23].

Access to Honey production Extension service (ACCEXT): This variable is measured as a dummy variable taking a value of one if the beekeeper has access to honey production extension service and zero otherwise. It is expected that extension service widens the household's knowledge with regard to the use of improved honey production technologies and has positive impact on honey market participation decision and volume of honey marketed [25]). Number of extension visits improves the household's intellectual capitals, which improves honey production. Therefore, frequency of extension visits is hypothesized to impact beekeeper market entry decision and marketed volume of honey positively.

Number of Beehives Owned (NBHO): It is continuous variable measured in number of beehives owned. The number of beehives kept is expected to have positive relation to market participation and marketable surplus. The larger the number of hives owned, the higher the quantity of honey harvested hence the participation in value addition and vice versa. As the beehives owned increases, the probability to participate in market and sales will increase. Hence, this variable is expected to influence market participation and volume of honey marketed positively. Tropical livestock Unit owned (TLU): It is the number of live animals measured in tropical livestock unit. Households with larger TLU size are supposed to be less concerned about the bees as they can sell their livestock to meet household needs; consequently, negative sign was expected to this factor. A study conducted on red pepper marketing reveals that TLU influenced the quantity of pepper supply negatively [26].

Financial Income other than Beekeeping (FIOBK): It is continuous variable measured in Ethiopian Birr (ETB). The variable represents income originating from different sources other than beekeeping obtained by household head and other household members. Through improving liquidity, this income makes the household to expand production and/ or purchase from market. It also strengthens the household position in coping with different forms of risks. Thus, income from non beekeeping source is hypothesized to affect honey market entry decision by household and volume of honey marketed positively.

Years in Beekeeping (YBK): It is a continuous variable; measured in the number of years that the household head spend in beekeeping business. Higher experience in beekeeping business may favor beekeeping activity. Hence, this variable is expected to have positive impact on the participation and volume of honey supplied to the market.

Type of Beehive used (TBH): This variable is a dummy variable indicating the beehive type that the household owned. Modern beehive is more productive in honey production. But due to financial, knowledge and other problems farmers may prefer the traditional beehive. A study conducted on bees and beekeeping states that modern beehives give higher yield and quality of honey [27]. Therefore, this variable has been hypothesized to take positive sign on market participation and marketable surplus. The households owning modern and /or transitional beehives = 1 and 0, otherwise.

Table 1. *Description of the dependent and independent variables used in the model.*

Variable	Description	Type	Value
Dependant Variables			
MPD	Market Participation Decision	Dummy	0 = No 1 = Yes
VHM	Volume of honeys old	Continuous	Volume in Kg
Independent Variables			
AGH(+)	Age of Household Head	Continuous	Number of years
SHH(+)	Sex of the Household Head	Dummy	1 = male, 2 = female
FS(+)	Family Size	Continuous	Number of families
EDH(+)	Education status of the Household Head	Dummy	1 = literate 0 = illiterate
DNM(-)	Distance to Nearest Market	Continuous	Distance in Km
LAND	Land size in hectare	Continuous	Size in hectare
MI(+)	Market Information	Dummy	0 = no 1 = yes
CA(+)	Credit Access	Dummy	0 = no 1 = yes
ACCEXT(+)	Access to Honey production Extension service	Dummy	0 = no 1 = yes
NBHO(+)	Number of Beehives Owned	Continuous	Number of beehives
TLU(-)	Tropical livestock Unit owned	Continuous	Number of livestock in TLU
FIOBK(+)	Financial Income other than Beekeeping	Continuous	Number in Birr
YBK(+)	Years in Beekeeping	Continuous	Number of years
TBH(+)	Type of beehive used	Dummy	1 = modern/transitional, 0 = otherwise

4. Results and Discussion

This section of the thesis discusses the findings of the study such as results of descriptive, value chain and econometrics analyses that are found in relation to the research questions and objectives. The descriptive analysis was used to describe the general socio-economic and demographic characteristics of the sample farm households, the characteristics of honey production and marketing in the study area, and the costs and benefits of honey marketing channels in the area. Mean, percentage, standard deviations and marketing margins were employed to obtain the results. In the value chain analysis description of major actors and their functions were done. Econometric model was also employed to identify the factors affecting farmers' participation in honey marketing and volume marketed in the study area.

4.1. Descriptive Analysis

For the descriptive statistics, sample households were divided into participants and non-participants of honey marketing. The objective is to assess the differences and similarities among participant and non-participants of honey producers in terms of their demographic and socio-economic characteristics.

4.1.1. Demographic and Socio-Economic Characteristics of Sample Households

The number of sample respondents handled during the survey was 160. The age of the sample respondents ranges from 20 to 80 years and the average age of sample respondents were 42.47 years. Honey market participantswere on average 42.84 years of age, while non-participants were 41.14 years old. Thus there is no statistically significant difference between the two groups with regards to age of household head. As Table 2 indicates that the average family size per sample household was 5.71 and 6.72 for participants and non-participants respectively.

Table 2. *Demographic and socio-economic characteristics of sample households.*

	Participants		**Non-Participants**		**Total sample**		**t/x² value**
	(N = 125)		**(N = 35)**		**(N = 160)**		
	Mean/number	**Std/%**	**Mean**	**Std**	**Mean**	**Std**	
Age (yrs)	42.84	12.14	41.14	8.51	42.47	12.02	0.738
Family size (№)	5.71	2.55	6.72	2.43	5.64	12.02	0.664
Sex							
Male	76	56.3	21	60	97	60.63	0.932
Female	49	39.2	14	40	63	39.38	
Marital Status (no)							
Single	3	2.4	1	2.85	4	2.5	
Married	116	92.8	33	94.28	149	93.13	0.876
Divorced	6	4.8	1	2.85	7	4.38	
Education (no)							
Illiterate	63	50.4	21	60	84	52.5	
Primary	55	44	11	31.43	66	41.25	0.384
Secondary	7	5.6	3	8.57	10	6.25	
Land size (ha)	2.36	1.37	2.24	1.2	2.33	1.33	0.484

N = Sample Size
Source: Survey result, 2015.

Of the total sample farm households 60.6% were male-headed and the remaining 39.4% were female-headed implying that more of the sample households were male. From honey market participants of sample households, 60.80%, and 39.20% were male and female headed respectively. Regarding their marital status, majority of them were married (93.1%) and few were single (2.5%) and divorced (4.4%). Referring Table 2, around 50% of the sample households were illiterate. During the survey, there were no households in the sample who has educational background above secondary level. With respect to land holding of the respondents, an average size of land holding per household is 2.33 ha with no statistically significant mean difference between participant and non-participants. The survey result depicts that there was no statistically significant difference between participant and non-participant sample households' demographic characteristics.

4.1.2. Household Income and Its Sources

Rural income generating activities encompass agricultural production (mainly crops and animal husbandry), agricultural and non-agricultural wage employment, non-farm enterprises, transfers and non-labor income sources. The people of the study area practice various livelihood and income generating activities mainly crop production in addition to animal husbandry, honey production, petty trading and daily labor. Crop production plays a major role in income generation in the area and cereals such as teff, wheat, maize and barley, pulse crops such as bean, pea, lentil and chickpea are the major crops grown. Especially, the area is known for its quality teff production nationally. For the total sampled households, the average annual income generated from selling of crops, livestock and other income sources (salary, pension, petty

trade, remittance, etc) was Birr 11,051.4, Birr 2263.43 and Birr 2,740.88, respectively. The total income that was obtained from all sources including income from selling of honey has statistically significant difference between the participants and non-participants of the sampled households at less than 5% level of significant.

Table 3. *Sources of income by sample farmers (Birr/HH).*

Income sources	Participants (N = 125)		Non-Participants (N = 35)		Total sample (N = 160)		t-value
	Mean	Std	Mean	Std	Mean	Std	
Crops	11014.4	6570.55	11190.2	6181.5	11051.4	6470.92	0.136
Livestock	2149.12	2229.33	2671.68	2401.37	2263.43	2270.68	1.205
Honey	10851.26	25022.63	-	-	-	-	
Others	2985.12	9203.61	1868.57	2568.16	2740.88	8227.1	-0.709
Total income	24814.5	26177.2	12915.2	6507.64	22309.4	23925.2	-2.545**

**Significant at less than 5% significant level, N = sample size.
Source: Survey result, 2015.

Mesela District's honey is used for table honey and local brewery making. With the given number of beehives, for those who participate in honey marketing, the average annual income from honey was 10,851.26 Birr with an average price of 80 Birr/kg. However, around 63% of the market participants have got annual income that ranges between Birr 1000-Birr 5000 from selling of honey.

4.1.3. Access to Services

Access to services like credit, agricultural extension and market information has vital importance to promote agricultural households' production and productivity which thereby increase marketable surplus and ultimately farm income. For farmers, knowing where and when to sell their output is one of the most difficult challenges. If they have no knowledge of current market prices, they can easily be exploited. But gathering current information about markets may not be easy, especially for people living in very remote areas. Addressing new challenges requires extension to play an expanded role with a diversity of objectives, which include linking farmers more effectively and responsively to domestic and international markets; enhancing crop diversification; coupling technology transfer with other services relating to input and output markets; poverty reduction and environmental conservation; viewing agriculture as part of a wider set of rural development process that includes enterprise development and non-farm employment; and capacity development in terms of strengthening innovation process, building linkages between farmers and other agencies, and institutional development to support the bargaining position of farmers [28].

Respondents were also interviewed whether or not they have access for services like credit and market information and only 15% of the total respondents replied as they have the access for credit services for their beekeeping and around 55% of the total respondents have an access for current and updated market information. From those who have the access, the major sources of the credit facilities are NGOs and government organizations though NGOs took the higher share in providing the service (58.33%). The main purpose why they took the money was for fertilizer and honey production.

As depicted in Table 4, from the total sample respondents 55.6% get current market information on honey from different sources. Among the groups, large proportion of honey traders has better access to current and updated market information than non-traders. The result also depicts that the major source of updated information for farm households includes personal observation (35.6%), other honey traders (27.6%), telephone (26.4%) and others (10.3%). There is also statistically significant difference between participants and non-participants' access to current market information at less than 1% significant level.

Table 4. *Access to credit and market information.*

Access to Services	Participants (N = 125)		Non-Participants (N = 35)		χ^2 value	Total sample (N = 160)	
	Yes (%)	No (%)	Yes (%)	No (%)		Yes (%)	No (%)
Credit	17.6	82.4	5.71	94.29	3.03	15	85
Market Information	65.6	34.4	20	60	15.497***	55.6	40

***Significant at less than 1% significant level, N = sample size.
Source: Own survey, 2015.

Ideally, current market information should be the starting point for any decision regarding next production, post-harvest handling, processing and marketing. However, access to market information is important but far from sufficient. Farmers often find it difficult to interpret market information and to understand its implications to their farming business. Therefore, extension officers can work with farmers to process and interpret market information as a step towards production and marketing decisions. As Table 5 depicts 37.14% of non-participants in honey marketing and 29.75% of the total sample respondents has no access for honey extension services. From sampled households who participate in honey marketing, 27.2% have got no extension services for their honey production.

Table 5. Extension service on honey by sample households.

Extension on honey	Participant (N = 125) %	Non-Participants (N = 35) %	Total (N = 160) %
Regularly	27.20	22.86	26.58
Sometimes	16.00	8.57	14.56
Rarely	28.00	31.43	29.11
No-extension on honey	27.20	37.14	29.75

N = sample size
Source: Survey result, 2015.

4.1.4. Inputs, Production and Marketing of Honey

According to the respondents, the major inputs and equipments used in the process of honey production in the study area includes bee colony, beehive, supplementary feed, sanitation materials (like ash), honey container and protective wears. In producing honey, those who participate in honey marketing have an average of 7.67 traditional beehives and non-participants have an average of 6.62 beehives per household. As presented in Table 6, there is significant difference on the mean of number of traditional and transitional beehives per household between participants and non participants at less than 5% level of significance.

Table 6. Number of beehives per household.

No. of beehives	Participants (N = 125)		Non-Participants (N = 35)		Total sample (N = 160)		t-value
	Mean	Std	Mean	Std	Mean	Std	
Traditional	7.67	10.96	2.86	2.46	6.62	9.95	-2.57**
Transitional	0.78	1.73	0.17	0.51	0.65	1.57	-2.06**
Modern	0.32	1.02	0.11	0.40	0.28	0.92	-1.17

**Significant at less than 5% significant level, N = sample size
Source: Survey result, 2015.

Honey is harvested in the study area from October through December and from May to June (peak periods) every year. Considering the whole sample, most farmers (83.8%) owned less than 10 traditional beehives, 12.5% owned 10-20, and only 3.8% owned traditional beehives around 20-60 indicating beekeeping is practiced in small scale in the District. Out of the sampled households only 31.3% and 11.3% have adopted the transitional and modern beehives, respectively. From the total number of beehives owned by the sampled households around 87.7% is traditional and 8.6% transitional and the remaining 3.6% is modern showing that majority of the households are engaged in traditional beekeeping.

Among those who use traditional beehive and participate in honey marketing, 56.8% of them harvest honey twice in a year, whereas 30.4% of participant traditional beehive users respond that they harvest three times in a year. It was investigated from the survey that harvesting of honey twice a year is a common practice in the study area (Table 7). It was also reported that while harvesting of honey, farmers leave some part of it in the beehive and any production obtained in the non-pick periods of the year would also be left as supplementary food for the colony to strengthen it for the next harvest.

Table 7. Frequency of honey harvest per year per household.

Frequency of harvest/year	Type of Beehives					
	Traditional beehive (n = 1059)		Transitional beehive (n = 104)		Modern beehive (n = 44)	
	Participant %	Non-Participant	Participant %	Non-participant	Participant %	Non-participant
1	6.4	0	1.6	0	0	0
2	56.8	85.7	66.4	94.3	87.2	88.6
3	30.4	14.3	19.2	5.7	11.2	11.4
4	6.4	0	1.6	0	1.6	0

n = number of beehives
Source: Survey result, 2015.

Honey yield was markedly different for the traditional and modern hives and between participants and non-participants. On average, it was about 9.77 kg/hive and 18.49 kg/hive from the traditional and modern hives respectively (Table 8). High variability in yield was also observed between honey market participant and non-participant sample farmers. This might be due to differences in management of bees, and lack of honey business concern. There is a significant difference between the mean yield obtained annually between participants and non-participants in traditional hives. As compared with the national average yield of honey per hive (kg/hive), 5, 13, and 15-20 for traditional, transitional and traditional beehives respectively the District has good potential of honey productivity.

Table 8. *Volume of annual honey production per beehive (kg).*

Production/Beehive type	Participants (N = 125)		Non-Participants (N = 35)		Total sample (N = 160)		t-value
	Mean	Std	Mean	Std	Mean	std	
Traditional	9.77	7.58	4.61	2.65	8.61	7.12	3.941***
Transitional	10.59	5.98	4.50	2.12	10.30	5.98	1.42
Modern	18.49	13.78	8.67	1.15	16.85	13.07	1.20

***Significant at less than 1% significant level, N = sample size.
Source: Survey result, 2015.

Sample households were interviewed whether there is seasonal variation in the quantity of honey produced and about 80.2% of honey market participants and 80.6% non-participants responded that there is seasonal variation and the highest production season ranges from October to December. Production season that ranges from May to June is the lowest production period for 83.80% and 87.1% of honey market participants and non- participants respectively.

Table 9. *Seasonal variation in production.*

Level of production		Participant		Non-participant	
		Highest (%)	Lowest (%)	Highest (%)	Lowest (%)
Seasons	Oct-Dec	80.2	16.20	80.60	12.9
	May-June	19.8	83.80	19.40	87.1

Source: Survey result, 2015.

Out of the total honey market participants 52% of them responded that they faced problems in accessing inputs for honey production and the remaining 48% replied they don't have any problem in accessing inputs. Main problems of accessibility of inputs for honey production are associated with lack of access to feed, modern beehive and services like extension and credit services. There is statistically significant difference between the two groups in accessing beehive and services at less than 10% level of significant and less than 5% significant level in affording beehives.

Table 10. *Problem of inputs in honey production.*

Problems	Participants (%) (N = 125)		Non-Participants (%) (N = 35)		Total sample (%) (N = 160)		χ^2 value
	Yes	No	Yes	No	Yes	No	
Access to feed	40.80	59.20	25.71	74.29	37.50	62.50	2.655
Access to modern beehive	38.40	61.60	22.86	77.14	35.00	65.00	2.904*
Affording modern beehive	40.00	60.00	17.14	82.86	35.00	65.00	6.279**
Access to extension & Credit)	44.80	55.20	28.57	71.43	41.30	58.80	2.972*

**And*Significant at less than 5% and 10% significant level respectively, N = sample size.
Source: Survey result, 2015.

4.2. Value Chain Analysis

This part discusses the structure and composition of honey value chain. The objective is to understand and describe the function of honey value chain actors, opportunities of honey production and major constraints of the sector in the study area and to identify the costs and benefits of the actors in the chain.

4.2.1. Actors in Honey Value Chain and Their Marketing Functions

The focus of value chain framework is developing an effective way of coordinating the hierarchical stages in the value chain to meet consumer demand in an efficient manner. Effective vertical coordination of value chain stages requires partnership, actor interactions, information flow along the chain and coordination of the activities of chain actors. Hence, the competitiveness of a value chain is greatly influenced by the partnership and collaboration for innovation that can be realized by chain actors. Moreover, the development and operation of enabling and supportive business development services (e.g. market information, transport, credit) play critical role in how well the value chain responds to consumer demands [17].

Beekeepers: These are the first actors in value chain of honey and the basis of market participant in honey markets. Traditionally, beekeepers work as integrated actors and perform two or more functions of value chain. They make their hives out of available local materials, catch and hive swarms, manage bees, harvest and process honey (for home consumption), package and sell to the consumers. In the study area traditional hives for honey production are mostly produced by the farmers (beekeepers) themselves and its price is 200 Birr for those who buy it. The improved hives and their accessories are usually supplied by other supportive actors. The beekeepers sell crude honey and only in few instances undertake some form of intermediate processing; that is, separating wax from crude honey. They sell crude

honey to brewers (which is a major outlet) and/or to collectors and transit consumers at the local market.

Local honey collectors: as a second link in the honey value chain, they are engaged in buying of honey from farmers and sell it to traders, retailers, and consumers who come from different areas. Collectors play important roles of bulking, grading and sending the products to the various market outlets. The collectors (particularly the association) undertake processing to just separate honey from wax, and produce honey jelly and crude wax and store independently for sale. Besides the processing activities, the collectors add value to honey by making spatial and temporal differences (i.e., collecting from distant location to make easily available to the user and storing for future use for long). However, the honey collectors found in the study area purchase honey produced directly from farmers and use it for their own processing (making or table honey) and hence become double agent as collector and processor in the value chain.

4.2.2. Marketing Costs and Margins of Honey Market

The costs and returns of actors playing various market functions are affected by differences in enterprise size and location, vertical integration of functions, the internal organization of enterprise operations and the nature of horizontal and exchange relations, particularly where the latter are linked with credit [29].

To start from the Beekeepers of the study area, they incur costs mostly during the production periods rather than marketing their product. Traditional beekeepers make beehives by themselves with very cheap materials even from the residues of other agricultural activities and use it for ten years on average. However, for those who purchase the traditional beehive, its average price in the study area is 200 Birr. But those who use the modern hives incur an investment cost of Birr 1,110/beehive including the accessories that are introduced with the modern hive. Farmers of the area do not use modern equipments like smokers and honey extractors. The most commonly used smoking material in the area is burning of dried cow dung. This makes the District's beekeeping activity less costly and requires very minimum initial capital.

Table 11. *Unit cost of items used in modern beekeeping.*

Items	Unit	Price per unit (Birr)
Hive (with two partition)*	Pc	780
Protective wears	Pc	
Glove	Pc	70
Veil	Pc	130
Cloth	Pc	130
Total		1110

*Most widely used type of modern beehive in the study area.
Source: Survey result, 2015.

There are three marketing channels of the District's honey:

Channel I: Producer (Beekeeper) ➔Collector &/Processor (Beekeeping association) ➔Retailer ➔Consumer (32.29%);

Channel II: Producer (Beekeeper) ➔Collector &/processor (local brewery houses) ➔Consumer (16.13%).

In the study area 95.2% of the sample farmers who participate in honey marketing sell their honey as honey comb. The reason behind of selling the honey as honey comb is that this kind of selling brought them a better market for their product and also people prefer it as it is taken out of the hive thinking that it is good for health. Producers sell their honey through one or more marketing channels available in the District.

In channel I of honey marketing the farmers sell their product to the processors (beekeeping associations) directly by transporting it to the collection centers. The West Hararghe Beekeepers Association is located in Chiro town, Oromia Regional State, about 395 km's away from Capital City of Regional state, Finfine. The major activities of the association are honey collection, honey and bee wax processing and supply. During the survey, the total number of suppliers of honey to the association was 350 and it reaches its minimum level, 90 farmers on average, during off seasons. The price of the honey at the collection center of the association in 2015 was 70 Birr /kg. Besides, it provides honey processing service to its members with minimum charge. After the processing of the collected honey, the association distributes itto its retailing shops, to Welela Animal and Animal Husbandry Cooperative (sister company of the association that perform the marketing activity) and to supermarkets. The price of the company's processed honey is 80 Birr/kg.

Table 12. *Estimated cost and marketing margin for honey market in channel I.*

Producer	Birr/Kg	Percentage of operating costs
Operating Costs		
Depreciation cost of investment items	4.36	19.99%
Labour cost	15.10	69.30%
Transportation cost	0.40	1.84%
Marketing cost	0.35	1.60%
Miscellaneous	1.58	7.27%
Total operating cost	21.79	
Selling price	70	
Farmer's profit	48.21	
Collector (WHBKA)	Birr/Kg	Percentage of operating costs
Purchasing price	70	
Operating Cost		
Labor cost	0.2	2.71%
Transportation cost	0.4	5.42%
Electricity	0.72	9.76%
Water	0.36	4.88%

Producer	Birr/Kg	Percentage of operating costs
Honey Container (Packaging)	3	40.65%
Label	0.7	9.49%
Distribution Cost	2	27.10%
Total Operating Cost	7.38	
Total Cost of production	77.38	
Selling Price	80	
Gross Profit	10	
Net Profit	2.62	

Retailer	Birr/Kg	Percentage of operating costs
Purchasing price	80	
Labor cost	0.4	28.44%
Transportation cost	0.25	17.78%
Tax	0.15	10.67%
Shop Rent	0.11	7.56%
Miscellaneous	0.5	35.56%
Total Operating Cost	1.41	
Total Cost of production	81.41	
Selling Price	85	
Gross Profit	5	
Net Profit	3.59	

Source: WHBKA and own computation, 2015.

Producers incur Birr 21.79/kg as an operating cost and sale their product with Birr 70/kg to the collectors. As compared with other actors in the District's honey value chain, the cost of honey producers' is much higher and the major share of the operating cost goes to labor cost (69.30%) followed by depreciation cost of investment items (19.99%).

Since WHBKA works as collector and processor and mostly collect honey at its own collection site located in the factory, its collection costs are almost nil. Therefore, the costs presented as operating costs referred as the costs of processing the collected honey. The result of Table 12 shows that honey processors earn a profit of Birr 2.65/1 kg of honey. This indicates that the performance of marketing of honey collectors &processors for the specified year 2011 was showing positive figure even though the amount of profit was small per kg basis. Table 12 also shows container (packaging) costs take the major proportion (40.65%) of the operating costs followed by distribution (27.10%) and electricity costs (9.76%) respectively.

With regard to the cost and profitability analysis of the sample honey retailer's in the District, as Table 12 clearly presents, they were found to be profitable. This indicates that a retailer can obtain a profit of 3.59 Birr/ kg which was higher than the profit of processors by 0.97 Birr/kg. Regarding cost of operation of retailers', miscellaneous costs like loading unloading, commission payments and other costs took the largest share of the operating costs (35.56%) and labor cost comes to the second level of being a higher cost (28.44%) in honey retailing stage of the value chain.

4.2.3. Opportunities of Honey Sub-sector in the District

Based on the survey conducted on the status of the Mesela District's beekeeping sub sector, it was inspected that it has lots of opportunities and constraints. The opportunities refer to the external favorable conditions that are in favor of honey production and marketing in the District. Some of these include availability and diversity of bee forage, availability of strong colonies and good yield, and market access.

Availability and diversity of bee forage: The forage sources for honeybees are an important consideration for beekeepers. In order to determine where to locate hives for maximum honey production one must consider the off-season. If there are no honey flows the bees may have to be fed. However, Mesela District is very special for its diversified acacia and shrubs species and there are also different kind of forage trees that flower at different seasons of a year which assures a constant supply of feed for bees.

Availability of strong colonies and good yield: During the survey it was noted that the average number of beehives per sampled household was 6.62 for traditional beehives with full of strong bee families indicating that the District has a good potential for bee business development. The survey also shows that production of honey per traditional beehive is 8.61kg and 16.85 kg per modern beehive and mostly harvested twice a year. All these sum up to give insight of the available opportunity of apiculture development in the District.

Market Access: Out of the sampled beekeepers who participate in honey marketing about 52% of them stated that they don't have market problem in selling their honey. In fact 85.5% of them sale their honey on the road side markets with better price (80-90 Birr/kg) than selling it at village level and for associations (70-75 Birr/kg).

4.2.4. Major Constraints of the District's Apiculture Development

Major constraints of the honey sub-sector in the study area were identified through review of literature and thorough discussions with key informants such as representatives of concerned government and non-government institutions, collectors, processors, retailers, and professionals. Accordingly, some of the principal constraints and problems are discussed below.

Lack of knowledge and skill on beekeeping: During the survey, it was noticed that the average years of beekeeping experience per house hold is 7.02 and 53.8% of the sampled households engaged in the sector have been keeping bees for at least 5 years. Though they have been engaged in the sector for long, their knowledge of how to keep them well and get better pay back is very low which results in lack of proper management of the beehives. Some of the problems observed were poor/no shades for hives, poor sanitation in the process of production (only 35% of the sampled households clean the apiary regularly), harvesting, storing and transporting of honey.

Lack of institutional linkage: There were few trained beekeeping experts or extension workers who can provide important advisory services to the farmers. The beekeepers have no relationships with other beekeeping associations and marketing institutions, which hinders them from promoting their production systems and market their products.

Lack of organized marketing channel: There is no well organized market channel for honey in the District and these results in lack of grading and standardizing of the product, poor quality control, and inadequate and inconsistent supply to the next users in the chain. Distant markets, unreliable transport and inadequate joint efforts in marketing make it difficult for timely delivery of the required volume. In this regard the farmers who use the road side market for their output stay long on the street holding the honey with open containers like tray. Due to dusty nature of the roads, the longer they stayed on the street searching for travelers to sell their honey, the more the quality of honey deteriorates.

Agricultural chemicals: Farmers in the District primarily produce teff, wheat, chickpeas and horticultural crops and for this they use various types of herbicides and pesticides without due considerations to the damages caused on bee colonies. The District's farmers highlighted that a number of bee colonies either die or escape their hives due to the agro-chemicals used on their forage.

Lack of appropriate extension service: As well explained in the descriptive part of this study, only 26.58% of the sampled beekeepers get regular extension visits for their honey bees which lead farmers to misinterpret the information available on the production and marketing systems of the sub sector.

Little or no product promotion: Beekeeping as a sector is overlooked and neglected and attracts very little attention and support in the District. This means, for example, extension advisers know little about the product and micro-finance institutions do not give credit for this business. This undermines the potential of the sector.

4.3. Results of Econometrics Model

The Heckman's procedure results for both outcome and selection variables are presented and discussed in the next subsection. Moreover, it is important to check multi co-linearity problem before running the model for both the continuous as well as the dummy variables. The usual measure of multi co-linearity among variables is Variance Inflation Factor (VIF). The values of variance inflation factor for the variables were in the ranges of 1.1 and 1.96. To check the multi co-linearity problem STATA 12 was employed and the VIF result shows that multi co-linearity was not a problem among the hypothesized variables.

4.3.1. Determinants of Farmers' Honey Marketing Decision

The hypothetical underpinnings of why farm households participate in agricultural markets can be found in trade theories. According to the theories farmers are essentially driven to enter into trade or markets so that they can enjoy a diverse consumption bundle. They can exploit welfare gains from trading by concentrating in the production of goods they have comparative advantage, and exchange for those they have no comparative advantage, mostly manufactures.

In order to examine what factors mainly affect Mesela District farmers' decision to sell or not to sell of their honey in the study area, fourteen variables which are age of the household head, sex of the household head, education status of the household head, family size, size of land holding (ha), distance to nearest market, market information, credit access, access to honey production extension service, number of beehives owned, tropical livestock unit (TLU), financial income other than beekeeping, years in beekeeping and type of beehive used were hypothesized. Based on the Heckman's selection assumption three variables, market information, total livestock unit (TLU), and years in beekeeping were taken as exclusion restriction variables and included in the participation equation but not in the observation equation. On Table 13, among the hypothesized variables, six of them influenced market participation decision significantly.

Sex of the household head (SHH) has a significant and positive effect (less than 10%) on the farmers' honey market participation decision. The marginal effect implies that being male headed household would increase the probability of that family to supply honey to the market by 4.4%. The probable reason for this result might be that even if female-headed households keep bees, they may lack good management practices; this in turn would reduce amount of production. As a result, they may not participate in honey market and use the produced honey for home consumption.

Number of Beehives owned (NBHO) influenced farmers' honey market participation decision positively and statistically significant at less than 1% level of significance. The number of beehives owned acts to represent the amount of honey harvested or the amount that a farmer anticipates to harvest come the harvesting season. The larger the number of hives owned, the higher the quantity of honey harvested hence the participation in honey marketing and vice versa. Farmers with larger quantities of honey are more likely to engage in selling as they see it as profitable unlike their colleagues who harvest smaller quantities. This factor was identified as a major constraint to market participation decision with those who harvested little amounts reporting that they could not participate in honey marketing majorly because they viewed it as a waste of time.

Market information (MI), as expected, was positively associated with the probability of entering in honey market with statistical significant level of less than 1%. Farmers constantly make production and marketing decisions and current market information can help them make choices, from

the very first stages of the production planning process up until the moment when the product is actually sold. Updated or current market information accessed through different sources like radio programs, telephone services, personal observations, other traders or from extension agents, reduces risk perceptions and encourages market participation decision of farmers.

The household's beekeeping experience (YBK) was rather surprisingly negatively associated with probability to sell honey and statistically significant at less than 1%. Explanation for this unexpected outcome may be perhaps more beekeeping experience could be associated with older farmers who are less inclined to be engaged in honey business and their risk avert behavior which results in less flexible in adopting new technologies and thereby boost production for marketable surplus.

Tropical livestock unit (TLU) influenced the farmers honey market participation decision negatively. This is mainly due to the fact that farmers with more number of livestock tend to specialize in livestock production by disregarding the importance of beekeeping as means of cash generating activity. Besides as explained by the sampled households, bees may sting livestock and result in loss of the livestock so that households prefer to keep their "valuable assets"; livestock than bees. According to the marginal effects computed, as TLU increased by one unit, the probability of a beekeeper household to participate in honey marketing will reduce by 0.1.

Type of beehive owned (TBH) is another key factor which influences the farmers' decision to participate in honey marketing. Ownership of modern beehive is a significant variable that was positively associated with increased probability of household's participation in honey market. The more the number of modern beehives owned by a household, the better the volume of production and marketable surplus, that encourages selling. The marginal effect also indicates that as the type of beehive owned increased by one unit, the probability of a beekeeper to be engaged in honey marketing increases by 5.5%.

Table 13. *Heckman Maximum likelihood estimates of honey market participation and their Marginal Effect.*

Variable	Coefficient	Marginal effects	Z	P>|z|
Constant	-2.690		-2.87	0.004
AGH	0.004	0.001	0.47	0.641
SHH	0.343	0.044	1.83	0.068*
EDH	0.009	0.001	0.06	0.955
FS	0.009	0.001	0.2	0.842
ACCEXT	0.069	0.009	0.84	0.402
DNM	-0.019	-0.002	-0.32	0.749
LAND	0.099	0.013	1.15	0.251
FIOBK	0.000	0.000	-0.85	0.394
NBHO	0.267	0.035	13.94	0.000***
TBH	0.583	0.055	2.15	0.032**
YBK	-0.001	0.000	-14.82	0.000***
MI	0.050	0.007	15.74	0.000***
CA	0.015	0.006	0.26	0.732
TLU	-0.007	-0.001	-15.78	0.000***

*, ** and *** are statistical significant level of 10%, 5% and 1% respectively.
Source: Own computation, 2015

4.3.2. Determinants of Volume of Honey Marketed

On table 14, in the observation equation of Heckman's ML procedure, eleven variables were hypothesized to influence volume of honey marketed. These variables are age of the household head, sex of the household head, education status of the household head, family size, size of land holding (ha), distance to nearest market, credit access, access to honey production extension service, number of beehives owned, financial income other than beekeeping, and type of beehive used. Out of these, four variables were found to influence volume of honey sold significantly.

The number of beehives owned (NBHO) by the household, just like in the decision to participate in honey marketing, influences the volume of sale of honey positively with statistical significant level of less than 1%. This indicates that farmers with more number of beehives can harvest more volume of honey and not only having of better marketable surplus but will able to sell in bulk. This puts them in a position where they can negotiate for better prices as well as contracts with major buyers in which case therefore, are assured of a constant market.

Sex of the household head (SHH) also significantly (less than 10%) and positively affects the volume of honey sold. Male headed households tend to sell more volume than female one and this can be related with the weight carrying capacity of female and usage of honey for home consumption.

Table 14. *Heckman Maximum likelihood estimation of volume of honey sold.*

Variable	Coefficient	Z	P>|z|
Constant	-260.36	-2.93	0.003
AGH	0.51	0.58	0.563
SHH	30.36	1.67	0.095*
EDH	1.48	0.1	0.922
FS	2.26	0.5	0.619
ACCEXT	6.29	0.78	0.433
DNM	-2.76	-0.48	0.630
LAND	4.54	0.54	0.589
FIOBK	0.00	-0.41	0.685
NBHO	26.67	30.71	0.000***
TBH	62.85	2.4	0.017**
CA	84.01	3.35	0.001***
athrho	16.01	0.11	0.91
lnsigma	4.58	72.3	0.00
rho( )	1.00		
sigma	97.16		
lambda	97.16		

LR test of indep. eqns. (rho = 0): chi2(1) = 67.51 Prob > chi2 = 0.0000, Loglikelihood = -719.2357
*,**and***are statistical significant level of 10%, 5% and 1%, respectively
Source: Own computation, 2015

Rho(ρ) is the correlation between the error terms of the substantive and selection models. Rho has a potential range between -1 and +1 and can give some indication of the likely range of selection bias. A correlation with an absolute value of 1 would occur if the regression coefficients of the

selection model and the regression coefficients of the substantive model were estimated by identical processes (i.e., potential selection bias).

5. Conclusion and Recommendation

A careful assessment and analysis of the production environment is required in order to formulate apiculture development strategies that will lead to better use of local resources, improve the living standards of poor farmers and ensure the sustainable development of the sub-sector. In order to provide some insights to the sector's development strategists, this study has made a careful assessment on the Mesela District's beekeeping sector opportunities and major constraints. From the findings of the study it emerges that the District's apiculture sector requires minimum initial capital to be engaged in and has a good prospect of being a development practice for the rural poor if some of the demerits of the sector are resolved.

Some of the demerits of the sector in the District include the honey value chain actors in the study area and the channels of honey marketing are few as compared to other agricultural outputs. Most beekeepers sell their honey comb directly to consumers at the road side of the nearby towns implying that there is lack of organized marketing channel. Lack of knowledge and skill on beekeeping, lack of institutional linkage, little or no product promotion, and lack of appropriate extension service and inappropriate application of agricultural chemicals were identified as the major constraints that the sector is facing in the District. Besides, as the result of the econometric model reveals, number and type of beehives owned, access to credit and market information have significant impact on farmers' honey market participation decision and volume of honey sale.

Based on the above mentioned points, the following recommendations could be given to promote value chain development and upgrading strategies of honey in the study area. Most of the beekeepers in the District have been using traditional beekeeping technique that result in low hive products. Raising awareness and capacity building of beekeepers for quality production is one of the many ways to assist beekeepers to build on their resources to create more income by managing their apiary skillfully, and fetch a good price in the market. Hence all concerned organizations (chain enablers) should focus on the provision of appropriate training for both farmers and District's agricultural development agents on how to manage beehives and incorporate new technologies profitably in to farm level production strategies.

The major constraints to exploit the untapped potential of beekeeping activity in the District were lack of access to credit, current or updated market information and modern inputs. This is due to their fragmented production units, which makes collective action in input acquisition, production planning and output marketing difficult. These problems can be addressed via formation of beekeeper unions and cooperatives and through governmental or non-governmental organizations intervention that improve possibilities for strong and successful collective marketing of their hive products.

The other issue that needs the attention of chain supporters is organizing of honey collection centers. These are centers where beekeepers can bring their products and be certain of a market. When significant volumes of good quality honey is available in one place, traders will be interested to travel to remote areas, being certain of the volume and quality they will be able to collect. This in turn has an impact on improving farmers' production and marketing capacity since they feel secured for the market of their product.

The District farmers use agricultural chemicals like herbicides and insecticides for their cereal production. This is a potential hindrance for beekeeping development in the study area. Though it is difficult to completely prevent the effects of agrochemicals on honeybees, their effect can be reduced through integrated pest management programs like application of the chemicals when bees are less active or by using insecticides of relatively low toxicity with proper methods of application. This requires the government or concerned bodies to launch and strengthen extensive awareness creation program for the District's farmers.

Appendix

Table A1. *VIF for multi co-linearity diagnosis.*

Variable	VIF	1/VIF
AGH	1.73	0.578742
SHH	1.11	0.904437
EDH	1.12	0.891301
FS	1.96	0.511255
ACCEXT	1.27	0.78981
DNM	1.12	0.892417
LAND	1.78	0.563112
FIOBK	1.62	0.616765
NBHO	1.43	0.699232
TBH	1.12	0.892724
CA	1.15	0.871885
YBK	1.37	0.732322
MI	1.22	0.820279
TLU	1.40	0.713022

Source: Own computation, 2012.

Table A2. *Conversion factor of tropical livestock unit (TLU).*

Livestock Category	Conversion factor
Heifer	0.75
Cow or Ox	1
Horse/Mule	1.1
Donkey adult	0.7
Donkey young	0.35
Camel	1.25
Sheep or Goat adult	0.13
Sheep or Goat young	0.06
Chicken	0.013
Bull	0.75

Source: Storck, et al., 1991.

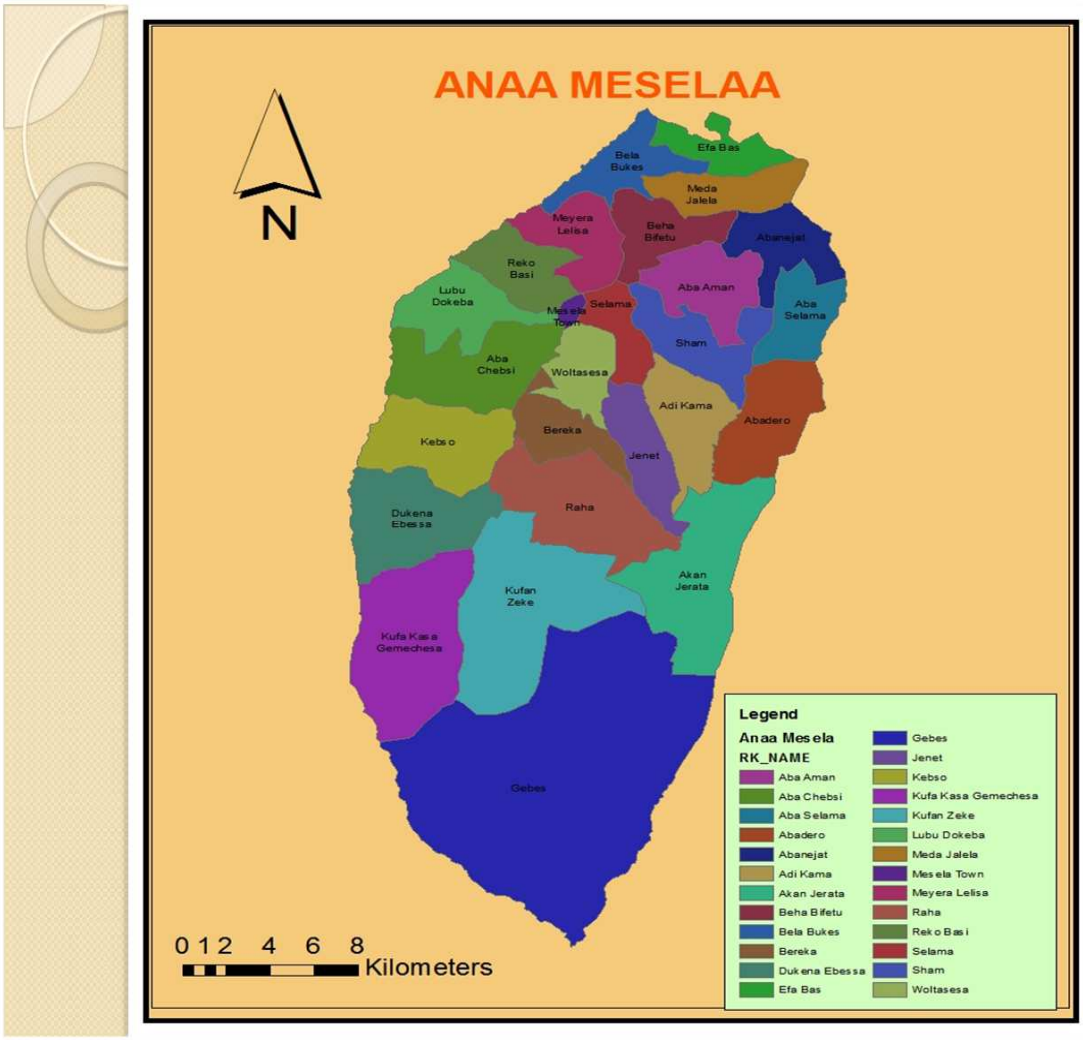

Figure A1. *Map of Mesela District.*

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