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RESEARCH ARTICLE

VALUE CHAIN ANALYSIS AND DEVELOPMENT: THE CASE OF BAMBOO AND HONEY PRODUCTS FROM MARAKA WOREDA, DAWURO, SOUTHERN ETHIOPIA

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ABSTRACT

Ethiopia has huge amounts of non-timber forest products like bamboos and honey resources, but the contribution of these resources to the national economy is very low due to underutilization. Thus, this study aims at identifying and understanding the reasons for inefficiencies in the highland bamboo and honey value chains and to identify potential leverage points for improving the performance of the chain: the case of Dawuro. Both mixed quantitative and qualitative research approaches; and cross-sectional survey were employed: A multistage sampling technique was employed to select a sample from the target sample units. Data were collected sample of 185 honey value chain actors and 132 highland bamboo value chain actors through initial desk research, key informant interviews, Focus Group Discussions, and interviews questionnaires and checklists. Both value chain and econometric analysis methods were used as analytical tools. Value chain analysis results shown that both bamboo and honey chain actors were neither vertically nor horizontally linked. Spot market transactions regime was the common marketing system in both bamboo and honey value chains. Most the existing marketing channels in study areas are to enlarged and inaccessible to move culm and honey products to market that diminishes mainly the producer's share the trade of culm accounts 17.5% (birr 4416 or $132.48(1EBT = USD 0.03)) share of total bamboo farmer's annual income. However, education status and training, farming experiences, farmer's expectation on bamboo business, lack of formal market access and information dissemination, weak bamboo value chain actors linkages, lack of bamboo extension services and incentives, knowledge and skills limitations on bamboo silvicultural managements, lack of treatments of culms to increase its service life and standards were the key contributing factors of highland bamboo value chain development at farm stage. Honey trade was accounts 28% (birr 28840 or $865.20) of household's gross annual income. On the other hand, the education status, selling price of honey, distance to the nearest market, access to honey extension service, honey farming experiences, the total number of modern hives owned by producer affects the quantity of honey supply to the market at $p < 0.00$ significance levels. The short and well-liked marketing channels should be established to enhance the reasonable benefit distribution of chain actors. To increase chain performance of both bamboo and honey value chains, product and process upgrading strategies, common objectives, extension and training should be designed and delivered continuously by honey and bamboo chain support providers.

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INTRODUCTION

The Non-Timber Forest Products (NTFPs) production and marketing involve millions of workers and producers including many women and men in the most remote areas of developing countries. NTFP activities are to provide poor people with a stepping stone to lift them out of poverty on a sustained basis (Marshall *et al*., 2006). Ethiopia has potential in NTFPs includes gum Arabic, frankincense, myrrh; wild coffee, spices and condiments, traditional medicine, honey or wild honey and bees wax; bamboos, reeds, wild palm, edible plants and their products (fruits, seeds, edible oil), essential oils from aromatic plants, fat, fodder, fibers, tannins and dyes, ropes, resins, latex, ornament, panel products produced from giant or long grasses, roof thatch for local house construction, byproducts after liquidating lumber, wild edible and non-edible animal products, and various other extractives, flavorings, sweeteners, balsams, and pesticides (Desalegn and Tadesse, 2004). Moreover, Ethiopia has the greatest bamboo and honey resources in Africa and representing a significant proportion of Africa's total bamboo and honey resources. Bamboos and honey have been widely produced and marked In Ethiopia.

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Bamboos are multipurpose fast-growing, adaptable and potential to link local, regional and national level chain actors. It suited and potential for agro forestry systems; and easily adapt to different climatic and soil conditions (Diver 2001, Maxim *et al.* 2005 and FAO 2007).It can provide a range of environmental benefits through reducing soil erosion; can hold 100 tons of water per hectares, suitable for the recovery of degraded lands, balances of carbon dioxide in the atmosphere and acts as an atmospheric and soil purifier. Bamboo industry is making important contribution in providing food, housing and income generation more than 2.2 billion people in the world. It has played an important economic value in addition to environmental, aesthetic and cultural values. Since, it can be utilized at all levels of industrial activity from small crafts based industries to modern highly integrated plants that important to produce pulp, paper and clothing, furniture, flooring, particle board, energy, food and medicine; and as a substitute for traditional hardwoods (Smith and Marsh, 2005).It has huge potential to increase national income or economic growth because market for bamboo is growing at different geographical spreads. Apiculture is also one of the potential sectors for earning foreign exchange, generating income for smallholder beekeepers and other actors along the chain in the country. Honey and beeswax value chain is also most important agribusiness activity that contributes significantly to improvement of livelihoods in Ethiopia. The country has suitable agro-ecological zones and diversity of the ecosystem for honey production (Melaku. 2008 & Kerealem *et al.2009*). Thus, honey value chain development and improvement absolutely play a significant role in the food security, income generation and employment opportunities in rural areas across the country.

Dawuro is located at 60.59' to 70.34' latitude and 360.68' to 370.52' longitudes, with elevation ranging from 500 to 3000 meters above sea level with total land size cover 466,082ha (55.49% is cultivated land, 13.39% is grazing land 16.81% is forest, bushes and shrub land, and 14.31% is covered by others); agro-ecology categories include 55.6% of lowlands (500-1500), 41.4% of midlands (1500-2500) and 3% of highlands (>2500 meters above sea level); the annual mean temperature ranges between 15.10c to 27.5oc and the annual mean rainfall range from 1201mm to 1800mm. The mixed agricultural system is the main livelihood strategy of households. Dawuro relatively large bamboo forest coverage and diverse bee colonies for honey production opportunities to further enhance livelihoods through income generation and poverty reduction. More than 3008.7ha of highland bamboo (locally named "Wosha") is growing by smallholder farmers in five Woredas (Loma, Tocha, Maraka and Maraka).

Statement of Problem: The economic potentials of bamboo and honey resources are underutilized, Ethiopia has the extent of production and geographical places of products were not delineated and managed in Ethiopia. Huge numbers of farmers engaged in highland bamboo value chain to support their livelihoods in Ethiopia. Bamboos are commonly growing and scattered in the south, south-west, and central parts Ethiopia (Kassahun, 2003). Commonly, Ethiopia has huge potential and untapped bamboo resources which are representing a significant proportion of Africa's total bamboo resources. However, the tangible volume and places of highland bamboo resources were not-well recorded exhaustively; the contribution of this sector to the national economy is still very low and underutilized.

On the other hand, Ethiopia has the potential to produce 500,000 tons of honey and 50,000 tons of beeswax per annum. Around two million farm households are engaged in market chain of honey in Ethiopia to support their livelihoods (MOARD, 2008). The annual honey and beeswax production of the country has been estimated at 53,680 and 3,658 tons, respectively (CSA, 2011). But, country also has huge forest coverage, diverse flora and fauna which have high potential for honey production next to bamboo production. The annual honey and beeswax market supply was below the estimation. Honey value chain actors have huge domestic and export market potentials for honey value chain development. But, the markets could be physically available but not accessible to some of the farm households in rural areas. Dawuro has relatively good forest coverage, diverse flora and fauna which have high potential for honey production.. Despite of existing potential apiculture and forest resources, both honey and bamboo sectors are contributing less amount of supports on livelihoods in rural areas. Thus, studying the contributing factor along bamboo and honey value chains is vital to leverage and design for the sustainable utilization of existing resources.

Objectives of the study: The main aim of this study was to understand the reasons for inefficiencies in highland bamboo and honey value chains and to identify potential leverage points for improving the its performances: the case of Dawuro, Southern Ethiopia. Hence, the specific objectives of the study include:

1. To identify the distribution of benefits of bamboo and honey value chain actors
2. To examine contemporary challenges and opportunities along high bamboo value chains
3. To analyze marketing systems and contributing factor of honey supply to market

Theoretical framework for value chain approach: The value chain is the full range of activities that are required to bring a product or service from conception through the different phases of production and trade including design, production, marketing, distribution, and export until the final consumer (Kaplinsky and Morris 2000). The value chain also refers to all the activities and services that bring a product (or a service) from conception to end-use in a particular industry from input supply to production, processing, wholesale, and finally, retail. It is so-called because the value is being added to the product or service at each step (Porter M, 1985). Moreover, the value comprises interlinked value activities that convert inputs into outputs which, in turn, add to the bottom line and help create a competitive advantage. This means that agribusiness chain actors in general or a single product value chain actors, in particular, are involved in handling and adding direct value or consuming the product and also the service network indirectly involved in the production. In a value chain approach, a group of players is working together to satisfy market demands for a particular product or group of products. A group of players include producers, researchers, and support providers, input suppliers, and business regulators. Value chains can be competitive only when they innovate and not by maintaining statuesque. With innovation a larger pie is created which provides greater incentives to share which in turn fosters further innovation (as a result new and higher value products would come out of the chain). Developing value chain is an improvement of cooperation between stakeholders of a particular sector and the coordination of their activities along

with different levels of a value chain with regard to the number of triggers for value chain development such as (system efficiency, product quality and specifications, product differentiation, social and environmental standards, and enabling business environment. It offers a strategic way to address the opportunities and constraints facing the productive sectors of a locality and its producers and businesses. Accordingly, developing an agricultural/ forestry value chains are vital to improve production operations and generate social benefits such as poverty reduction, income generation, economic growth, environmental performance, gender and other development goals.

The prerequisites for developing successful agricultural value chain include establishing objectives, building trust, and establishing working relationships, managing information flows, and upgrading in value chains. The objectives of the value chain will depend on the product, market circumstances, and the participants, among other factors. The aim might be to bring a new product to market, or to introduce an existing product to a new market; it might be to provide assurances of food safety, traceability and/or quality to end consumers; it might be to maintain or expand market share in the face of increased competition from imports or from domestic competitors; and it might be to respond to new government regulations which affect product design, processing, traceability; to strengthen and deepen existing relationships with a view to increasing market share. Another important parameter in developing value chain is trust. Trust is one of biggest issues in the formation of a value chain. Potential participants must trust that their partners" motives are not solely self-serving, and that there are benefits to working together. Ideally, the value chain will create a win-win relationship whereby all participants benefit through the establishment, maintenance, or expansion of secure and sustainable markets.

This is often referred to as governance of the value chain in different literature. The issue of trust highlights the importance of continuous dialogue among all parties to ensure that the objectives of the alliance are being met, and that no one member has tried to create a situation in which they benefit at the expense of the other partners. Managing information flows is one of the prerequisites for developing successful Value Chain. At times, data and information are knowledge. At other times they are not. When you are managing information, however, you are also managing data and knowledge. Knowledge is power. Often the farmers are in a disadvantaged information position. They have no information about the performance of their own organization, l*et al*one of the market. Information about product demand, supply, and price are important for every firm to decide production and marketing of particular commodity. Upgrading the chain include process, product, functional and chain upgrading. For example; process upgrading: this means producing the same product more efficiently-perhaps by using new technologies or management methods. For example, farmers may grow more by switching varieties or applying fertilizer; they may reduce pest attacks and save costs through integrated pest management rather than spraying; they may husk maize more quickly using a machine rather than by hand; or they may invest in build new grain bins to improve storage. Farmers can also improve their links with other actors in the chain -for example, they can sign contracts with input suppliers or processors. Product upgrading: farmers can improve their product in various ways. For example, they may plant a new variety that has more desirable characteristics; or they may stop using agrochemicals and apply for certification so they can sell their produce as "organic". Functional upgrading: farmers can take on new activities in the chain, either upstream or downstream, or change the mix of activities they undertake. For example, they may start grading and sorting their produce; they may bulk it to make pick-up more convenient for buyers; or they may process it (drying, milling, etc.) to improve its value or increase its storage life. Chain upgrading: farmers can also set out on a new value chain: they can start growing a new crop, keep a new species of livestock, or start a new enterprise such as dairying or agro-tourism. They may be completely new to these activities, or they may transfer their skills and experience from their existing enterprises.

Approaches to Value Chain Study: Value chain analysis is useful research approach for identifying constraints and opportunities for the provision of products and services. It is emerged as a new research technique to answer questions on why inefficiency in agriculture, as well as forestry sectors, occurs and what constraints face poor people and places in better contributing to and benefiting from particular sector growth. Moreover, the efforts of value chain analysis involve breaking a chain into its constituent parts to better understand its structure and functioning. Thus, the analysis consists of identifying chain actors at each stage and discerning their functions and relationships; determining the chain leadership and sustainable production, 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. But, the dimensions of value chain analysis in forestry vary with forest and non-forest products. It extends from simple to more complexes and consists of a set of different determining parameters. For example, the simple dimensions of the value chain in agriculture/forestry include input-output structure, geographic spread, and control. However, the complex dimensions of the value chain include sourcing of inputs and supplies, sustainable production and technology use, end-markets and trade, business environment and socio-political context. The dimensions focused on value chain analysis depend on the research questions. Accordingly, in this study, factors affecting of bamboo and honey value chain development and improvement at different dimensions are addressed.

An approach used in value chain analysis depends on the research questions. On the other hand, the most common approaches of value chain study includes Value chain mapping; identifying the distribution of benefits of actors in the chain; examining the role of upgrading within the chain; and the role of governance in the value chain are commonly employed in agriculture as well as forestry value chain analysis in general. Value-chain analysis systematically maps the actors participating in the production, distribution, processing, marketing, and consumption of a particular product (or products). This mapping assesses the characteristics of actors, profit and cost structures, and flows of goods throughout the chain, employment characteristics, and the destination and volumes of domestic and foreign sales. Steps in mapping are mapping the core processes in the value chain; identifying and mapping the main actors' involved in these processes; mapping flows of products, information, and knowledge; mapping the volume of products, numbers of actors and jobs; mapping the geographical flow of the product or service; mapping the value

at different levels of the value chain; mapping relationships and linkages between value chain actors; and mapping supports and services that feed into the specific agricultural/ forestry value chain. Identifying the distribution of benefits of actors in the chain through the analysis of margins and profits within the chain, one can determine who benefits from participation in the chain and which actors could benefit from increased support or organization. This is particularly important in the context of developing countries (and agriculture in particular), given concerns that the poor in particular are vulnerable to the process of globalization. Examining the role of upgrading within the chain involve improvements in quality and product design that enable producers to gain higher value or through diversification in the product lines served. An analysis of the upgrading process includes an assessment of the profitability of actors within the chain as well as information on constraints that are currently present. Governance issues play a key role in defining how such upgrading occurs. Besides, the structure of regulations, entry barriers, trade restrictions, and standards can further shape and influence the environment in which upgrading can take place. The role of governance in the value chain: governance in a value chain refers to the structure of relationships and coordination mechanisms that exist between actors in the value chain. The 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 distortions, and increase value-added in the sector by systematically understanding these linkages within a network, one can better prescribe policy recommendations.

MATERIALS AND METHODS

Cross-sectional survey research design, quantitative and qualitative research approaches were employed. The multistage sampling technique was used to select study woreda (district), kebeles/villages, and household heads. First, out of five woredas in Dawuro, Marakaworeda selected purposively due to high highland bamboo and honey production and marketing potentials; second, four honey potential kebeles and two bamboo potential kebeles were selected purposively. Third, 117 samples of bamboo producers and 132 samples of honey producers were selected randomly based on proportional to the population size of the selected kebeles (Table 1). Moreover, the numbers of traders were obtained from the Office of Trade and Industry. But, the total number of traders very small in number, 53 honey trades; and 15 culm traders were sampled from different local market centers purposively.

Table 1. Sample size distribution in the sample selected kebeles

	Sampled kebeles	Population	Proportion	Sample
Honey potential kebeles	Samu	803	0.27	35
	Mayla	942	0.31	41
	Gasho	456	0.15	20
	Shamu	814	0.27	36
	Total	3015	1.00	132
Highland bamboo potential kebeles	Ocha	509	0.66	77
	Daka	263	0.34	40
	Total	772	1.00	117

To determine the sample size, Cochran's (1963) equation was used. Then, data were collected through initial desk research, key informant interviews (KII), Focus Group Discussions (FGD), and targeted individual actor interviews by using semi-structured questionnaires and checklists.

Methods of Data analysis: Both value chainand econometric analysis methods were used as analytical tools. Approaches followed to analyze value chain include mapping value chain, identifying the distribution of benefits of actors, and examining the role of upgrading within the chain. Total gross marketing margin is used to identify the distribution of benefits of factors. Total gross marketing margin (TGMM) is related to the final price or the price paid by the end consumer and then expressed as a percentage. The TGMM of bamboo chain actors were obtained by using the following formula:

$$TGMM = \frac{Culm\ retail\ price\ minus\ farmer\ gate\ price\ of\ culm}{Retail\ price\ of\ culm} X100$$

The producer's share is the ratio of producer price to retail/end market price and obtained by using formula

$$p_s = \frac{P_p}{C_p} = \frac{1 - GMM}{C_p}\ or\ GMMp = 1 - TGMM$$

Where p_c= the producer's share, p_p= producer gate price of culms; c_p = end market price of culms GMM = Gross Marketing margin; GMM_p is producers' participation which is the proportion of the price paid by consumer that belongs to the producer and producer. Moreover, multiple linear regression models used to identify factors affecting farm level honey supply to the market because of all honey producers participate in the market and they supply different quantity of honey. Theeconometric model ofthis study was specified as:

$Y = Xi\beta + Ui$; *Where Y = quantity of honey supplied to market;* X_i *= a vector of explanatory variables;* β *= a vector of parameters to be estimated and Ui = disturbance term.*

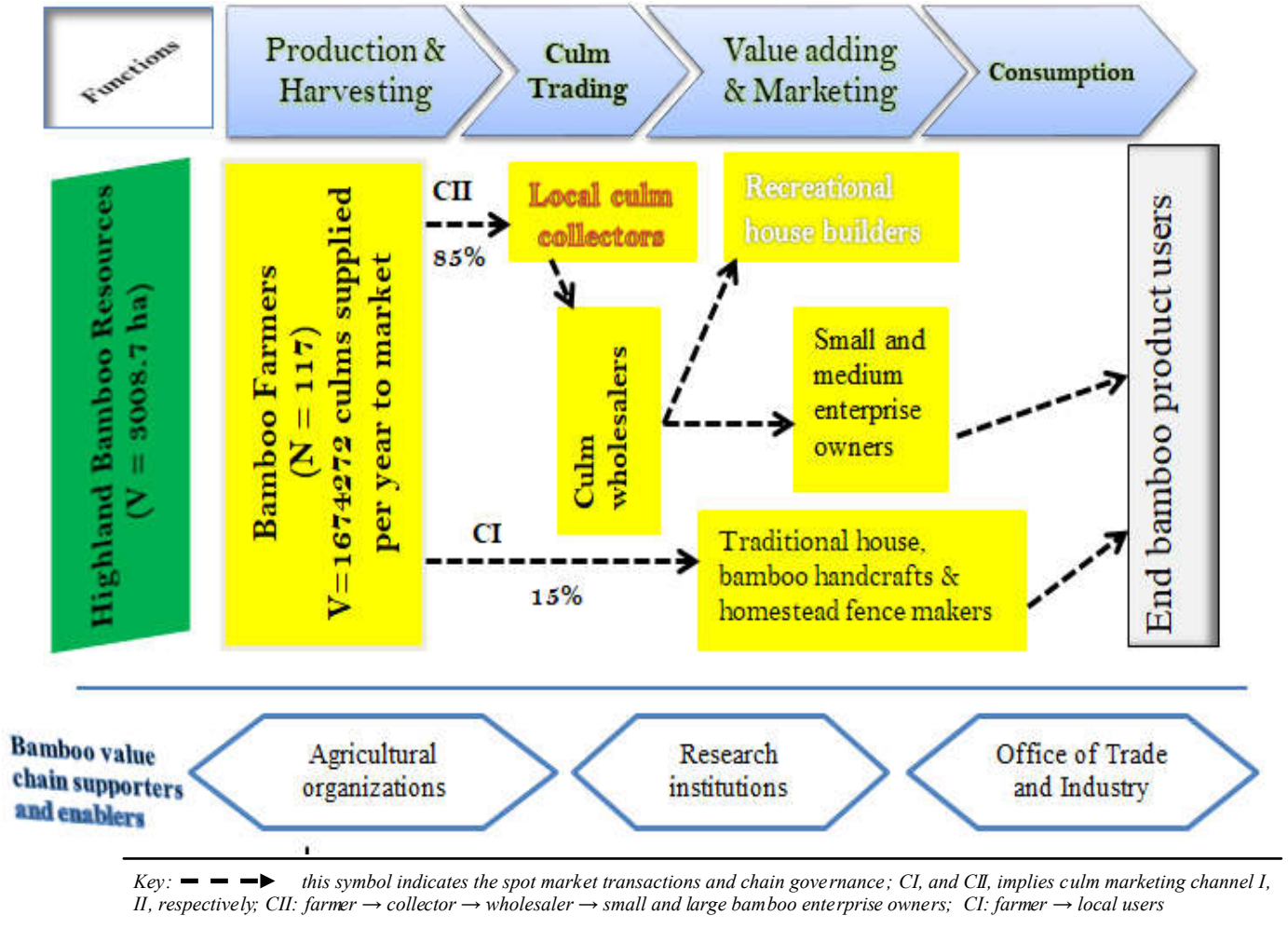
RESULTS AND DISCUSSIONS

Structure of highland bamboo value chain: Highland bamboo value chain is indicates the full range of activities that bring bamboo products from producers through the different phases involving a combination of physical transformation and bamboo culms processing activities and end bamboo product users. Figure 1 below shows the highland bamboo value chain actors, activities, flow of bamboo products, and supporters in Maraka district. Highland bamboo resources covered more than 3008.7 hectares in Dawuro. It is possible to harvest about 1.6 million culms or 288 tons of matured culms on a sustainable basis from existing 3008.7hectares ofhighland aged culms per year. This estimation was obtained based on LUSO Consult (1997) who stated the national highland bamboo culm measurement standards i.e.51 tons per ha or 114 culms per ton. Out of the total resources in Dawuro, 25% of the resource is found in Maraka. The remains are distributed in

Loma, Tocha, and Esseraworedas. On average the individual bamboo farmer supply more than 3201 bamboo culms to market through CII (farmer → collector → wholesaler → small and large bamboo enterprise owners); and CI (farmer → local users). Farmers have been selling almost 85% of culms through CI, and 15% of culms through CI. This implies CI is the most important outlet that bamboo culm moves to market from study area. The structure of the highland bamboo value chain has three dimensions include the input-output structure of bamboo culm production and knowledge and expertise flows (research, silvicultural management, and value addition), geographic spread (locations of activities) and bamboo value chain governance (bamboo industry policy and strategy). The result associated with Zenebe *et al*. (2014) who indicated that the bamboo value chain in Ethiopia has three main dimensions includes vertical channels, the horizontal dimension, and the intensity which relates to the amount of labor and capital that is used to carry out a particular function. But, the knowledge and expertise flow, value chain governance or control, and vertical channels and horizontal linkage were required further improvement to maintain the overall performance of the bamboo value chain in Ethiopia.

land. The average household landholding was 2.5 hectares with a minimum of 0.5 hectares and a maximum of 6 hectares in Maraka district which is higher than the national average household landholding (1.0 to 1.5 hectares). The bamboo plantation size in the study area ranges from 0.25 to 1.25 hectares with the average land size is 1.15 hectares.

Bamboo planting through propagation by offsets (rhizome with the attached section of the stem) methods. But the extraction of the rhizome is difficult and inefficient, and it is difficult to collect large quantities of planting materials. The culm matured harvested within 3 to 4 years and the next rotation culms harvesting take place after 2 years. The average culm thickness (diameter at breast height) and length were 5 centimeters and 11 meters, respectively. This finding agreed with INBAR (2001) which reported the height of highland bamboo culm as 12-20m tall and thickness of 5-13 cm in diameter. But, cum height and thickness due to bamboo silvicultural management, soil fertility conditions, and stand density per hectare differences in the farm plots.



Key: ▬ ▬ ▬► this symbol indicates the spot market transactions and chain governance; CI, and CII, implies culm marketing channel I, II, respectively; CII: farmer → collector → wholesaler → small and large bamboo enterprise owners; CI: farmer → local users

Figure 1. Typical highland bamboo value chain structure from Maraka, Dawuro

Highland bamboo value chain actors and activities:

- Bamboo farmers are one of the core chain actors who directly deal with the products. The key production functions of producers include field establishment, planting, site management, and selective harvesting of matured culms. They plant a bamboo tree at the homestead in a small plot of

Culm traders are also directly deal with the bamboo value chain. The local collectors and wholesalers are the main culm buyers from farmers. Local collectors are primary assembly traders who normally buy culms from individual bamboo farmers, perform important storage functions at roadsides, and sell to wholesalers. The wholesalers buy larger volumes of

culms from either farmers or collectors and sell to processers (recreational house builders and small and medium enterprise owners) at different urban markets in Ethiopia.

Culm processers along highland bamboo value chain include traditional house-builders, handcrafts makers, individuals, recreational house builders & small and medium enterprise owners involved in the transformation of a product and value-adding activities. Small and medium scale bamboo enterprise owners make different bamboo furniture and sell their products to final consumers in different urban cities. Handcraft makers who buying culms from producers in a small volume and add value on the products and sell products (chairs, baskets, and traditional beehives for honey, different strips (wall covering, floor wrapper, and roof covering) to consumers in the local market.

Bamboo value chain supporters and enablers include agricultural organizations, research institutions, and office of trade and industry or local and regional governments. These actors not directly deal with bamboo production and marketing activities. They have been providing more supportive services including capacity building training and extension services, market information, financial services for crop production and animal husbandry activities. But, a support provisions along the bamboo value chain was not adequate and less focused by value chain supporters and enablers in Ethiopia in general and Dawuro in particular.

Culm marketing and distribution of benefits of chain actors: The main livelihood activities of bamboo farmers are crop production, animal husbandry, forest production, and off-farm activities. The average annual income of households was birr 56745 (1EBT = USD 0.03). The total average annual household's income from bamboo culm sale was birr 4416 or 132.48. Hence, in terms of contribution to the household's annual income, highland bamboo production accounts for 17.5%. This agrees with Oukula *et al*., (2015) who were reported that cash annual income from highland bamboo shares about 19% of the total annual income of smallholder bamboo producers in Dawuro. The share benefits of chin actors were obtained through market margin analysis. A marketing margin is the percentage of the final weighted average selling price taken by each stage of the marketing chain. The culm (pole of bamboo or stem) is supplied to the market by producers. The farmer has been selling culm through two marketing channels or outlets (Figure 4). Culm processers in urban areas were considered in the specific study as end market receivers; because they converted into different products through value addition. Among those channels, the outlet that links farmers, collectors, wholesalers, and small and large bamboo enterprise owners vertically is very important in terms of volume of product flow and accounts for the largest proportion of bamboo culms supply Most of the buyers prefer to buy a large size and well-matured culms. The bigger bamboo culms products fetched higher prices while smaller ones fetched lower prices, but culms prices were fixed either negotiation between producers and buyers or only buyers.

The market value of culm varies across outlets due to variation in market access, market information, and vehicle accessible road services. The average selling price of bamboo culms at the producer stage was different across marketing channels. The average price of bamboo culm was birr 3 per culm at farmer gate (local market). But, the average selling prices of culm in major urban culm market, as 2019 is birr 30

(1EBT = USD 0.03). But, the price of one average culm in the major cities, as of 2005 is ETB 7.00 (USD 1 = ETB 8.68, 2005). Its price is increasing from time to time since, its importance in the local market is increasing and no other plant provides as many services as bamboo especially for low-income families. The market margin analysis result (Table 2) shown that about 90% of the total gross marketing margin was added to bamboo culm price when it reaches the final receivers at the national capital city of AA in Ethiopia. This due to the inaccessibility of seasonal vehicle roads, loading and unloading costs, and huge care rent to move culm from local market to the national market. Out of the total gross marketing margin about 10% of gross margin shared by bamboo farmers, 20% gross margin shared by local culm collectors, while 90% was that of culm wholesalers.

Contemporary Challenges and Opportunities along High Bamboo Value Chain: Figure 2 shows the key demographic, socio-economic and institutional factors affecting high bamboo value chain development. The education level of actors is vital factor for enhancing production and marketing decisions; accept new ideas, easy to get supply, demand and price information along the chain; increases actor's willingness to produce more and increase the volume of supply. The farming experiences and belief in bamboo business also influence the bamboo value chain development because relatively riche farmers were not considering bamboo farming as part livelihoods stagey. Weak bamboo value chain actors' linkage, limited skills on bamboo propagation and limited value adding knowledge were also hindering the bamboo value chain development in study area.

Absence of bamboo silvicultural management reduces the amount of market supply of culms in study areas. Field establishment and plantation maintenances include tending of shoots and appropriate harvesting enhance the productivity of bamboo stands. Little bamboo research supports on propagation, treatments of culms to increase its service life and culm processing and value-adding process was another key determining factors affecting bamboo value chain development. Finding aligned with Teshome *et al*. (2015) who revealed that the quantity of highland bamboo produced, distance to access to all weather roads, inappropriate silvicultural management methods, access to market information, land allocated for bamboo plantation, and highland bamboo farming experience were significantly affecting the household marketable supply of bamboo culms at household level in Dawuro.

Opportunities along high bamboo value chain: highland bamboo value chain actors have sufficient national and global market opportunities for bamboo products. It has huge income generating potentials to support their livelihoods in rural areas because the demand for bamboo products is foreseen to grow with the expansion of the bamboo markets at the local, national, and global levels.

Table 2. Culm marketing margin as a proportion of final price and in each chain actors marketing channel (Birr/culm)

Group of bamboo culms market participants	Purchasing costs and marketing margins	Culm marketing channels or outlets	
		CI	CII
Bamboo farmers	Selling price/culm	2.50	03.00
	Farmer's share %	100.00	10.00
TGMM %		-	90.00
Local culm collectors	Selling price/culm	-	9.00
	Margin/culm	-	6.00
	Marketing margin%	-	66.67
	TMMc%	-	20.00
Culm wholesalers	Selling price/culm	-	30.00
	Margin/culm	-	21.00
	Marketing margin%	-	70.00
	TMMw%	-	90.00
End market receivers		2.50	30.00
TCMM		2.50	27.00

Key: CI, and CII, implies culm marketing channel I, II, respectively; TGMM: Total gross margin (%) as Marketing margin as a percentage of end market price; TCMMc: Collectors' portion of the total channel marketing margin (%); TCMMw: Wholesalers' portion of the total channel marketing margin (%); TCMM: Total channel marketing margin

Bamboo culm substitutes fuel wood and lumber; therefore save tree cutting for timber production and fuel energy consumption. Increasing bamboo planting has environmental conservation values through reduce soil erosion, increase water infiltration, and climate change adaptation through carbon dioxide sequestrations.

Contributing Factors of quantity of honey Supply and Marketing Channels: Honey marketing channels analysis**:** to understand the determinants of honey supply to the market at the farm level, it better to analyze and cognize the existing honey marketing channels of the study area. Accordingly, marketing channel analysis is a useful tool to examine and understand the determinants of specific commodity supply to market because marketing channels link chain actors over time and space. The sampled honey producers (n = 132) were supplied 79880kg of honey to market i.e. on average over 605kg or 0.6 quintal of honey were supplied to the market by each producer per year. The sale of honey contributes to 28% (birr 28840.00 or $865.20) on the composition of the household's income. The producers have been supplying through six honey marketing channels (C) includes (1) CI: Farmers → rural collector → wholesaler → consumer. This is the largest and most important channel and accounts for 27.42% (21910.00kg) of the total marketed volume of honey supplied; (2) CII: Farmer → rural collector → retailer → consumer. This market channel was the second large and most important channel and accounts 22.51% (17985.5kg) of total market volume honey supplied; (3) CIII: Farmer → wholesaler → retailer → consumer; this channel was the third important channel and accounts 18.32% (14640kg) of total honey marketed; (4) CIV: Farmer → wholesaler → consumer; accounts 15.4% (12316.5kg) from the total volume of honey supplied; (5) CV: Farmer → wholesaler → processor → consumer; accounts 8.1% (6550kg) of total honey marketed. (6) CVI: Farmer → consumer; this market channel accounts 8.2% (6478 kg) of total volume marketed, This channel is the shortest channel at which producers directly sell to consumers.

Econometric analysis results: Multiple regression models were employed to identify the factors affecting the quantity of honey supply (as dependent variable) at the farm level. It is not possible to include a complete list of all possible variables that could affect the household level of honey products supply to the market.

But, potential independent variables such as sex of household head, age of household head, family size, education status, price of honey, distance to market, honey extension services, honey farming experiences, accessibility of credit, land size held, the total number of modern hives, and annual income were supposed to influence the quantity of honey supply to market at study area/Maraka district. For the parameter estimates to be efficient, assumptions of the Classical Linear Regression (CLR) model should hold. Accordingly, the existence of Multicollinearity problem detected by Variance Inflation Factor (VIF) and for discrete variables; Contingency Coefficients (CC) and there was no serious Multicollinearity problem in data set since for continuous variables; VIF < 10 and for discrete variables; CC < 0.75. Also, the existence of a heteroscedasticity problem was detected by White's Test and there was no serious heteroscedasticity problem in the data set because of the small p-value (Prob> chi2 = 0.008) that rejects the null of homoskedasticity that there is heteroscedasticity in the explanatory variables. Thus, the determining factor affecting honey supply to the market at the farm level was presented in Table 3 below. The most significant determining factor of honey supply to the market in the study area includes:

Age of household head: This variable affects the quantity of honey supply positively and significantly at less than a 1% significance level. In the study area, the majority of honey producers were under the productive age category (20-48 years). As a result, they would acquire knowledge and experience through continuous learning which helps them to actively participate in honey production and increase the quantity supply of honey by 5.30 kg. This associated with Ayelech (2011) who showed the age of household head is prone to use resources and has a positive effect on market participation and marketable surplus in the fruits value chain in Jimma. Total family size per home affects the quantity of honey market supply negatively and significantly at a less 5% significance level.

The average family size is 5persons per home. Since an increase in family size possibly increases household consumptions and reduces marketable surplus by 10.21kg.

The education status of producers was positively related to the quantity honey supply and statistically significant at less than 1% significance level.

Figure 2. Challenges of highland bamboo value chain development in Marakaworeda

Table 2: Determinants of honey supply to market: Econometric analysis results

Explanatory variables	Coefficient (β)	SD	P-value
Sex of household head (1=male or 0= female)	20.80	13.46	0.125
Age of household head (year)	5.30***	1.62	0.001
Total family size (number)	-10.21**	5.07	0.046
Education status of producer (year of schooling)	7.34***	2.90	0.007
Local market price of honey (in birr)	14.25***	2.83	0.000
Distance to nearest market (kilometer)	-7.24***	1.81	0.000
Honey extension service (1=yes or 0= no)	14.55***	1.88	0.007
Honey farming experiences (year)	13.02***	3.13	0.000
Accessibility of credit (1=yes or 0= no)	47.61	16.88	0.216
Land size held (hectare)	9.30	15.11	0.271
Total number of modern hives owned by producer (number)	11.28***	0.20	0.000
Household's annual income (birr)	10.01**	4.06	0.031
Constant value (kg)	-684.41	133.32	0.000

Key: ***, ** and * indicates statistically significant at 1%, 5% and 10% respectively; SD = Standard Deviation, km = kilometer, kg =kilometer; Adjusted R-squared = 0.960; F (12, 117), = 514.82, Prob> F = 0.00

Most of the honey producers found under lower years of education schooling. Increasing the education level of producers by single grade will increase the quantity of honey supply by 7.34 kg. This finds associated with Assefa (2009) who revealed that education has a positive effect on honey sale quantity per year household per in Atsbi Wemberta District, Tigray.

The local market price of honey: The price of honey per kg was very low in the rural market when compared within the urban market in Ethiopia in general. The average price of unprocessed honey in the year 2019 was birr 38 per kg, minimum birr 30 per kg and the maximum birr 45 per kg. Consequently, price affects positively related to the quantity honey supply and statistically significantly less than a 1% significance level. When the price of the product was promising, farmers are motivated to take they're produced to the market. This makes the supply to be directly related to the current market price.

Distance to the nearest market impacts honey market supply negatively and significantly at less than a 1% significance level as expected. The result shows that as the distance from the nearest market increase by 1km the quantity of honey supplied to the market most likely decreased by7.24kg. Distance from the producer's house to the nearest market is also one of the key factors affecting honey supply to the market. This may be because as the distance to the market center increases transportation cost increases. This result aligned with Teshome *et al*. (2015) who reported that distance to nearest all-weather roads affects bamboo culms marketsupply negatively and significantly at a 1% significance level in Dawuro.

Access to honey extension service was positively related to the quantity honey supply and statistically significant at less than a 1% significance level. Honey extension services are expected to have a high influence on the honey production and marketing behavior of the farmers. The higher access to the extension service, the more likely that farmers adopt new technology and innovation. Access to extension contact is the most important factor that promotes honey production and thereby increases the income of the producer and marketable surplus by 14.55kg. Farmers' training is one of the essential inputs in the beekeeping sector to increase yield, quality maintenance, bee forage development, and disease controls.

Honey farming experiences have a positive relationship with the quantity supply of honey at a 1% significance level. Increase in honey farming experience by 1year experience most likely increase in the quantity of honey supply to the market by 13 kg. This result is also consistent with other results that show a significant effect of experience on avocado production in Gomma District, Oromia region (Ayelech, 2011).

The total number of modern hives owned by the producer: using modern hives for honey production rather than traditional beehives was positively and significantly correlated with honey supply at a 1% significance level. A unit increase in modern hive leads to an increase in quantity honey supply to the market by 11.28kg. The productivity per hives depends on the type and the quality of hives. The average productivity per hive of modern and traditional within one harvest was 20kg and11kg, respectively. A farmer harvests honey twice per year. The amount of modern hive was very small when compared with the traditional hive. This finding aligned with Kerealem *et al*. (2009) who publicized that the use of improved hive was directly related to the amount supplied to the market and return earned by the beekeeper.

Household's annual income: the average annual income of households was birr 56745 ($1702.36). Accordingly, increasing the annual income of honey producers probably increases the modern hives purchasing power and hence most likely adds the quantity of honey supply to the market by 10kg. Biruk *et al*. (2018) also stated that shortage of input supply, lack of skill to make locally made transitional hive, shortage bee forage and lack of finance were major factors affecting the effectiveness of honey value chain in Wolaita, Ethiopia. Kassa *et al*. (2018) reported on types of bee hive used by beekeepers and productivity of hives. In the case of productivity of hives in the study area, honey yield was markedly different for the types of beehives used. On average, it was about 7.45 kg/hive and 25.76 kg/hive from the traditional and modern hives in Kaffa and Sheka, Ethiopia. This implies that using traditional beehives affect negatively the quantity of honey marketable surplus.

Contribution of bamboo tree plantation to honey supply: Bamboo plantation has direct impact on honey supply to market. Because most traditional beehives made from bamboo culm and it also enhance the availability of water and flowers that many bee species collect nectar that they convert to honey as a food source. The type of honey produced depends on the species of plants being visited by the bees. Honey is judged by its aroma, flavour and colour, which depend mainly upon the sources of the nectar that the bees have gathered. Planting bamboo tree has a great role in quality honey production.

Conclusion

Bamboo and honey provide wide range of economic for many different groups of users in Ethiopia. Bamboos are one of the renewable resources and have enormous growth potential opportunities for income generation and enhance the sustainability of ecological health. Moreover, the bamboo industry has huge income generation opportunities for pro-poor groups via culm processing in rural areas. Bamboo culm has huge processing potentials, so young entrepreneurs can easily enter into new product development in the manufacturing industry. Bamboo culm production was accounts 17.5% of the composition of bamboo farmer's income (gross value) in study area. This implies that highland bamboo value chain has a vital role on household's income generation and poverty reduction in rural areas. Culm marketing outlet that links farmer → collector → wholesaler → small and large bamboo enterprise owners vertically is very important in terms of volume of product flow and accounts for the largest proportion of bamboo culms flow to market, while an outlet that links farmer → wholesaler → small and large bamboo enterprise owners vertically is very important in terms of farmer's share of benefits. The result was shown that the result tells us that increasing the marketing margin from one stage to next diminishes the producer's share. However, inappropriate bamboo production technology adoption, the weak institution supports in terms of extension and research services, lack of formal market place and access, low chain actors' linkage, absence of policy and common objectives are the key contributing factors for bamboo value chain development. In other hand, honey marketing channels that link farmer→ rural collector→ wholesaler → consumer was the most important in terms of the large volume of honey flow to market; on the other hand, an outlet that links farmer → wholesaler → retailer → consumer was vital in terms of benefit share of farmers and traders. Compering with the remains, this outlet has better coordination, access to vehicle roads, and market information that might leave honey producers and traders better off. In another word, a wide margin means usually high prices to consumers and low prices to producers. Besides, shortage of modern hives, lack honey extension services and market access highly influencing the quantity of honey supply to market.

Recommendation

Fundamentals for developing successful highland bamboo value chain development; bamboo value chain supporters and enablers should establish bamboo industry-specific strategies, objectives, policy, build chain actors relationships, disseminating market information about demand, supply and price of bamboo products, develop formal market places, and promote appropriate bamboo silviculture methods in production stage. Moreover, individual bamboo processors in rural areas should be organized into small scale enterprises for promoting processed products and take advantage of economies of scale. The extent of bamboo resources distributed across the country should be reorganized and updated to get the actual potential of bamboo resources in Ethiopia because existing reports were too old. Scientific researchers should promote the adoption of bamboo silvicultural management methods, and value-adding process. Besides, shortage of modern hives, lack honey extension services and market access highly influencing the quantity of honey supply to market. Moreover, to improve the existing honey value chain development, supplies of input like modern beehives, deliver extension services and training on honey post-harvesting and handling to keep the quality and food safety, and improve chain actors cooperation and communication systems, establish market access for small scale honey producers were the key activities that should be more focused by honey value chain support providers. Country reports on the extent bamboo resources in Ethiopia should be revised and remapped because the existing information too old and not clearly include and demarcated the full volume and places of potential areas. To develop successful honey and bamboo value chains in Ethiopia requires establishing common objectives, building trust and establishing co-operative working relationships among actors, managing information flows and upgrading process and products.

Conflict of Interest: I declare that this thesis is the result of my own work and that all sources of materials used for this study have been duly acknowledged. Seriously declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate. Brief quotations from this thesis are allowable without special

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Abbreviations and acronyms

CC Contingency Coefficients
CLR Classical Linear Regression
CSA Central Statistical Authority
FAO Food and Agriculture Organization
ILRI International live stock research institute
ITC International Trade Center
MoARD Ministry of Agriculture and Rural Development
NTFPs Non-Timber Forest Products
TGMM Total Gross Marketing margin
USD United States Dollar exchange rate
VIFVariance Inflation Factor

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