VALUE CHAIN ANALYSIS OF HONEY IN BANGLADESH: PRODUCTION PRACTICES AND LIVELIHOOD PERSPECTIVE

M.T. Uddin[*], M.Z.I. Kamal and M. Kamruzzaman

Department of Agricultural Economics
Bangladesh Agricultural University, Gazipur, Bangladesh

ABSTRACT

The study was designed to develop honey value chain through analyzing the production practices and stakeholders' activities as mediated by livelihood strategies. A total of 84 stakeholders were interviewed for data collection. The study depicts that assemble and set up the wooden box with artificial wooden beehives near the fields was the main procedure for honey production. *Apis melifera* is the major honey bee reared by the beekeepers and the average number of boxes is 50, harvested honey per box per year is around 35 kg. Profitability analysis shows that honey production was profitable and the benefit-cost ratio is 1.83. Estimates of logit model indicates that age of household head, educational level, farm size, farm income and non-farm income were the significant factors that influence beekeepers' decision for adoption. The study identified six actors in honey value chain and among the actors; processors added the highest value of total value addition. Engagement in different activities of beekeeping had a great impact on their livelihood. SWOT analysis indicates favorable environment as strength, inadequate market infrastructure as weakness, high demand for honey as opportunities, and dominancy of the middlemen as threat, respectively. Lack of credit, lower price of honey as well as lack of storage facilities was the main problems faced by the stakeholders. To overcome the problems moreover to make this business more profitable, the study recommended to form contract based cooperative groups, establish proper storage facilities and provide necessary training by the government and non-government organizations.

Keywords: Value chain analysis, Honey, Production practices, Livelihood

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[*]Corresponding Author: tajbau@yahoo.com

INTRODUCTION

As an agricultural country, majority of the people in Bangladesh are directly or indirectly involved in wide range of agricultural activities. Agriculture in Bangladesh is commercialized day by day and the farmers are showing interest in producing valuable crops like vegetable, fruit, oilseeds and pulses in parallel with traditional cereal crops. Pollination acts as the key driver for better production of these commercial crops, and the relationship between flowering plants and flower-visiting insects is of great importance in Bangladesh (Amin et al., 2019). Beekeeping is an important sub-sector of agriculture and honey bees are the most crucial pollinator of agricultural crops and more than 80% of agricultural crops are more or less dependent on bee pollination (Klein et al., 2007).

Beekeeping can play a vital role in sustainable agricultural development as it increases resource without changing environmental balance. As a cottage industry, it is a source of income of the rural people and one of the important components of integrated rural development programmes (Verma, 1990).

Honey production offers useful opportunity for poor and landless farmers to gain income as it requires minimum startup investment; can be carried out in small space close to the house and generally yield profit. Honey production are environmentally friendly activities and it offers benefit in two ways: firstly, increase in the number of managed and feral honey bee colonies increases honey production which can be sold as high value low volume product; secondly bees support and facilitates gene flow system and helps the environment at different tropic level to improve diversity and productivity (ICIMOD, 2015).

Although commercial beekeeping in Bangladesh is still in a rising stage, it is possible to make the honey farming a million-dollar business for the country. It can be an enterprise of possibility for many self-dependent, freedom loving youths and women and such initiative will ultimately contribute to the economic development of our country.

Value chain analysis is a tool to assess the inter-linkage of different actors involved in the production, processing and distribution of a product (Furuholt and Matotay, 2011). According to (Kaplinsky and Morris, 2001), the value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

The present study is linked in some extent with other few studies, which are: Bhattarai et al. (2020) conducted a study on value chain analysis of honey bee (*Apis mellifera*) products in Chitwan, Nepal and found that the producers, collectors, processors cum wholesalers and retailers were the major value chain actors and the marketing margin of wholesalers cum processors found to be highest; Amin et al.

(2019) studied on apiculture for sustainable agriculture: Bangladesh perspective and reported that for the development of agriculture and rural economy, bee-keeping may play a vital role as one of the economic activities. Moreover, for strengthening high-value cash crop production, proper pollination could be ensured through apiculture; Shrestha et al. (2017) performed a study on honey value chain analysis: a case study of Gahate village, Lamjung district of Nepal and pointed out that honey value chain is relatively short initiating from producers and ending in consumers and includes actors like input suppliers and service providers, producers, wholesalers, retailers and consumers; and Islam et al. (2015) performed the financial analysis of apiculture profitability in Bangladesh and revealed that *Apis mellifera* bee species have a higher IRR than *Apis cerana* for a particular size.

It is evident from the above discussion that research on value chain analysis of honey in Bangladesh is rare and many policy level questions still are remained unanswered. Therefore, this study was designed to support the policy makers to formulate strategic policies for an effective value chain considering production practices and livelihood status of the stakeholders. The current study was aimed to examine the nature and extent of honey production along with profitability. The study also encompassed the factors affecting adoption of honey production along with development of honey value chain map, value addition by different actors and policy options.

MATERIALS AND METHODS

Study Areas and Sample Size

Most of the beekeeping approaches has been taken places based on the nectarine sources of flowers and the beekeepers move their hives according to the availability of nectar and pollen sources, is known as migratory beekeeping. Afterwards, Modhupur upazila of Tangail district, Gurudaspur upazila of Natore district and Birol upazila of Dinajpur district were purposively selected as a place of study area. The primary data was collected from a total of 6 input suppliers, 60 beekeepers, 3 processors, 3 traders, 6 retailers and 6 consumers using a structured questionnaire through direct interview. Simple random sampling technique was used to select the respondents. Focus group discussion (FGD) was conducted to collect group information and cross-check the data and information. Besides, secondary information sources in the form of handouts, reports, publications, notifications, etc. having relevance and similarity with this study were also considered.

Analytical framework

For analyzing the data, a combination of descriptive, mathematical and statistical techniques was used to achieve the objectives and to get the meaningful results. Profitability of honey production from the view point of individual beekeeper was measured in terms of gross return, gross margin, net return and benefit cost ratio (Dilon and Hardaker, 1993). The formulas needed for the calculation of profitability were discussed below:

GR = P × Q; GM = GR – TVC; NR = GR – (TFC + TC); BCR = GR ÷ (TFC + TVC)

Where,

GR = Gross return (Tk); P = Sales price of the product (Tk.); Q = Yield per 100 box (Kg); GM = Gross margin (Tk.); TVC = Total variable cost (Tk.); NR = Net return (Tk.); TFC = Total fixed cost (Tk.); and BCR = Benefit cost ratio.

As there was variation in same location among the farmers in terms of adoption of honey production, the following dichotomous logistic regression analysis (i.e., logit model) was used to identify the factors affecting adoption of honey production (Gujarati, 2003):

$K_i = \ln [P_i \div (1- P_i)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + E_i$

Where,

P_i is the probability of adoption and non-adoption of honey production ($P_i = 1$ for adoption and $P_i = 0$ for non-adoption); K_i = Probability of adoption of honey production of ith farmer; X_1 = Age of household head (years); X_2 = Education level of household head (years of schooling); X_3 = Farm size (ha); X_4 = Non-farm income (Tk.); X_5 = Training on honey production (days); ($P_i = 1$ indicates having training and $P_i = 0$ indicates having no training); X_6 = Farm income (Tk.); β_0 = Intercept; β_1 to β_6 = Regression coefficient of the independent variables; and E_i= Error term.

In order to develop the value chain map of honey, descriptive statistics with the support of flowchart was used. Value addition at different stages of honey marketing by different stakeholders was estimated using the following equations (Acharya and Agarwal, 1987):

Gross margin = Sales price - Production cost/Purchase price;

Value addition = Gross margin - Marketing cost;

Price spread = Retailers' sales price - Farmers' sales price; and

Producers' share to consumers' Tk. = (Farmers' sales price/Retailers' sales price) × 100.

To address the livelihood patterns of the respondents, the sustainable livelihood framework analysis including the asset pentagon (which is composed of five types of capitals namely, human capital, social capital, natural capital, physical capital and financial capital) were followed (DFID, 2000).

To identify the potentials and challenges of honey value chain, SWOT analysis was constructed. SWOT analysis guides to identify the positives and negatives inside of the organization (S-W) and outside of it in the external environment (O-T) (Uddin et al., 2018).

Finally, to address the problems in relation to production, value addition and marketing of honey, problem facing index (PFI) was calculated using the following formula (Goswami, 2016):

$$PFI = (P_s \times 3) + (P_m \times 2) + (P_l \times 1) + (P_n \times 0)$$

Where,

P_s = Number of respondents facing the problems severely (weight assigned as 3);

P_m = Number of respondents facing the problems moderately (weight assigned as 2);

P_l = Number of respondents facing the problems at low level (weight assigned as 1); and P_n = Number of respondents facing no problems (weight assigned as 0).

RESULTS AND DISCUSSION

Socioeconomic status of the respondents

The socioeconomic status of the respondents represented that average number of members in respondents' family was 5.63, which was almost 1.3 times higher compare to national average of 4.1 (BBS, 2016). It is seen that about 57.4% beekeepers had crossed above secondary educational level and most of the respondents' (78.7%) average years of experience was more than 10 years in honey production. With regard to the number of hives possession, majority of the beekeepers (57.0%) owned about 50-100 bee hives. In terms of training, 52.5% of the beekeepers had no training in related to beekeeping.

Nature and extent of honey production

Beekeepers generally collected honey from types of honey bees in Bangladesh. The bee species are namely *Apis dorsata*, *Apiscerana*, *Apisflorea* and *Apis mellifera*. Among the four mentioned bee species, it is seen that beekeepers mainly reared *Apis mellifera* honey bee for their apiculture activities in the study areas. Beekeepers followed some procedures for completion of these activities. It is found that beekeepers usually selected shady, dry and suitable places near the major nectar producing plants such as mustard, cumin, coriander, litchi, etc., where bees found their adequate food to produce good quality honey. Then, they made wooden box with an average height of 14 inch and width of 10 inch and maintain the distance around 1 feet between two boxes and lastly purchased a nuclear colony having a queen bee, a male bee and workers bees from a local apiary. In the period of honey extraction, they used some instruments such as honey extracting machine, smoker, protective clothes, brush, etc. Beekeepers cleaned up the beehive box once in a week and checked out the presence of queen bee in the box after the extraction of honey. It is seen that each beekeeper harvested about 35 kg honey from each beehive box in a

year. The peak season of honey extraction lasts only six months (from November to April) in the study areas.

Profitability of beekeeping

To determine the sustainability of beekeeping, it is necessary to analyze the profitability. It is apparent from Table 1 that the benefit cost ratio (BCR) was found as 1.83 which revealed that beekeeping was profitable. The current findings are similar with the earlier observations of (Bhattarai et al. 2020), in which the benefit cost ratio was found as to be 1.56 per hive.

Table 1. Profitability of beekeeping

Items	Amount (Tk./100 Boxes/ Year)
Total fixed cost (TFC)	8000
Total variable cost (TVC)	675060
Total cost (TC = TFC+TVC)	683060
Total production (kg)	5000
Price (Tk./kg)	250
Gross return (GR)	1250000
Gross margin (GM = GR-TVC)	574940
Net return (GR-TC)	566940
Benefit cost ratio (BCR = GR÷TC)	1.83

Factors affecting adoption of honey production

Table 2 presents the result of logit regression model. Six independent variables were identified as major determinants of adopting honey production by the beekeepers which were: age of household head, educational level of household head, farm size, non-farm income, training and farm income.

Table 2. Estimates of logistic regression of determinants of adopting honey production

Variables	Coefficient (β)	Standard Error	z	P>|z|	95% Confidence Interval	
Constant	5.859	2.995	1.17	0.001	1.067	5.648
Age of household head (X_1)	-0.363***	0.123	-2.95	0.003	-0.605	-0.121
Educational level of household head (X_2)	0.068*	0.219	0.31	0.075	-0.362	0.499
Farm size (X_3)	-5.153*	2.794	-1.84	0.065	0.631	0.323
Non-farm income (X_4)	0.012**	0.039	1.38	0.039	0.011	0.019
Training (X_5)	0.147	1.185	0.12	0.901	-2.176	2.470
Farm income (X_6)	0.009***	0.020	2.92	0.004	-0.002	0.013

*** P<0.01, ** P<0.05, * P<0.1

It is depicted from the Table 2 that the estimated coefficient of educational level of household head, non-farm income and farm income were positive and significant at 10%, 5% and 1% level, respectively which implies that having higher level of education, more non-farm and farm income had higher probability of adopting honey production in the study area. Besides these factors, experience in beekeeping, apiary size, access to credit would also have significant influence on farmers' decision of adopting honey production (Mujuni et al., 2012).

Actors involved in the honey value chain

Honey value chain describes the way in which the honey flows from its inception to ultimate users. Figure 1 depicts the activity of various actors' involved in honey value chain.

Input suppliers

Input suppliers are the basic support service providers in the honey value chain. Input suppliers contribute for the foundation of the value chain and they comprise organizations and or individual entrepreneurs engaged in the construction and supply of beekeeping equipment to interested producers. They mostly focus on producing beehives along with other hive equipments. Inputs for beekeeping include beehive, bee veils, bee colonies, hive stands, gloves, hat, brush, smoker, medicines, supplementary feed (sugar) and honey extractors.

Producers (Beekeepers)

Producers are the major actors in value chain who aggregate all the required inputs from different possible sources and manage them in an efficient way for high quality and quantity of honey production. It was found that average number of boxes of hive was 50. *Apis mellifera* is mostly reared and modern beehives have been in practice these days which are found to be more convenient and productive as compared to the traditional ones. About 35 kg of honey has been extracted at most from each beehive annually. Best quality honey obtained in winter season from mustard field. The peak season of honey growing lasts only six months (November to April). The beekeepers sell honey either directly to the local consumers or to the wholesalers or processors. Commission agents collected honey from the producers directly. There is no provision of grading, processing and labeling of the product at producer's point.

Processors

These are actors who collect crude honey at a farm get level from the producers then adding value through processing and supply honey to the commission agent and company.

Companies

Around twenty local brands of honey are sold in the domestic market of Bangladesh. From these, Ayurvedia Pharma (AP Honey), Lichi Honey, Tropica Honey, Pran, Bengal Honey, Moti Modhu, Nahol Honey, Amber Honey, etc. are more popular brand. Various foreign brands of honey are also sold in the market of Bangladesh.
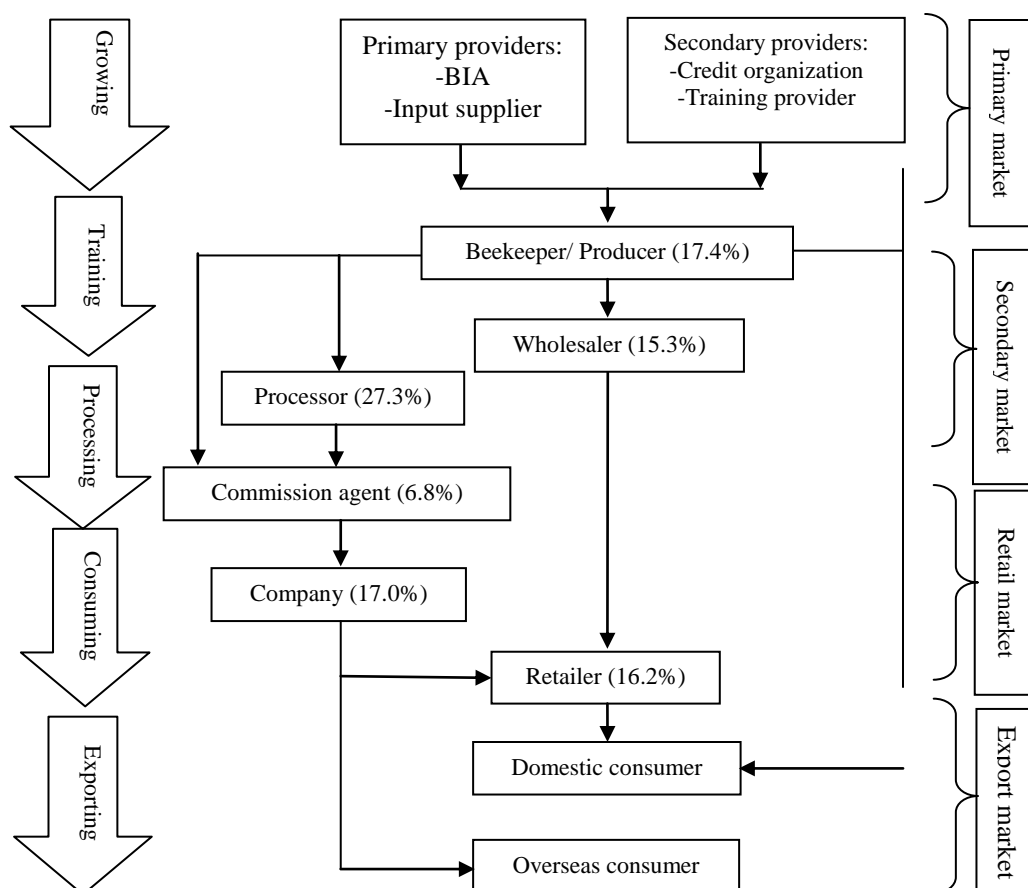
Figure 1. Value chain map of honey

Note: Values within the parentheses indicate percentage of the total value addition.

Wholesalers

These actors buy honey from producers at a large quantity and resell to other traders in a bulk. They contact with their regular producers and demand for the product. In most cases, they visit the producers themselves at the production site to buy honey. The wholesalers either sell honey directly to the consumers after packaging or they supply honey to retail shops and supermarkets after packaging. They have also storage facilities for storing the packed honey. Payment to producers is done through cash during the time of their visit.

Retailers

Retailers are the value chain actors who buy the products from wholesalers or companies and sell them to the final consumers. The grocery stores, supermarkets,

shopping centers and ayurvedic shops are the major retailers prevalent in the market. Honey is packaged in plastic or glass jars of different weight, generally ranging from 100 grams to 1 kg and sold to the consumers.

Consumers

Consumers are the final value chain operators. The honey produced in the study area passes through different chain actors to reach on the hand of final consumers. There are two types of consumers who consume the honey produced in the study area. The first one is local consumers who buy crude or processed honey directly from producers and retailers shop. The second type of consumer is overseas consumers who buy exported honey.

Value addition by different actors

Table 3 reveals that the gross margin of beekeeper was Tk. 110 per kg honey. The marketing cost of beekeeper was Tk. 8 per kg honey. So, the value addition of beekeeper was Tk. 102 per kg. Likewise, the value addition of wholesaler, processor, commission agent, company and retailer were Tk. 90, Tk. 160, Tk. 40, Tk. 100 and Tk. 95, respectively. Total value addition by all the market actors was Tk. 587. Value addition was the highest by the processor which was 27.3%. It was followed by beekeeper (17.4%), company (17%), retailer (16.2%), wholesaler (15.3%) and commission agent (6.8%). The finding is similar with (Uddin et al., 2018) where the authors also found that value addition was the highest by the processor (53.9% and 53.7% for pangas and tilapia, respectively). On the other hand, producers' share (41.7%) was moderate which is considered as an indicator of increase in the efficiency of the marketing system in favor of the traders. It was also found that price spread Tk. 350 was very high which indicates the lower efficiency of the marketing system of honey.

Livelihood status of beekeepers

Engagement with different activities of beekeeping had a great impact on their livelihood. It is apparent from the table 4 that beekeepers' income was increased which improved overall socioeconomic condition and livelihood status. As the beekeepers were migratory, it is found that their self-managerial capability, social networking and efficiency were improved. Beekeepers affirmed that they have regular source of income from beekeeping and now are able to plan and buy inputs for other farming activities and paying school fees for their children. This means that their health condition, educational status, household stuff, etc. were enhanced though apiculture activities. Moreover, due to beekeeping, the least visible livelihood outcome was the pollination which tends to enhance crop yield and boost financial asset base.

Table 3. Value addition of honey value chain actors

Particulars	Market actors						
	Beekeeper	Wholesaler	Processor	Commission agent	Company	Retailer	Total value addition
Production cost/ Purchase price (Tk./kg)	140	200	210	225	250	500	
Marketing cost (Tk./kg)	8	10	40	10	150	5	
Sales price (Tk./kg)	250	300	410	275	500	600	
Gross margin (Tk./kg)	110	100	200	50	250	100	
Value addition (Tk./kg)	102	90	160	40	100	95	587
% of total value addition	17.4	15.3	27.3	6.8	17	16.2	100
Producers' share to consumers'							
Producers' sale price (Tk./kg)						250	
Consumers' purchase price (Tk./kg)						600	
Price spread (Tk./kg)						350	
Producers' share to consumers' Tk. (in %)						41.7	

Table 4. Perceived livelihood status of beekeepers in the study area

Asset category	Response			Asset category	Response		
	Increase	Decrease	Constant		Increase	Decrease	Constant
Human capital				Physical capital			
Health	77	3	20	Building	11	5	84
Education	89	0	11	Tin roof	50	2	48
Training	47	1	52	Tube well	35	0	65
Knowledge/ Efficiency	90	0	10	Paka toilet	27	0	73
Access to information	55	5	40	Electric fan	69	1	30
Natural capital				Motorcycle	33	2	65
Cultivable land	9	6	85	Radio/TV	72	0	28
Using open water resources	0	0	100	Chair/Table	87	0	13
Forests	0	0	100	Mobile phone	78	0	22

Asset category	Response			Asset category	Response		
	Increase	Decrease	Constant		Increase	Decrease	Constant
Social capital				Shop	12	1	87
Involved in social group	49	8	43	Refrigerator	26	0	74
Political involvement	67	4	29	Financial capital			
Self-managerial capability	86	2	12	Cash in hand	86	2	12
Social access/network	70	9	21	Cash at bank/ Liquid assets	44	3	53
				Remittance/ Donation	2	1	97

SWOT analysis on honey value chain

SWOT analysis on honey value chain reveals that the major strength was favorable environment for beekeeping (stated by 100% respondents). As major weakness, 95% respondents gave opinion about inadequate market infrastructure. The major opportunities included high demand in domestic market as well as international market (according to 100% respondents). All the respondents (100%) identified dominancy of middleman in the market as serious threat (Table 5). The results are supported by (Bhandari and Kattel, 2020) where the authors identified favorable climatic conditions as the major strength, dominancy of traditional hives as the major weakness, high demand of unprocessed honey as the major opportunity and mono-cropping as the major threats of honey value chain in Nepal.

Table 5. SWOT analysis on honey value chain

Strengths	% of responses	Weakness	% of responses
Honey has social acceptance as food and medicinal product	95	Lack of testing and quality control facilities.	70
Favorable environment for beekeeping	100	Inadequate market infrastructure	95
Bees can be helpful to increase agricultural production through pollination.	90	Lack of access to financial services	90
Availability of technical and economic support from government as well as non-government organizations.	50	Lack of knowledge about colony size, stocking rate, disease and pests.	90

Strengths	% of responses	Weakness	% of responses
Opportunities	% of responses	Threats	% of responses
High demand in domestic market as well as international market	100	Dominancy of middleman in the market	100
Diversified business development like wax, bee colony, queen and beehives production	90	Large number of retailers who present themselves as producer	95
High employment opportunities	70	Traditional marketing system	90

Problems related to production, value addition and marketing of honey value chain

As shown in table 6, most of the beekeepers commented that lack of credit, migration from one place to another and higher price of inputs were the major input and production related problems in apiculture activities. In response to product price/ marketing related problems, it is found that lower price at the honey flow season was the main constraint in beekeeping. Furthermore, lack of preservation and processing facilities were the main hindrance in case of value addition of honey value chain in the study areas. The present findings seem to be consistent with Goshme and Ayele (2020) where authors found that pests, disease and predators, shortage of bee forage, absconding, shortage of equipment, poor management practices were the constraints of honey production in Ethiopia.

Table 6. Ranking problems associated with honey value chain in the study area

Name of the problems	Extent of problems				PFI	Rank order
	Severe (3)	Moderate (2)	Low (1)	Not at all (0)		
Input and production related problems						
Lack of credit	58	3	0	0	180	1
Migration from one place to another	55	4	2	0	175	2
Higher price of inputs	50	6	4	1	166	3
Attack of pest and disease	41	12	8	0	155	4
Lack of scientific knowledge and training	37	10	9	5	140	5
Ignorance of the farmers as bees are harmful for crops	33	15	9	4	138	6
Product price/ marketing related problems						

Name of the problems	Extent of problems				PFI	Rank order
	Severe (3)	Moderate (2)	Low (1)	Not at all (0)		
Lower price at the honey flow season	59	9	4	0	199	1
Importation of honey	57	8	6	1	193	2
Influences of powerful intermediaries	48	16	7	1	183	3
Value addition and quality related problems						
Lack of preservation and processing facilities	56	14	2	0	198	1
Inadequate skills in grading and packaging	38	21	9	4	165	2
Lack of knowledge about byproduct of honey	46	12	2	12	164	3

CONCLUSION

The study concludes that honey production has enormous opportunities to boost the livelihood enhancement of the stakeholders. Though *Apis mellifera* was found as the major honey bee reared by the beekeepers, the honey production could be expanded with more rearing to other bee species at large scale. The study exposed that processors added the highest value of total value addition among the value chain actors involved in honey value chain. Lack of credit, lower price of honey at the honey flow season, and lack of preservation and processing facilities were the main problems for value chain of honey. Considering the findings of the study, some essential policy recommendations have been arisen which are: contract based cooperative groups should be established, proper preservation and processing facilities should be ensured. Moreover, government and non-government organizations should provide scientific and technical assistance to encourage chain actors in order to develop honey farming as a commercial venture.

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