

# Honey Value Addition Initiatives Selection Choices among Smallholder Beekeepers: Case of the Eastern Cape Province, South Africa

Tina Hans, Amon Taruvinga, and Abyssinia Mushunje  
Agricultural Economics and Extension, University of Fort Hare, Alice, South Africa  
Email: tlhans47@live.com, {ataruvinga, amushunje}@ufh.ac.za

**Abstract**—The aim of this study was to determine factors that influence honey value addition selection choices among smallholder beekeepers. This was against a background where honey value addition is reported to be very low, yet very beneficial in terms of formal market access and increased revenues. A census of all active smallholder beekeepers in the Eastern Cape Province during the period of study was considered for this study. Using descriptive statistics to profile most common value addition initiatives pursued by beekeepers, the study found that liquid honey processing, bottling and beeswax processing were the major value addition pursued by the farmers. Regression estimates revealed that honey value addition selection choices among smallholder beekeepers were mainly conditioned by; gender, household size, group membership, training, quantity of honey harvested, number of colonized hives, access to market information and extension services. Several policy insights were generated mainly focused on institutional and technical support.

**Index Terms**—beekeeping, honey value addition, honey processing

## I. INTRODUCTION

The South African honey industry is characterized by underproduction as a result it is a net importer of honey. South Africa is estimated to consume about 4000 tons of honey per annum yet production ranges around 2000 tons annually [1]. The deficit of 2000 tons is imported from other honey producing countries such as Ethiopia, China and Kenya to satisfy the existing demand [1]. The main constraint which hinders the exploitation of the existing potential includes low levels of technical knowledge, poor access to adequate training, poor quality products and low value addition activities [2]. Value addition is the process of changing or transforming a product from its original state to a more valuable state [3]. For the purposes of this paper Matthewson, [4] definition was used which states that: “Value addition entails changing a raw agricultural product into something new through packaging, branding, processing, cooling, drying, extracting or any other type of process that differentiates the product from the original raw commodity.”

In the case of bee products they can be considered value added if the original raw product such as honey or

beeswax is modified, changed or enhanced to increase its value. Given the claimed benefits of value addition (premium prices and formal market access), several forums endorse honey value addition initiatives especially among smallholder beekeepers. From a production point of view, South Africa is endowed with highly diversified natural flora favorable for the production of honey, beeswax and other bee products [2]. High potential for beekeeping is also found in agricultural land where substantial bee products can be harvested from agricultural and horticultural crops e.g. sunflower, beans, coffee, and citrus.

Despite high production potential and available national demand the honey industry is still dominated by commercial beekeepers and a few smallholder beekeepers. These smallholder beekeepers more often sale raw honey without adding value [5]. This normally affects their formal market access and in most cases they get low prices for their raw honey. This paper therefore investigated, honey value addition initiatives practiced by smallholder beekeepers and drivers of their selection choices. The objective was to understand barriers and opportunities for honey value addition among smallholder beekeepers. The structure of the paper is as follows:

### A. Problem Statement

Honey is sold in various forms such as pure honey, comb or section honey, cut comb honey, chunk honey and cream honey for human consumption. For the industrial market, honey is extracted and sold in bulk as a food ingredient or in pharmaceutical and cosmetic industries for further processing. For the generally known bee products (liquid honey and beeswax) most beekeepers focus on producing liquid honey, yet wax and several hive by-products fetch more than twice the price of liquid honey [1], [2]. Contrary to popular belief honey, wax and pollination services are not the only goods bees can offer; other hive products such as pollen, propolis, royal jelly, venom, queens, bees and their larvae are also marketable bee products but remain unrecognized by beekeepers as a means of income generation. The paper therefore questions honey value addition initiatives selection choices by smallholder beekeepers given that, a majority of them do not add value to their raw honey and for the few who add value, they focus on basic value

addition initiatives. This is against claimed benefits of value addition (formal market access, premium prices) which ironically are also some of the major challenges faced by smallholder beekeepers (poor formal market access). If honey value addition leads to formal market access and premium prices, why are smallholder beekeepers failing to add value to their raw honey and potentially benefit from premium prices and wider formal market access?

### B. Objectives

The overall objective of this study was to investigate honey value addition initiatives selection choices among smallholder beekeepers. Specific objectives were as follows;

1. To profile honey value addition initiatives pursued by smallholder beekeepers
2. To investigate factors that influence smallholder beekeepers' selection choices of honey value addition initiatives

## II. LITERATURE REVIEW

This section presents related literature on honey value addition initiatives and factors that influence their selection by beekeepers. Where does value addition begin in apiculture? This is a common question asked by apiarists and has been a tricky question to answer by scholars and authors. It is assumed that value addition begins when a beekeeper opens and extracts combs from the hive; the reasoning behind this thought is that labour has been applied to take the combs out of the hive. A number of approaches have been used to characterize value addition systems, however there is unanimity in the fact that value addition is influenced by resource availability, labour availability, technology utilized, consumer needs, available infrastructure and equipment employed [6]. Omari [2] revealed that most traditional beekeepers do not add value mainly because they consider value addition as a tedious activity. Omari [2] further ranked the different value addition activities by level of tediousness. Quality testing and packaging were considered the most tedious activities. With reference to value addition targeted by traditional beekeepers, packaging, filtering and quality testing were the most common [2]. Omari [2] also discovered that there is no incentive to add value to honey as it provides less revenue as compared to unprocessed honey due to a high demand for raw honey sold locally for making honey beer. To the contrary several studies endorse that the decision to add value to honey reduces poverty levels and has a positive contribution to household income and food security [7], [8]. In South Africa there is a high demand for bee products and value can be added to honey in a number of ways although better opportunities for further value addition lie from other hive products such as beeswax [9]. There is limited literature with regards to factors that condition small-holder beekeepers' honey value addition initiatives selection choices. Berem *et al.* [7] noted that the decision to add value is influenced by a

number of factors including age, group membership, number of hives, household size and amount of honey harvested.

## III. METHODOLOGY

This study was conducted in the Eastern Cape Province of South Africa purposively selected given the rich vegetation diversity [2]. A census of all active smallholder beekeepers in the province was targeted for interviews, focus group discussions and observations. Ninety one (91) smallholder beekeepers were active during the study period (active smallholder beekeepers was defined based on; (a) those with more than 10 colonised hives and (b) have been operational for more than one year).

### A. Theoretical Framework

Smallholder beekeepers exist under different socio-economic and institutional settings. We therefore assume that these conditions may influence how smallholder beekeepers select different honey value addition initiatives in line with profit and utility associated with each choice. Utility maximization theories argue that, the utility associated with different strategies (value addition selection choices in this case) by smallholder farmers are not directly observable, while (value addition) choices they make are observable, and unordered [10]. In line with this thinking, honey value addition selection choices may therefore be explained by the random utility and profit maximisation theory. A smallholder beekeeper is rationally expected to choose honey value addition initiative "c" over initiative "q" if and only the perceived profit and utility from value addition initiative "c" is greater than that of "q".

$$U_{ic}(\beta_c X_i + \varepsilon_c) > (U_{iq}(\beta_q X_i + \varepsilon_i)), \forall c \neq q \quad (1)$$

where;

- $U_{cq}$  = denotes perceived profit and utilities of honey value addition initiatives "c" and "q"
- $X_i$  = vector of explanatory variables that condition the perceived honey value addition initiative
- $\beta_{jk}$  = parameters to be estimated
- $e_{ik}$  = error terms (assumed to be independently and identically distributed)

Against this background several econometric models can be used to estimate the relationship between observable beekeepers' socio-economic and institutional variables and honey value addition selection choices made.

### B. Analysis

A binary logit model was used to estimate determinants of honey value addition selection choices made by smallholder beekeepers. Five honey value addition initiatives were common from the study area; (a) liquid honey processing - LHP, (b) beeswax processing - BWP, (c) comb honey processing CHP, (c) liquid honey

bottling - LHB and (d) wax purification - WP. The binary regression approach allowed for each honey value addition initiative to be analyzed separately and independently. Most beekeepers used more than one of the above honey value addition initiatives. This ruled out the possibility of using multinomial logit regression for there were no homogenous mutually exclusive honey value addition initiatives. Following several previous studies that adopted a similar approach the paper used the binary logit model mainly to manage the challenge of the Independence of Irrelevant Alternatives (IIA) assumption common with multinomial logit (MNL) model [11]-[14].

Operationally each beekeeper was therefore faced with a binary choice dummied as 1 if a beekeeper chooses “c” honey value addition initiative and 0 otherwise [11]. Assuming Y to be a honey value addition initiative likely to be practiced by “i”<sup>th</sup> beekeeper and X are the socio-economic and institutional factors likely to affect Y, a logistic model can be used to analyze the expected relationship [12], [15]. Following an approach by Acquah [16] the effects of X on the response probability, P(y=j/x) can be estimated using a binary logit model as illustrated in equation 2 to 5:

$$P\left(\frac{Y_i}{X}\right) = F(Z_j) = \frac{e^{Z_i}}{1 + e^{Z_i}} = \frac{1}{1 + e^{-Z_i}} \quad (2)$$

$$P\left(Y_i = \frac{j}{X_i}\right) = F(Z_j) = \frac{e^{Z_i}}{1 + e^{Z_j}} = \frac{1}{1 + e^{-Z_j}} \quad (3)$$

$$Z_i = \beta_0 + \beta_1 X_{1i} + \dots + \beta_{ni} X_{ni} + \mu_i \quad (4)$$

With the specific binary logit model expressed as follows [17];

$$\ln\left[\frac{P_j}{1 - P_j}\right] = \beta_0 + \beta_1 X_{1i} + \dots + \beta_{ni} + \mu_i \quad (5)$$

n = 1, 2, ..., 15.

Five binary regression models were used with the following as the dependent variables; (a) model 1: liquid honey processing - LHP, (b) model 2: beeswax processing - BWP, (c) model 3: comb honey processing CHP, (d) model 4: liquid honey bottling - LHB and (e) model 5: wax purification – WP, (dummied as 1 if the respondent practices that particular honey value addition initiative and 0 otherwise).

Independent variables: The following fifteen socio-economic and institutional variables were used based on previous studies and availability of data (age, gender, education, household size, access to market information, access to extension distance to market, types of hives, quantity of honey harvested, group membership, training, years of experience, number of hives, access to credit and marketing channels used).

#### IV. RESULTS AND DISCUSSION

This section presents study findings based on descriptive and econometric results as presented in Tables I and II as well as Fig. 1 and Fig. 2.

Demographic characteristics of the interviewed active beekeepers are presented in Table I. Findings reveal that most of the beekeepers from the study area were male (71.4%) with a few females (28.6%). The interviewed respondents had a mean age of 48 years with minimum and maximum of 26 and 76 respectively. The marital status of the beekeepers showed that 69.2 percent of the beekeepers were married with 29.7 percent single. In addition, about 74.7 percent of the beekeepers had received secondary education; only 12.1 percent had attained primary education, while the others had tertiary (12.1%) education.

The census results also show an average household size of 5 with a minimum and maximum of 1 and 12 respectively. Furthermore, those that are full time farmers were the majority (36.3%) followed by formally employed individuals (33%), 17.5 percent unemployed persons; the rest were pensioners (9.9%) and part time farmers (3.3%). Lastly, with reference to the numbers of years of experience acquired by the beekeepers were as follows; an average of 7 years with a minimum of 1 and maximum of 20 years was revealed by the results.

*Demographic characteristics of the active beekeepers:*

TABLE I. DEMOGRAPHIC CHARACTERISTICS OF BEEKEEPERS

Characteristic	Description	Frequency (N=91)	Beekeepers (%)	
Gender	Male	65	71.4	
	Female	26	28.6	
Employment Status	Full time farmer	33	36.3	
	Part-time farmer	3	3.3	
	Employed	30	33	
	Pensioner	8	9.9	
	Unemployed	17	17.5	
Marital status	Single	27	29.7	
	Married	63	69.2	
	Divorced	1	1.1	
Level of education	None	1	1	
	Primary	11	12	
	Secondary	68	75	
	Tertiary	11	12	
		Mean	Min.	Max.
Household size	Actual number	5	1	12
Age	Number of years	48	26	76
Years of experience	Actual number	7	1	20

TABLE II. DETERMINANTS OF THE CHOICE OF VALUE ADDITION ACTIVITIES AMONG BEEKEEPERS

Variables		Model 1	Model 2	Model 3	Model 4	Model 5
		Liquid honey processing	Beeswax Processing	Comb honey	Bottling	Wax Purification
Constant	β	(-5.835) 0.074	(-46.920) 0.996	(4.349) 0.326	(-2.364) 0.523	(-0.853) 0.811
Socio-economic and institutional variables						
Age	β <sub>1</sub>	(0.029) 0.245	(-0.064) 0.113	(-0.049) 0.267	(-0.045) 0.161	(-0.010) 0.752
Gender	β <sub>2</sub>	(-0.386) 0.538	(-1.480) 0.143	(-0.439) 0.674	(-1.955) 0.037**	(0.363) 0.616
Household	β <sub>3</sub>	(-0.053)	(0.247)	(0.176)	(0.088)	(0.080)

size		0.672	0.297	0.463	0.620	0.065*
Level of education	$\beta_4$	(0.541) 0.365	(0.085) 0.934	(-0.679) 0.473	(1.119) 0.176	(-0.635) 0.323
Access to market information	$\beta_5$	(0.574) 0.459	(16.936) 0.999	(19.763) 0.999	(0.369) 0.670	(2.874) 0.003***
Access to extension	$\beta_6$	(0.296) 0.692	(-1.614) 0.113	(-23.132) 0.999	(0.900) 0.290	(2.304) 0.007***
Distance to market	$\beta_7$	(0.031) 0.043**	(-0.019) 0.503	(0.043) 0.034**	(0.026) 0.138	(-0.040) 0.020**
Type of hives	$\beta_8$	(-0.859) 0.588	(12.481) 0.996	(4.785) 0.087*	(-1.907) 0.157	(1.206) 0.351
Quantity harvested	$\beta_9$	(0.000) 0.846	(0.014) 0.032**	(-0.001) 0.498	(-0.001) 0.211	(0.100) 0.869
Group membership	$\beta_{10}$	(-0.309) 0.689	(-4.527) 0.001***	(-1.589) 0.323	(0.153) 0.089*	(-0.141) 0.878
Training	$\beta_{11}$	(1.433) 0.045**	(-8.775) 0.998	(-2.754) 0.349	(2.044) 0.014**	(0.069) 0.929
Years of experience	$\beta_{12}$	(-0.064) 0.493	(0.569) 0.012*	(-0.151) 0.311	(-0.026) 0.805	(0.013) 0.907
Number of hives	$\beta_{13}$	(0.006) 0.056*	(-0.122) 0.047**	(0.003) 0.531	(0.006) 0.085*	(0.163) 0.883
Access to funds	$\beta_{14}$	(1.349) 0.198	(29.369) 0.995	(0.949) 0.657	(0.513) 0.733	(-1.097) 0.471
Marketing channel	$\beta_{15}$	(1.128) 0.071*	(0.110) 0.912	(-4.520) 0.005***	(2.450) 0.001***	(-0.045) 0.951
Model Summary						
Chi-Square (df=15)		31.027	3.330	18.522	44.481	49.632
(-2) Log Likelihood		95.027	42.439	41.110	69.427	75.982
Accuracy (%)		75.8	87.9	93.4	78.0	78.0
Nagelkerke R <sup>2</sup>		0.585	0.590	0.580	0.542	0.562

Notes: \*\*\*, \*\* and \* indicates significance at 1%, 5% and 10% levels respectively.

**Honey value addition activities pursued by smallholder beekeepers:** Two categories of value addition initiatives were observed from the study namely; primary (defined as minor/primary modification to the raw honey) and secondary (defined as advanced/secondary modification to the raw honey) value adding activities, as summarised in Fig. 1 and Fig. 2.

**Primary value addition initiatives:** This section presents primary value addition initiatives observed from the study area as summarised in Fig. 1.

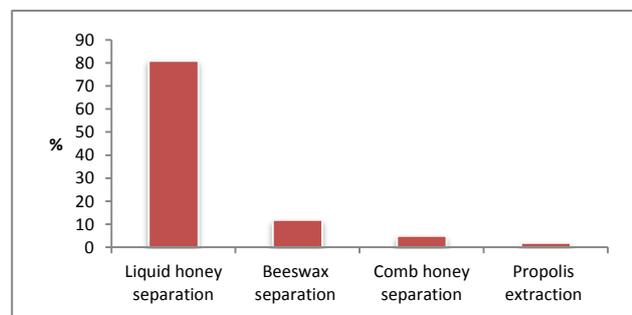


Figure 1. Primary value addition initiatives observed from the study area

The results reveal that four primary value addition initiatives were common from the study area more skewed in favour of liquid honey processing (81%), beeswax processing (12%), comb honey processing (5%) and propolis extraction (2%). These findings indicate that liquid honey processing was the dominant primary value

addition initiative practiced by smallholder beekeepers from the study area. This may be explained by the type of hives owned (Langstroth) by a majority of the beekeepers which support liquid honey production. Results further indicate that beeswax processing was also practiced by a significant number of beekeepers from the study area as a value addition initiative. This was mainly practiced by beekeepers with top bar hives. The least popular primary value addition initiatives were comb honey processing and propolis extraction. Respondents noted limited markets for such products. Several previous studies acknowledge the dominance of liquid honey production by beekeepers with Langstroth hives [5], [7], [18] and beeswax production among beekeepers with top bar hives [2], [19], [20]. The next section focuses on secondary value addition initiatives observed from the study area.

**Secondary value adding activities:** This section presents major secondary value addition initiatives observed from the study area as detailed in Fig. 2.

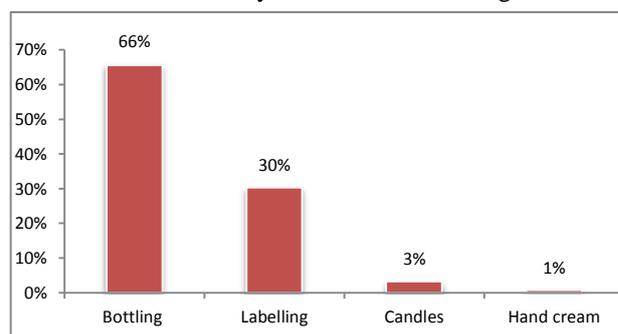


Figure 2. Secondary value addition initiatives observed from the study area

Fig. 2 presents the second category of value addition (secondary value addition) where primary hive products are further processed and transformed to appeal to consumers. The results show that bottling (66%) was the most performed value addition initiative from the study area. Bottling material used varied from plastic bottles, glass containers and pre-used containers. Thirty percent of the beekeepers labelled their honey with a trade name. Beekeepers perceive labelling as an expensive venture which requires marketing knowledge such as branding. According to the Department of Agriculture, [21] and SABIO [22] beekeepers should adhere to the requirements for the labelling of honey for the consumer market under the Agricultural Product Standards Act (119/1990). These strict requirements further exclude smallholder beekeepers from labelling their products as they lack market information and necessary resources to label their products. Only 3% and 1% of the beekeepers made candles and hand creams, respectively. These activities require purified beeswax, technical knowledge, experience and processing equipment. These factors may technically exclude a majority of smallholder beekeepers who own hives that support liquid honey production. Unlabelled bottling therefore dominates secondary value addition initiatives from the study area mainly as a result of easy of entry (cost wise). The next section estimates drivers of major honey value addition initiatives selection choices.

*Determinants of the choice of value addition activities among beekeepers:* This section presents results for the factors that influence value addition initiatives selection choices among smallholder beekeepers based on five binary regression models. With regards to the model fit, the Lemeshow Goodness-of-Fit test statistics for the overall fit of the models showed that the explanatory variables were jointly significant in explaining each of the dependent variables at an acceptable level. The following Nagelkerke  $R^2$  were obtained 0.585, 0.590, 0.580, 0.542 and 0.562, suggesting that more of the variation was explained by the models with overall prediction percentages of 75.8%, 87.9%, 93.4%, 78.0% and 78.0% respectively.

Results reveal that gender negatively influence selection of bottling as a honey value addition initiative. These findings suggest that female beekeepers are more likely to select bottling as a value addition initiative compared to their male counterparts. Manual bottling is normally viewed as a female activity in African cultures. Thus far, the observed negative association may be explained by cultural norms from the study area. Results further indicate that household size positively influence selection of liquid honey processing and wax purification. These activities are labour intensive especially for manual processing. Large family members are therefore more likely to supply “cheap labour” required for manual liquid honey processing and wax purification.

Access to market information and extension services positively influence the selection of wax purification as a value addition initiative. These findings highlight that, understanding of where to sale purified wax is a critical factor towards selection of this option.

As distance to market increases smallholder beekeepers are likely to increase the selection of liquid honey and comb honey processing value addition initiatives and decrease wax purification value addition. These findings suggests that as distance to market increases beekeepers focus on guaranteed value addition initiatives that produces by-products with readily available market like liquid honey and comb honey to cater for increased marketing costs (mainly transport) compared to purified wax that may have a premium price but with no guaranteed market.

Model results reveal that an increase in top bar hives positively influence selection of comb honey processing as a value addition initiative. Technically, top bar hives enhance comb honey processing; where honey filled combs are cut from the top bars for preparation into salable honey combs of different sizes. This is contrary to Langstroth hives, where liquid honey is normally extracted from the frames using centrifugal systems.

An increase in the quantity of raw comb honey harvested positively influence selection of beeswax processing as a value addition initiative normally under top bar hives. Beekeepers reported that 1kg of raw comb honey roughly produces 700g of liquid honey and 300g of beeswax. Thus far, the more the quantity of raw honey is harvested the more it makes economic sense to target beeswax, given that more, raw comb honey is required to generate beeswax.

Group membership negatively influences beeswax selection and positively influences bottling. Focused group discussions revealed that not much was known by beekeepers in as far as beeswax processing was concerned given that a majority of them were focusing on liquid honey production. Group members highlighted that commonly shared honey value addition initiatives were more on liquid honey than any other by-products like beeswax. This may therefore explain the observed negative association between group membership and beeswax selection, for group members didn't get any supportive technical (processing) and market information concerning beeswax. The observed positive association between group membership and honey bottling reinforce respondents' suggestions that most discussed honey value addition initiatives were based on liquid honey by-products. In this case group members were encouraged to sale their honey in bottles to improve hygiene and acceptance on the market.

Training positively influences liquid honey processing and bottling value addition initiatives. Manual liquid honey processing goes through several processing phases that require some form of advanced beekeeping training to avoid liquid honey spoilage. This therefore suggests that to promote liquid honey processing and bottling training is critical for most untrained beekeepers from the study area mainly concentrated on selling raw unprocessed honey to neighbouring villagers.

Experience positively influences the selection of beeswax processing as a honey value addition initiative. Beeswax processing from raw comb honey goes through a much more complex processing system than liquid honey. This also requires advanced beekeeping training and experience to produce quality beeswax that can be acceptable on the market. Beeswax markets (cosmetic and pharmaceutical industries) highly rated in literature in terms of availability and premium prices, were in actual fact very difficult to identify and penetrate. Only a few experienced and well connected beekeepers claimed access to these markets.

An increase in the number of colonised langstroth hives owned positively influences selection of liquid honey processing and bottling value addition initiatives while negatively influencing beeswax processing as a value addition initiative. More colonised hives means more raw honey that normally floods local markets. This will therefore force beekeepers with more colonised hives to consider liquid honey processing and bottling targeting formal markets (that normally required processed and bottled honey) to dispose their large volumes. An increase in colonised langstroth hives technically discourages beeswax processing for the processing system (centrifugal) allows liquid honey extraction from the frames not the wax component.

Formal market channel access positively influences liquid honey processing and bottling while negatively influences comb honey processing. Most formal market channels preferred bottled processed liquid honey than comb honey. Thus far, beekeepers with access to formal market channels were forced to process and bottle their honey to meet formal market requirements.

## V. CONCLUSION

The paper concludes that current honey value addition initiatives are very limited among smallholder beekeepers, mainly dominated with liquid honey processing and minor beeswax processing. Against this background and for purposes of promoting honey value addition among smallholder beekeepers institutional and technical support are critical factors to target given that beekeeping is a non-conventional agricultural enterprise that is normally excluded from institutional support frameworks.

### Policy insights

Several policy messages are suggested as summarized below:

- There isn't much honey value addition initiatives among smallholder beekeepers (where current value addition initiatives are focused on liquid honey processing and bottling) a significant factor that may technically exclude them from formal premium markets. This may discourage smallholder beekeepers from selecting beekeeping as an enterprise. Several factors have been noted as potential drivers of honey value addition initiatives worth targeting for purposes of promoting value addition among smallholder beekeepers:
- Liquid honey processing: Training and high number of colonized hives may be targeted to enhance high liquid honey processing under smallholder beekeepers.
- Beeswax processing: Experience (knowledge), type of hive (top bar) and high output (yield) are critical factors that may be targeted to promote beeswax production under smallholder beekeepers.
- Comb honey processing: Type of hive (top bar) and market access are critical factors towards promotion of comb honey.
- Bottling: Formal market access, number of hives, training, group membership and gender are crucial factors to target towards promoting bottling.
- Wax purification: Labour, access to market information and extension are critical drivers of wax purification among smallholder beekeepers worth targeting.

We therefore argue that to promote honey value addition initiatives among smallholder beekeepers focus should be more on institutional and technical support. This is not surprising given that beekeeping like any other non-conventional agricultural enterprise lack technical support from the government extension wing and institutional frameworks that are currently skewed in favour of conventional agricultural enterprises (on-farm crop and livestock enterprises).

### ACKNOWLEDGMENT

The authors wish to thank the beekeepers, District agriculture office workers, Dr. Christian and all those who contributed during data collection. This work was

financially supported in full by a grant from NRF, South Africa - RTF.

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**Tina Hans** was born in Eastern Cape Province of South Africa. She obtained her B Agric from University of Fort Hare. She is currently studying for her M Agric at University of Fort Hare. Ms. Hans' research interests include; food security and natural resource economics.

**Dr. Amon Taruvinga** was born in Zimbabwe. He received his BSc (Hons) degree in Agricultural Economics from the University of Zimbabwe and his PhD, also in Agricultural Economics, from the

University of Fort Hare, South Africa (2012). He is currently a Senior lecturer in the Department of Agricultural Economics and Extension at the University of Fort Hare, South Africa and a CIRCLE Visiting Fellow (CVF). He is also the Platform Chair for Southern Africa Climate Change & Biodiversity Research Platform ([www.saccbrp.org](http://www.saccbrp.org)). Dr. Taruvinga specializes in biodiversity, environmental economics, human wildlife interactions, food security, climate change and smallholder agriculture. He is interested in promoting sustainable human-wildlife interaction. ORCID: A. Taruvinga <http://orcid.org/0000-0001-8829-2826>

**Prof. Abyssinia Mushunje** was born in Zimbabwe. He obtained his B.Sc. (Hons) degree in Agricultural Economics from the University of Zimbabwe and he received his Ph.D. in Agricultural Economics from the University of Fort Hare, South Africa. He is the current HoD, Agricultural Economics and Extension Department at the University of Fort Hare. Prof. Mushunje's area of specialization is livelihood economics, food security and climate change.