academicJournals

Vol.8(8), pp. 130-140, August 2016
DOI: 10.5897/JAERD2016.0771
Articles Number: 812185C59463
ISSN 2141-2170

http://www.academicjournals.org/JAERD

Journal of Agricultural Extension and Rural Development

*Full Length Research Paper*

# Mushroom value chain analysis in Addis Ababa, Ethiopia

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Received 3 February, 2016; Accepted 17 June, 2016

**Mushroom value chain analysis was conducted in Addis Ababa, Ethiopia. In rural areas of Ethiopia eating mushroom is a common practice in traditional way.The objective of the study was to measure the amount of value added along the chain. Primary and secondary data were collected from 120 producers, 5 traders, 8 spawn suppliers, 6 supermarkets, 7 hotels and restaurants and 40 end users. For analysis descriptive and inferential statistics such as, Percentage, value added, gross value added, t-test, $x^2$-test, F-test, were applied. On average, about 14.5 quintal mushroom is produced per season with the productivity of 4.4 kilogram per bed. The average price of mushroom range from 43.6 to 57.9 ETB per kilogram. Mushroom value chain actors were input suppliers, producers, traders, processors and end users. There were eight mushroom marketing channels in the study area. The highest and the lowest amount of the total value added were 171.87 and 20.77 ETB per kilogram. Spawn suppliers play the greatest role in the collection and distribution of mushroom along the marketing channels. Substrate left after mushroom production was disposed in different ways. Most 54.2% of mushroom producers were throwing it away because they believed it causes environmental pollution. About 31.4% of the respondent used spent spawn for compost. Based on the results it can be concluded that, demographic, cultural, socio- economic and institutional factors influences mushroom value chain. It is recommended that, higher educational and research institutes should release mushroom technologies and scale up suitable varieties and substrate. Relevant governmental bodies should also create awareness about the nutritional and medicinal values of mushroom, generate market information, facilitate licensing, establish standard and quality control mechanisms and link producers to potential market. Food processing companies should also give attention to add value to mushroom for local and international markets.**

**Key words:** Ethiopia, Addis Ababa, mushroom, value chainand value added.

## INTRODUCTION

Mushroom is a delicious food consumed throughout the world. It is also called the future vegetable which is a guarantee for food insecurity, malnutrition problem and has medicinal value. World production of mushroom is growing and now exceeds three million tons that worth a market value of 10 billion USD. Major mushroom producers are China, USA and Netherlands, and they share 47, 11, and 7% of world supply, respectively. The

remaining 35% of the total production was from Italy, France, Poland, Ireland, United Kingdom, Canada and India (Harsh and Joshi, 2008).

According to Birhanu and Zerihun (2012), mushroom consumption habit in many parts of African countries is well developed. In rural area of Ethiopia, eating wild mushroom is a common practice in a traditional way (Tuno, 2001; Teferi et al., 2013). The prevailing mild temperature in Ethiopia, particularly in the highlands, is conducive to mushroom growing. In addition it can be produced indoor with small area of land and with little investment throughout the year using agricultural and industrial by-products as substrate (Abate, 1998).

Cultivated mushroom is fat and cholesterol free, low-sodium foods, rich in important nutrients (including some nutrients not usually found in great amounts in fresh produce) and containing antioxidants. Mushrooms satisfy the needs of health-conscious consumers and are a desirable alternative food, especially for vegetarians (USITC, 2010).

Since mushroom is an emerging business sector in Ethiopia, the informationon value chain actors, activities and their interrelationships among themselves and with other institutions are not clearly known. In addition, the type of value addition and the amount of value added by the value chain actors were not identified. Therefore, in order to make interventions this study is expected to generate useful information.

The general objective of this study was to understand mushroom value chains which help to identify interventions in order to make the sector more competitive in the domestic and export markets, and thereby improve the livelihood of the urban people. The specific objectives were aimed to describe mushroom value chain, to measure the amount of value added along the mushroom value chain, and to identify the value chain functions, actors and activities.

## METHODOLOGY

### Description of the study area

The study is conducted in Addis Ababa, Ethiopia. Addis Ababa, the federal capital city of Ethiopia, was founded in 1886. The city is located at an altitude between 2300 in the south of the city and 3000 meters in the north. Addis Ababa is called “political capital of Africa” since it is headquarters of the African Union, numerous international organizations and embassies are located in the city. Geographically, Addis Ababa is located at 9°1′48″N and 38°44′24″E having area coverage of 526.99km$^2$ (Figure 1). It has a subtropical highland climateas well as complex mix of highland climate zones, with temperature differences of up to 10°C (18°F), depending on elevation and prevailing wind patterns.

### Data and sampling techniques

Both primary and secondary data were collected for this study. To collect primary data; household survey, focused-group discussion, key informants and personal observation were carried out. Secondary data were collected from, spawn suppliers, training providers and from Addis Ababa Administration Urban Agriculture Office. The study addressed 8 input suppliers, 120 producers, 5 collectors and traders, 7 hotels, restaurants and cafeterias, 6 supermarkets and 40 consumers and non consumers. Mushroom producers sample size was determined using a simplified formula provided by Yamane (1967).

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

Where, n =Sample size, N = Total active mushroom producers in the study area, $e$ = precision at $\pm$ 5%.

A two stage random sampling was adopted for selecting mushroom growers. At the first stage, of the total 17 spawn suppliers 5 were randomly selected. Then a list of all mushroom producers was prepared based on the information provided by selected spawn suppliers and urban agricultural offices. Sample producers was proportionally drew by simple random sampling technique.

Focused group discussion with producers and consumers were conducted at the study area. And a checklist was developed and used to facilitate the discussion. Key informants such as input suppliers, mushroom assemblers, hotels, restaurants, super markets and end users were also randomly identified and interviewed. For this purpose, different semi-structured guiding questionnaires were prepared and used.

### Methods of data analysis

Descriptive statistics such as percentage, mean, standard deviation, costs and revenue were used to analyze the amount of value added along the chain. The major opportunities and constraints along the mushroom value chain were also addressed.

## RESULTS AND DISCUSSIONS

### Description of mushroom producers

Mushroom producers in Addis Ababa,Ethiopia were categorized into three; individual producers (sole proprietors), producer groups (partnership) and cooperatives. Variation in the distribution of female and male mushroom producers or members was seen among sole proprietors’, partners and cooperatives (Table 1). The role of women’s in the production and trade of

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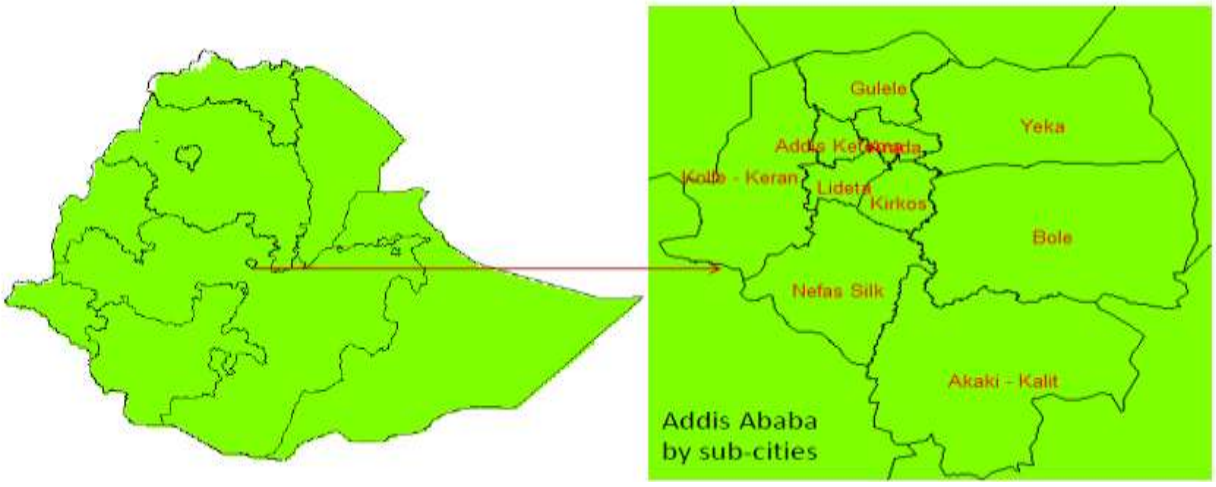


**Figure1.** Geographic map of Addis Ababa, Ethiopia.

**Table 1.** Gender distribution among business types.

| Sex n | Sole prop. (%) | Partners (%) | Cooperative (%) | $\chi 2-test$ |
|---|---|---|---|---|
| Female | 30 (17) | 55 (31.3) | 91 (51.7) | 62.794*** |
| Male | 55 (39.3) | 29 (20.7) | 56 (40) | |

*** Significant at 1% significance level.

**Table 2.** Educational background of mushroom.

| Education level n (%) | Type of the business | | | F-test |
|---|---|---|---|---|
| | Sole proprietor (%) | Partners (%) | Cooperative (%) | |
| Primary | 7 (5.8) | 1 (0.8 ) | 4 (3.3) | |
| Secondary | 28 (23.3) | 6 (5.0 ) | 1 (0.8) | |
| Diploma/TVET | 27 (22.5) | 9 (7.5) | 7 (5.8) | 0.065 |
| BA/ B. Sc and above | 23 (19.2) | 3 (2.5) | 4 (3.3) | |
| Total | 85 (70.8) | 19 (15.8) | 16 (13.3) | |

mushroom were higher than that of men (Birhanu and Zerihun, 2012).

The educational background of respondents in mushroom production showed that all mushroom business types have members from all education levels. It revealed that mushroom can be produced and managed by all people including those who have lower educational level with supplement of short time training (Celik and Peker, 2009). About 32.9% of respondents in sole proprietorship had secondary educational level, whereas 47.4% in partnerships and 43.8% in cooperatives had Diploma/TVET educational level. Generally, there was no significant difference in the highest education level reached by members of mushroom producers (Table 2).

## Mushroom value chain functions, actors, activities and market flow

Mushroom value chain actors in Addis Ababa were generally classified to input suppliers, producers, traders, processors and consumers. All actors along the chain add value in the process of changing product title. The main functions and activities performed along the value chain are shown in Figure 2.

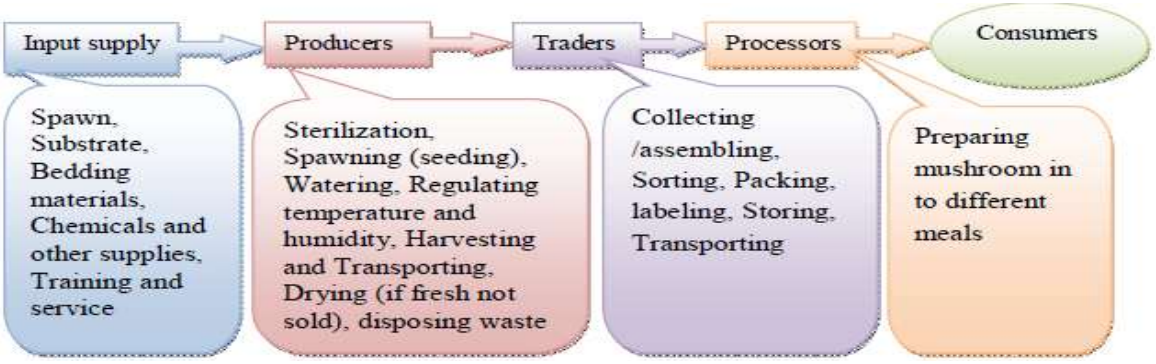


**Figure 2.** Processes and functions of mushroom value chain.


**Figure 3.** Spawn market flow.

## Input suppliers

### *Spawn*

During the study period, there were about sixteen spawn suppliers and five own spawn producers found in Addis Ababa. Fifteen of the spawn suppliers were private sectors and only one spawn supplier under the government. Producers have got the spawn from two channels. The first channels originate from primary spawn suppliers to the producer where as the second channel passed through primary and secondary spawn suppliers to reach mushroom producers (Figure 3).

### *Substrate*

As shown in Figure 4, the dominant substrates used for mushroom production were cotton seed husk and wheat straw. About 95.8% of the total producers used cotton seed husk. Regarding four channels of substrate, 53.3 and 4.2% of producers were purchased substrate directly from the oil refinery and farmer, respectively. The remaining two channels provided substrate to the producer through spawn suppliers (39.2%) and local markets (3.3%). Other findings showed that substrates like coffee pulp (Martínez et al., 2000), saw dust (Oseni et al., 2012), maize straw, rice straw and sugarcane bagasse and leaf (Amin et al., 2010) were also suitable for mushroom production.

### *Training*

Mushroom producers obtained training from spawn suppliers (78.9%) on average of 6.4 h, and from governmental Technical Vocational and Educational Training (TVET) colleges (21.1%) on average for 22.5 days with 3.4 h. per day. TVET colleges provide training for jobless individuals organized by sub cities under small and micro institutions. Regarding to other inputs such as bedding materials, chemicals and other supplies, producers obtained from the local markets, pharmacies, and/ or *merkato* (the main market in Addis Ababa).

### *Credit service*

Credit service helps for the development of any business sector. Since mushroom sector is a new business area to Ethiopia, producers urgently need credit facilities to run the business. Out of the total sampled producers, 86.7% had no access to credit in 2013 cropping year. For mushroom production even if 16.4% need credit, they did not have access due to restrictive procedure and other reasons while 83.6 percent of them did not face any financial problem.

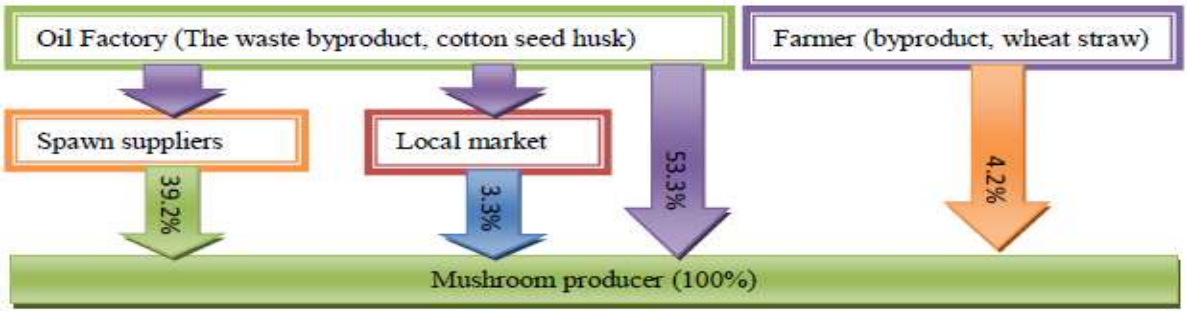


**Figure 4.** Flow of substrate for mushroom production.

**Table 3.** Access to extension, demonstration and written materials.

| Extension contact | Type of the business | | | $\chi 2-test$ |
|---|---|---|---|---|
| | Sole. Prop. n (%) | Partners n (%) | Cooperative n (%) | |
| No extension contact | 77 (65.3) | 13 (11.0) | 12 (10.2) | 7.752** |
| Have contact | 7 (5.9) | 6 (5.1) | 3 (2.5) | |

**Significant at 5% significance level.

***Extension and demonstration***

Addis Ababa urban agricultural office organized and assist those engaged in urban agriculture through district urban agricultural offices. Even though professionals were recruited under different case teams for the agricultural sector including horticulture in all sub cities and districts, the extension service was not uniform among business types. The study result indicated significant difference in extension contact at 5% significance level within and among business types (Table 3).

**Producers**

Mushroom producers are the next major actors who perform most of the value chain functions start from mobilizing inputs to post harvest handling and marketing. The major value chain activities that mushroom producers perform include purchasing inputs, sterilizing substrates, spawning, managing the growing shade, disease and pest controlling, harvesting, post harvest handling and marketing.

According to mushroom producers, hot water and steam sterilization were the most difficult activity, since it is labor intensive and time consuming. The major actor in the production function of the value chain includes sole proprietors (individual mushroom producers), partners (producer groups) and cooperatives. These producers harvested their product early in the morning and immediately transported them to six market outlets. About 34.5% of the total product in the study area supplied to spawn suppliers followed by 31.6 and 14.6% to hotels and restaurants and supermarkets, respectively. The remaining 10.4% to consumers, and 9% were supplied to traders such as assemblers and retailers. The flow of input for the production of mushrooms towards the producers and the supply of output to different alternative market is depicted in Figure 5.

**Traders**

The major actors in mushroom trade are categorized into spawn suppliers, retailers and supermarkets. The activities of spawn suppliers and retailers were collecting, sorting, packing and transporting to the next destination market. As shown in Figure 6, spawn suppliers played the leading role in collecting and distributing fresh and dry mushroom from producers to alternative markets. Their destination markets were consumers, supermarkets, hotels and restaurants, and retailers. The main alternate markets for spawn suppliers were supermarkets, consumers and hotels and restaurants with the market share of 50.9, being 24.9 and 20.1% of the total supplied mushroom, respectively. Retailer market, found at Bole Ruanda *gulitgebeya,* collected fresh mushroom from producers and spawn suppliers. Hence, this market was well known by foreigners who live in Addis Ababa, almost the entire mushroom product sold for them.

Supermarkets sale both imported and locally produced mushroom. Their major activities are packaging, labeling and storing. The primary client of supermarkets for

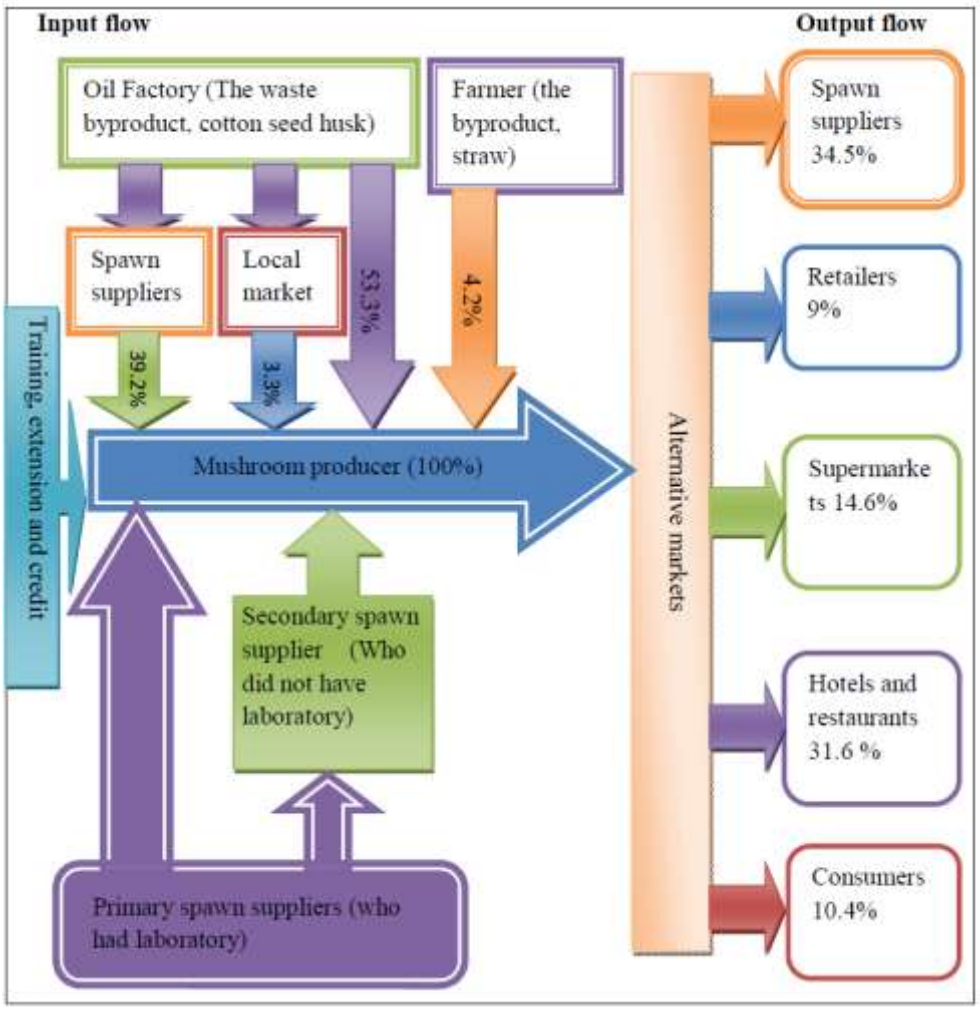


**Figure 5.** Input and output market flow for producers.

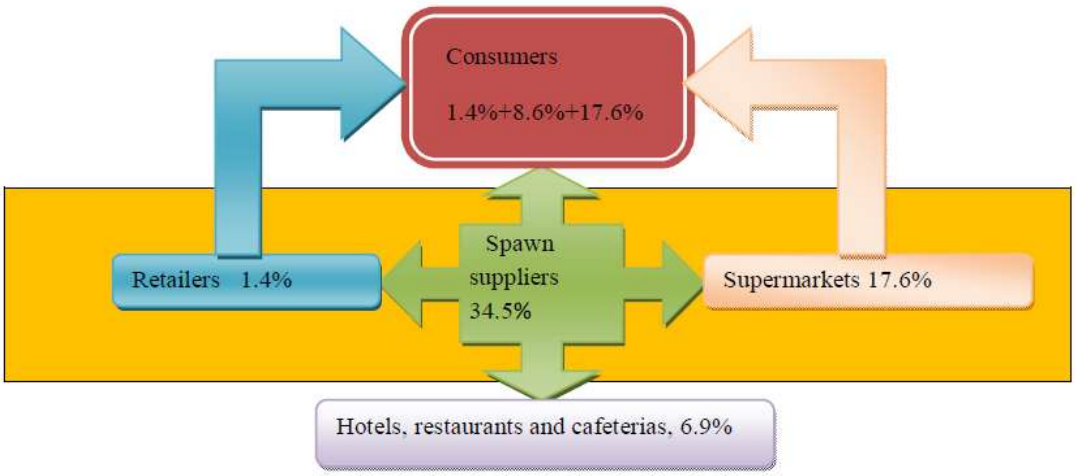


**Figure 6.** Mushroom market flows from spawn suppliers.

locally produced fresh mushroom were foreigners (66.7%) followed by Diasporas (16.7%) and local peoples (16.7%). On average, supermarkets sold 640 kg fresh mushrooms per month to end users. The shelf life of mushroom at supermarket, on average is 4.33 days, which is longer life than any other types of market actors for whom the life period is not more than a day.

**Processors**

Processing is one of the mushroom value chain functions. As stated by Tibrichu and Buykusenge (2009), there was no special mushroom processing and packaging company to local and international market. Rather, hotels, restaurants and cafeterias further process locally produced and imported mushroom into different dishes. Sampled hotels, restaurants and cafeterias prepared 48 types of 154 fasting and non fasting mushroom dishes per day. The main customers for mushroom dishes were foreigners (71.4%) and local peoples (28.1%).

**Consumers**

Consumers are end users of mushroom in the value chain. Consumers purchase and used mushroom from producers, traders and processors. About 67.5% of sampled consumers did not know about mushroom whereas 32.5% knew either wild, locally cultivated, imported or all types. Wild edible mushroom was well known (46.2%) than both locally cultivated (23.1%) and imported ones in the study area. Accordingly, 53.8% of those who knew mushroom have consumed it in the last twelve months. Whose monthly income of birr 3 551and above were 66.6%, while the remaining 33.4% had below birr 1 400. Some of the reasons for those who knew but did not consume mushroom were due to non availability and expensiveness (50%), lack of awareness (33.3%) and prefer to consume meat (16.7%).

**Institutional support**

Like any agricultural sector, other originations' organizations' plays vital role for sustainability of the mushroom production. For instance, agricultural offices involved in facilitating mushroom training, licensing, organizing producers in small and micro- institutions, provide shade, extension service and spawn. Addis Ababa University contributes to the sector through training, research and development. Food and Health Research Institute give certificate for those producers who qualify for the edibility criteria of their produced mushroom. Forestry research center of the Ethiopian Institute of Agricultural Research is the other facilitator who conducts research on substrates under the non timber forest product case team. TVET colleges provided training service for those willing to join mushroom production.

**West disposal**

Bulky substrate left after mushroom production, spent spawn, was disposed in different ways. Most mushroom producers (54.2%) were throwing it away believing that it leads to environmental pollution. About 31.4% of the respondent used spent spawn for compost which is in line with the findings of Polat et al. (2009). The remaining 12.7 and 1.7% used spent spawn for fuel and for livestock feed, respectively.

**Mapping mushroom value chain**

***Mushroom value added along the market channels***

Mushroom value chain actors added value when the product passes from one actor to another. The actors either change the form of the product through processing or improving the grade through sorting, cleaning, packing or creating place and time utility. Unlike Mabuza et al. (2013), who identifies four mushroom market channels, there were eight value chains in the study area. The chains were:

Producers → spawn suppliers → hotels, restaurants and cafeterias → consumers
Producers → spawn suppliers → Retailers → consumers
Producers → spawn suppliers → supermarkets → consumers
Producers → spawn suppliers → consumers
Producers → retailers → consumers
Producers → supermarkets → consumers
Producers → consumers
Producers → hotels, restaurants and cafeterias → Consumers

Among the chains, the total values added to mushroom were highest in the first and the eighth chains, which was171.87 Ethiopian birr (ETB) per kilogram. It showed that the producers' share of the value added were the lowest which is in line with the findings of Khatkar et al. (2005). In both chains, hotels, restaurants and cafeterias, processed mushroom into different meals, adding the highest gross values to mushroom. In contrast, the seventh marketing channel, direct flow of mushroom from producers to consumers, shows the lowest total value added to mushroom product (20.77 ETB/ kg). Spawn suppliers played the greatest role in the distribution of mushroom along first four marketing channels. Their percent of value added in these channels were 5.82, 24.78, 18.74 and 38.77%, respectively (Table 4).

**Table 4.** Mushroom values added along the chains in ETB per kilogram.

| Channels | Producers | Spawn supplies | Retailers | Super markets | Hotels and rest | Consumers | Total value added |
|---|---|---|---|---|---|---|---|
| Selling price, birr/kg | - | 50 | - | 60 | 204.1 | 204.1 | - |
| Cost of raw materials | 32.23 | 50.00 | - | 60.00 | - | - | - |
| Gross value added | 17.77 | 10.00 | - | 144.10 | - | - | 171.87 |
| Total value added (%) | 10.34 | 5.82 | 0.00 | 83.84 | 0.00 | 0.00 | 100.00 |
| Selling price, birr/kg | - | 50 | 57.5 | - | - | - | - |
| Cost of raw materials | 32.23 | 50.00 | 57.50 | - | - | - | - |
| Gross value added | 17.77 | 7.50 | 5.00 | - | - | - | 30.27 |
| Total value added (%) | 58.70 | 24.78 | 16.52 | 0.00 | 0.00 | 0.00 | 100.00 |
| Selling price, birr/kg | - | 50 | - | 58.75 | - | 83.67 | - |
| Cost of raw materials | 32.23 | 50.00 | - | 63.51 | - | - | - |
| Gross value added | 17.77 | 8.75 | - | 20.16 | - | - | 46.68 |
| Total value added (%) | 38.07 | 18.74 | 0.00 | 43.19 | 0.00 | 0.00 | 100.00 |
| Selling price, birr/kg | - | 50 | - | - | - | 61.25 | - |
| Cost of raw materials | 32.23 | 50.00 | - | - | - | - | - |
| Gross value added | 17.77 | 11.25 | - | - | - | - | 29.02 |
| Total value added (%) | 61.23 | 38.77 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| Selling price, birr/kg | - | - | 43.6 | - | - | 57.5 | - |
| Cost of raw materials | 32.23 | - | 43.60 | - | - | - | - |
| Gross value added | 11.37 | - | 13.90 | - | - | - | 25.27 |
| Total value added (%) | 44.99 | 0.00 | 55.01 | 0.00 | 0.00 | 0.00 | 100.00 |
| Selling price, birr/kg | - | - | - | 51 | - | 83.67 | - |
| Cost of raw materials | 32.23 | - | - | 55.78 | - | 0.00 | - |
| Gross value added | 18.77 | - | - | 29.91 | - | - | 48.58 |
| Total value added (%) | 38.56 | 0.00 | 0.00 | 61.44 | 0.00 | 0.00 | 100.00 |
| Selling price, birr/kg | - | - | - | - | - | 53 | - |
| Cost of raw materials | 32.23 | - | - | - | - | 0.00 | - |
| Gross value added | 20.77 | - | - | - | - | - | 20.77 |
| Total value added (%) | 100.0 | - | - | - | - | - | 100.00 |
| Selling price, birr/kg | - | - | - | - | 56.65 | 204.1 | - |
| Cost of raw materials | 32.23 | - | - | - | 56.65 | 0.00 | - |
| Gross value added | 24.42 | - | - | - | 147.45 | - | 171.87 |
| Total value added (%) | 14.21 | 0.00 | 0.00 | 0.00 | 85.79 | 0.00 | 100.00 |

**Mapping the volume of mushroom along the chain**

The volume of mushroom supplied varies along the alternative market channels. On average, the total amount of 13,477.5 kg of mushroom is supplied by sampled producers per month to different markets. Out of which individual producers supplied 59.4% followed by partners (32.3%) and cooperatives (8.3%). In the shortest channel, 10.4% of the total mushroom was supplied directly from producers to consumers. The largest volume of mushroom (34.5%), flow from producers through spawn suppliers to retailers (1.4%), supermarkets (17.6%), hotel, restaurants and cafeterias (6.9%) and consumers (8.6%). Hotels, restaurant and cafeterias processed 37.5% of the total mushroom into different meals before eing delivered to consumers (Figure 7).

**Mushroom value chain map in Addis Ababa, Ethiopia**

Mushroom value chain map in the study area, depicted in Figure 8, summarizes the whole input and output flow

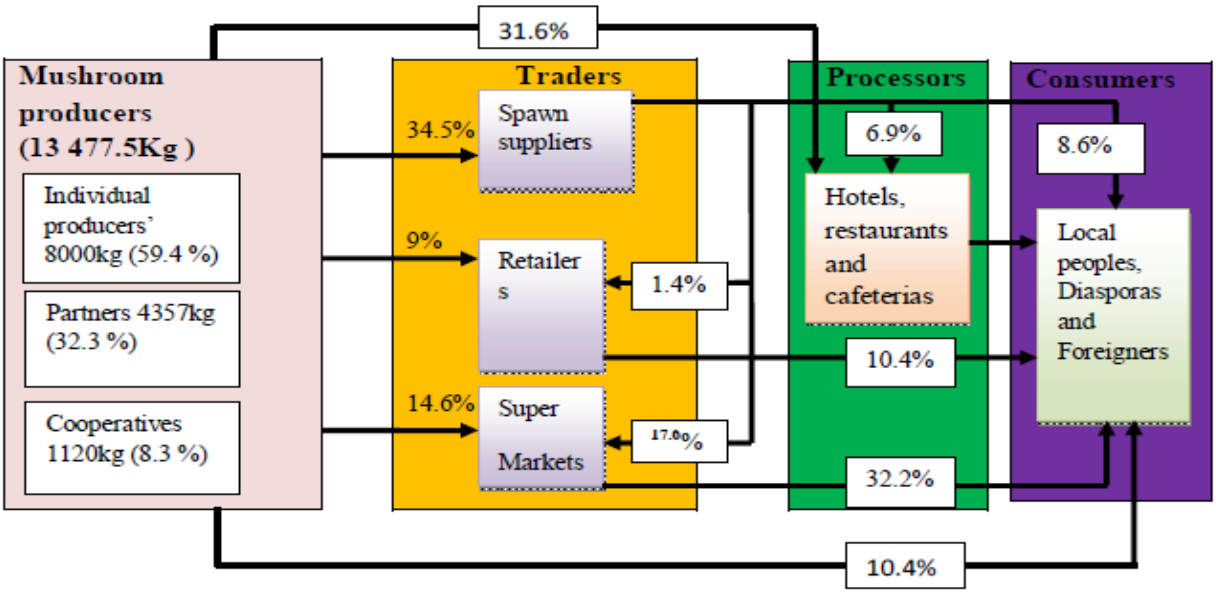


**Figure 7.** Volume of mushroom flow per month through the value chain function.

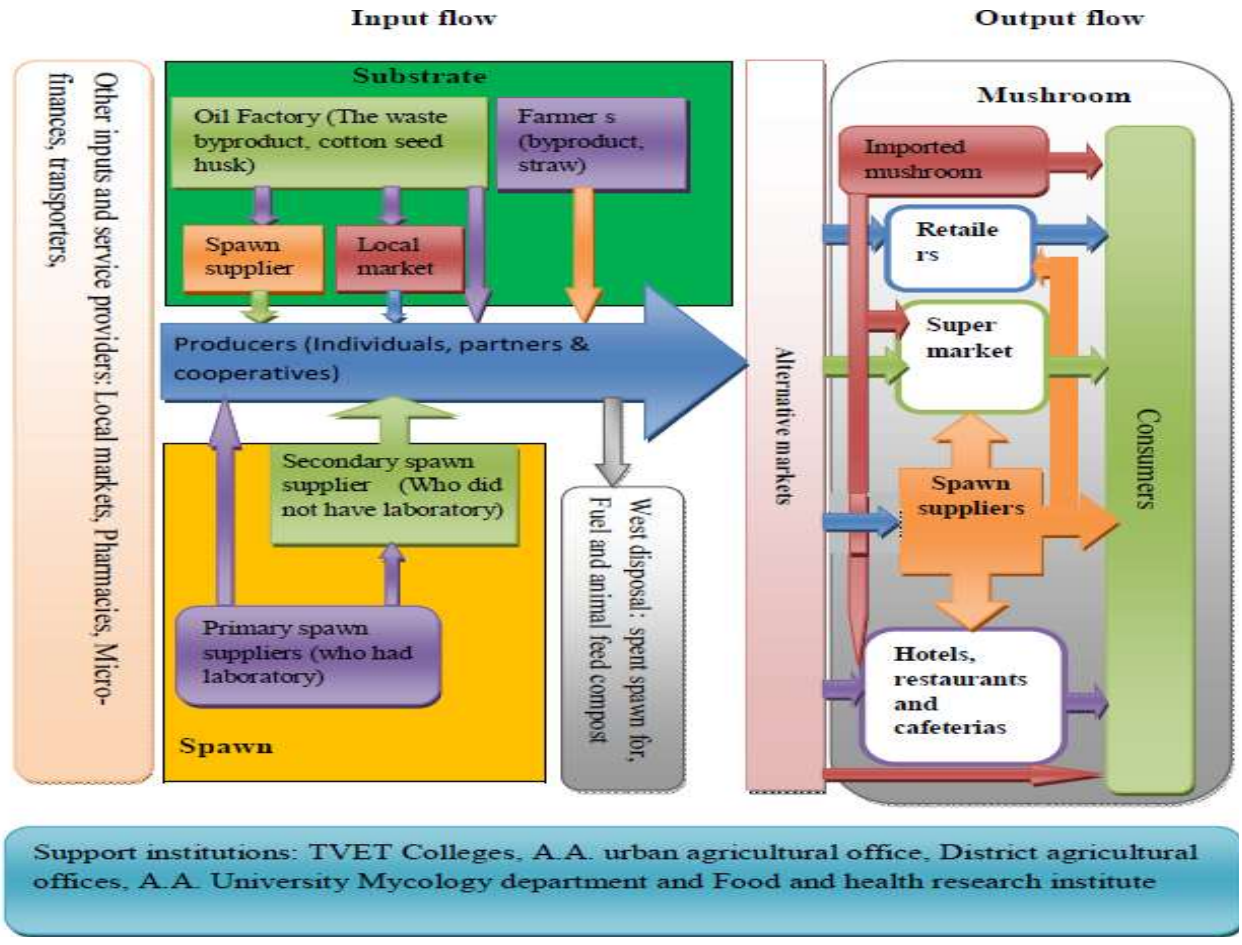


**Figure 8.** Mushroom value chain maps in Addis Ababa, Ethiopia.

**Table 5.** Summary of opportunities, constraints and weakness.

| Opportunities | Constraints | Weakness |
|---|---|---|
| Availability of substrate and spawn | High cost of substrate and spawn and lack of quality of spawn<br>High cost of processing equipments | Producers do not exploit their most relevant assests/resources (for example, growing shade) |
| Free training by TVET, attention given to urban agriculture | Lack of door to door extention services, lack of national management system and lack of access to affordable credit facitly | Lack of effective linkage among mushroom producers and bretween research institutes<br>Lack of cooperstion and co-ordiantion among different mushroom producers, input supplier etc. |
| Increasing consumers awarness | Producers hardly get to the market during the oversupply of mushrooms | Producers did not have linkage to potential buyers of mushrooms, lack of promotion, most producers are unable to supply the required amount of mushroom product sustainably, low quality of mushroom product |
| The emerging world demand for mushroom | Lack of mushroom market organization and techniques, absence of mushroom value chain governance system<br>Unable to exploit the emerging markets (Internet, website set up and development, E-commerce etc). lack of awareness to mushroom processing technology | Lack of enough skills, knowledge or experience in mushroom production technology . Unable to exploit the changed production technology (new production variety, new production substrate, new production method etc.) |
| Credit facilities | Lack of collateral, production knowledge abot mushroom other than oyster, unaffordable expansion cost for modern mushroom farming | Lack of shade for mushroom production, poor post harvest managemen and handling practies, poor financial management system |
| West recycling technologies | Bulky substrate cause environmental pollution | Serious production loss due to contarmination, unable to recycle substrate left after mushroom production. Lack to co-operate and network with other enterprises |

along with the support institutions. As shown in the map spawn suppliers were the leading actors almost in all input and output flows along the mushroom value chains. It seems the mushroom business is centrally controlled by these actors.

### Opportunities and constraints of mushroom value chain

Most of the mushroom producers in the study area don't have enough knowledge towards mushroom production technique and marketing. The most common opportunities include availability of spawn, substrate and increasing local consumers awareness about nutritional value of mushroom. In addition, special attention given by the government for urban agriculture in general and for mushroom in particular provides opportunity for mushroom producers to expand their business. Some of the constraints beyond the capacity of mushroom producers are high cost of spawn and substrate, lack of quality spawn; extension service and market access (Table 5).

## CONCLUSIONS

Mushroom value chain actors are classified into input suppliers, producers, traders, processors and consumers. Producers in the study area were sole proprietors, partners and cooperatives. Mushroom business was well suited for both females and males of all levels of education. Among the actors, spawn suppliers played the major role in the distribution of inputs, collection and marketing of the product.

Eight mushroom value chains identified with the highest, 171.87 ETB, and the lowest, 20.77 ETB, were value added per kilogram to the mushroom. The largest proportion of mushroom was supplied by sole proprietors followed by producers and cooperatives.

The most familiar opportunities of the value chain were availability of spawn, substrate and the increasing awareness of local consumers about the nutritional value of mushroom. In contrast, high cost of spawn and substrate and lack of market access were the major constraint in the study area.

## RECOMMENDATIONS

Most mushroom producers had limited choice to spawn and substrate. As a result, they are constrained to produce mushroom using only cottonseed husk. Therefore, having substitute substrate ensure sustainable mushroom production. In addition, spawn should be available in terms of quantity, quality and sustainability. Thus, there is a need to link higher educational and research institutes to urban agricultural offices and producers to scale up suitable spawn and substrate technologies.

Mushroom and spawn market are concentrated in the hands of spawn suppliers which makes mushroom market imperfect. As a result, most of the mushroom producers are exploited and discouraged. Therefore, government intervention required in terms of generating mushroom market information like other agricultural commodities, establish standard and quality control mechanism and link producers with potential markets. In addition, producers should communicate with each other and establish cooperatives and unions to overcome the problem.

Mushroom is perishable vegetable cash crop and producers have limited market options. As a result, they dispose it during over supply. Therefore, there is a need to increase the shelf life through value addition process. In addition, continuous promotion may contribute to improve the awareness of the society about the nutritional and medicinal values of mushroom. Moreover, providing mushroom processing technologies at fair price needs focus of relevant body.

## Conflict of interests

The authors have not declared any conflict of interests.

## ACKNOWLEDGEMENTS

The authors acknowledge Addis Ababa city urban agricultural office, mushroom producers, spawn suppliers, hotels, restaurants, cafeterias and super-markets for their patience and keenness to provide honest information. They would also like to acknowledge Forestry Agricultural Research Center of the Ethiopian Institute of Agriculture and Council for the Development of Social Science Research in Africa (CODESRIA) for their financial support during data collection and thesis writing.

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