Beekeeping for Women Empowerment: Case of Commercial Insect Programme in Kitui County, Kenya

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ABSTRACT

Beekeeping is an important activity that helps rural communities to raise additional income to improve their livelihoods. An intervention conducted by the International Centre of Insect Physiology and Ecology (ICIPE) introduced modern hives through the Commercial Insect Programme (CIP), trained farmers and developed a value chain to ease marketing of honey from farmer groups. Owing to these interventions, beekeeping has become an important income generating activity for both men and women. In order to contribute to the debate on gender roles in beekeeping, this study was undertaken to assess how commercialization of beekeeping through the CIP has influenced gender roles and women empowerment in Kitui County. Results show that modern beehives introduced by ICIPE contributed significantly to the differences in gender roles among the treatment (CIP) and control group (NCIP) at the household level. In addition, women in CIP were found to be significantly more empowered compared to those in the control group. These findings suggest that participation of women in rural development programmes such as CIP is likely to improve their empowerment. Therefore, a consideration of gender mainstreaming in development and roll out of projects is likely to empower more women.

Key words: Gender roles, Women Empowerment, Beekeeping, Participation, Kitui County

Introduction

Beekeeping is a form of agriculture that involves management of bee colonies for production of honey and wax. Generally, in Kenya, women perform majority of the agricultural activities such as food production, storage, processing and marketing (Oduol et al., 2013). Even though they play a major role in these activities, they end up receiving a fraction of the income generated (GoK, 2005). In most of African countries, beekeeping has often been a male-dominated enterprise (Ogaba &Akongo, 2001; Nel et al., 2004; Shackleton et al., 2011). However, with intervention from development agencies, a change in this practice could occur.

Men and women perform different roles and have different responsibilities in most societies. Traditionally, in most African societies, the norm has been that men reserved the right of making most of the decisions at the household level. Therefore, women have had less ownership and control over assets, less decision-making capacity and fewer educational and economic opportunities than men (Malholtra and Schuler, 2005). Consequently, development initiatives affect male and female beneficiaries in varying ways due to gender differences and inequalities. In addition, women often encounter obstacles that prevent them from

participating in, and benefiting from, development projects. Therefore, a deliberate consideration of gender dynamics for understanding how development initiatives lead to changes in gender roles is paramount.

Beekeeping has been promoted by various governmental and non-governmental organizations in Kenya's rural areas. The aim has been to reduce food insecurity, unemployment and improve the people's social well being (Raina et al., 2009). Examples of such organizations include the Kenya Forest Service (KFS) and international organizations such as United Nations Development Program (UNDP) and the International Centre of Insect Physiology and Ecology (ICIPE). Mwingi is part of the arid and semi-arid lands of Kenya where conventional agriculture does not thrive (Gachimbi et al., 2002). Therefore, residents of Mwingi dependent upon the environment to meet needs through charcoal burning. The predominant tree species felled for this activity was the *Acacia tortilis* which has numerous pods that are food to goats and sheep while the flowers are rich in nectar that bees rely on for honey production. Owing to this beneficial trait of the species, beekeeping was championed to curtail the vice and reduce environmental degradation.

In 2007 ICIPE implemented the Commercial Insect Programme (CIP) in Mwingi Central, North and West Sub-Counties. The programme activities included distribution of modern hives (e.g., the Langstroth beehive, introduction of stingless bees, farmer training and honey value chain development (Kioko, 2010). The latter activity involved the formation of farmer groups for bulking and marketing of honey. The introduction of stingless bees and issuance of Langstroth bee hives was intended to encourage women participation in beekeeping. This is because bee care and honey harvest chores could be carried out during the day alongside household chores. In addition, placing the hives in close proximity to the ground enabled the women to overcome previous cultural constraints such as the need to climb trees in order to harvest honey (Raina et al., 2009). Following the introduction of the CIP, beekeeping which was a male dominated enterprise has now become an important economic activity in Kitui County where men and women participate. How beekeeping and the commercialization of its products has influenced gender roles in honey production and marketing remains unknown. To contribute to the gender and agricultural commodity commercialization debate, the study reported here investigated the gender roles at the household and whether beekeeping empowered women.

Literature Review

An overview of women involvement and gender roles in beekeeping

Previous studies have shown that beekeeping has often been considered a male-dominated enterprise in Uganda, Kenya and Zambia (Mujuni et al., 2012; Vlek et al., 2003; Shackleton, 2011). Further research indicates that women are increasingly taking up beekeeping as an income generating activity in Nyando and Mwingi, Kenya (Macoloo et al., 2013 and Raina et al., 2009). However, they often encounter social and cultural constraints that hinder them from performing apiary cultural practices (Qaiser et al., 2013). Some of the constraints identified were lack of time, bee-sting phobia, inability to hoist and harvest from the traditional bee-hive (Ogaba & Akongo, 2001; Chemurot, 2011; Qaiser et al., 2013). Even then, beekeeping is an important activity that is passively carried out by most farmers and is now a vital income source to both men and women (Nell et al., 2004).

In lower Nyando, the Kenyan ministry of livestock found it easier to roll out modern beekeeping technology to farmers within groups. In addition, it was observed that 70% of the active members within beekeeping groups were women (Macoloo et al., 2013). Qaiser et al.

(2013) found that women beekeeping groups encountered numerous challenges because members were unable to perform some of the apiary cultural practices unlike those with both gender in Uganda. Another study noted that, participation of women in beekeeping was more likely within groups unlike when carried out by individuals due to shared, responsibilities, indigenous knowledge and skills in the management of bee colonies (Nell et al., 2004). At the Kenya coast, PactKenya (2010) found that formation of beekeeping groups led to more women getting involved. In Kitui County, beekeepers in Mwingi Central, Mwingi West and Mwingi North sub-counties were organised into groups that had a gender ratio of 1:1 at inception and roll out of CIP in the year 2007 (Raina et al., 2009; Kioko, 2010).

Ogaba and Akongo (2001) established that some of the factors that deterred women from participating in beekeeping in Uganda included lack of time at night when honey is usually harvested and the nature of the bees kept. The African bee, *Apis Millifera* is common and known to be aggressive. Therefore, apiary cultural practises on beehives inhabited by the African bee could only be done at night when women were expected to be carrying out household chores (Qaiser et al., 2013). In Kenya, Raina et al. (2009) found that training of beekeepers in Kitui County on modern apiculture addressed some of the challenges experienced by women. The training encouraged the use of bee suits to protect the beekeeper from bee stings when harvesting honey during the day a time at which bees are more aggressive. In addition, due to introduction of the Langstroth hives that were hoisted near the ground, honey harvesting could be done easily without having to climb trees, which is culturally unacceptable for women.

Both men and women have for centuries been involved in beekeeping in many societies. For example, in Southern Africa, traditional beekeeping dates back to the 16th Century where use of log hives and smokers to smoke bees during honey harvesting was largely carried out by men in Angola (Nel et al., 2004). In Zambia, women were more involved at the honey processing stage of the value chain where they converted harvested honey to a local beer called '*mbote*' while men harvested honey, kept records and took minutes during group meetings (Shackleton 2011). At the Kenyan coast, the role of women in beekeeping was cleaning the apiary, watering bees and transporting of hives to the apiary while men offered security, repaired the hives, harvested and marketed honey (Pactkenya 2010). In Pakistan, involvement of women in beekeeping as an income generating activity has been due to involvement of development agencies through trainings that boost their skills in the management of apiculture (Qaiser et al., 2013). Some of the apiary activities carried out by women in Pakistan include feeding bees with supplements, extraction of honey from combs and packaging. Men on the other hand, replaced bee colonies, breed queens, harvested and marketed processed honey. As observed from literature, gender roles along the beekeeping value chain vary from one country to another. In the advent of modern beekeeping technology and involvement of development agencies, apiary roles performed by women are increasingly changing to resemble those of men in the previously male dominated enterprise (Presser and Sen 2000).

Most of the studies have neither stratified apiary cultural practices nor characterized them by gender. Studies by Vlek et al. (2003) and Macoloo et al. (2013) in Baringo County and Lower Nyando respectively, for example appreciated that more women are participating in beekeeping as an income activity with the aim of improving their livelihoods. Additionally, Nel et al. (2004) argued that beekeeping can enhance the position and income of a woman in a society. The current study stratifies apiary cultural activities by gender to clearly highlight activities carried by each of them.

Methodology

Study area

This study was conducted in Mwingi Central, Mwingi North and Mwingi West sub-counties that are located in Kitui County in the former Eastern Province of Kenya. The three sub-counties are part of the arid and semi-arid lands of Kenya and they have a heterogeneous type of vegetation which could be due to different soil types found in the area. The county is covered by various combinations of dry-land vegetation that is largely bush-land, grasslands and shrubs. It is hot through-out the year with temperature ranging between 24 and 30 degree Celsius with an average annual rainfall of about 300 mm (Opiyo et al., 2011). These areas have a low potential for conventional agriculture and most of the population derives its livelihood from the forests. Beekeeping is, therefore, a vital source of income to the residents of this region.

ICIPE and the KFS implemented the Participatory Forest Management project in Kitui County in the year 2004 to 2008. The project's aim was to strengthen the protection of the forest reserves and promote the utilization of forest resources among rural communities in addition to employment creation in Kitui County. In the year 2007 to 2013 ICIPE implemented the CIP to up-scale beekeeping as a source of revenue for farmers who participated in the forestry conservation programme.

Farmers participating in the CIP were organised into groups for collective marketing of honey. They were trained in practical techniques of managing apiculture and sericulture technologies. Development of a value chain was meant to increase farmers' bargaining power in selling their finished products. Their silkworm and bee products were certified as organic by the Kenya Organic Agricultural Network (KOAN), thereby enabling farmers to access international markets.

Sampling and data collection

Primary data were collected using a pre-tested semi-structured questionnaire. The questionnaire captured questions on who owned the beehives, who managed the apiary, watered the bees, transported hives to apiary, hired apiary labour, paid apiary labour, repaired beehives, harvested and sold the honey, who decided to set up beekeeping enterprise, who decided the type of beehives to be used and who sourced the smoker and bee suits, among others. The survey respondents comprised of beneficiaries and non-beneficiaries of the CIP. Non-beneficiaries were used as a control group against which comparison in differences in gender roles were carried out. The CIP beneficiaries registered with farmer groups were 1,815. Farmers in CIP participated voluntarily probably due to perceived or anticipated benefits of the programme. Of these, 251 farmers were selected using a random number generator in Microsoft Excel. A similar number of non-beneficiaries were identified through referrals within the study sites. It is important to note that the number of non-beneficiaries identified during the study period was 247 only. Therefore all the non-beneficiaries were interviewed.

In order to determine the sample size of the CIP beneficiaries which constituted the treatment group, the Cochran formula (1963) was used:

$$n = {(Z^2 pq)}/{e^2} \quad (1)$$

where *n* was the sample size, *Z* the standard normal score of 1.96 at 95% confidence level; p was the proportion in the target population estimated to have characteristics being measured

and q was 1 – *p*. The denominator, *e*, was the desired level of precision taken to be 5%. *p* was determined during the reconnaissance survey where eight out of every 10 households interviewed practised beekeeping. Therefore the sample size, *n*, came to 245.8, which was rounded of to 250

The distribution of the 250 respondents across the three counties was random. The persons identified by the random number generator were scattered across the three counties which are expansive. Village elders were used to locate the homesteads of interviewees. Data collection clerks recruited and trained were locals who had attained college education. Recruitment of locals in the process was highly motivated by the fact that they could help overcome language barrier especially in situations where the interviewee could not comprehend Kiswahili or English languages. The survey was conducted over a period of 35 days between 13th of May 2013 and 21st of June 2013.

Data analysis

Data entry was done on Excel while cleaning, coding, computation of descriptive statistics and data analysis were done on Stata software version 12 (Stata Corp, College Station, TX). Differences in gender roles were determined using descriptive statistics such as frequencies and means. Comparison of continuous variables among the two groups was achieved through the two group mean comparison test at 5% level of significance while categorical variables were compared using the two group test of proportion. Socio-demographic characteristics among CIP and non-CIP were compared using t-test.

Assessing differences in gender roles and women empowerment

The use of an activity calendar has been applied previously in identification of what men and women do on a day-to-day basis (Meyers, 2012). In this study however, because agricultural practices are seasonal in nature and production occurs in cycles, an activity calendar could not conclusively capture division of labour in beekeeping. Therefore, apiary maintenance practices and other farm enterprise cultural practices that are carried out within a season were identified and stratified by gender. In addition, ownership of household, livestock and farm assets was stratified by gender.

Kantor (2005) argued that women empowerment can be represented by their control over enterprise earnings while Kabeer (1999) noted that empowerment can be measured through evaluation of one's choices or decisions on social and economic responsibilities. Therefore, questions on control over resources were a more appropriate proxy for empowerment if one was able to determine who made the decision on how the resource would be used (Pahl, 1989). Some of the questions used by Kantor (2005) to proxy women empowerment relate to health, children schooling and purchase of items such as food and assets that include property and household items. Use of indicators that comprise of questions that can be used to proxy women empowerment at the household focus more on access to and control of resources that include labour, capital, and entrepreneurship (Presser and Sen, 2000; Pitt et al., 2006; Garikipati, 2008). This study borrowed that understanding for developing the woman empowerment index (WEI).

WEI was computed using Principal Component Analysis (PCA). A total of 15 indicators were subjected to PCA (Table 1). These included who established the farm enterprises, who decided on when and where to sell the enterprise products, who negotiated the pricing of the farm products during sale, who owned the beekeeping assets and who managed the farm

enterprises outputs. They also encompassed who kept money from the sale of farm products, credit access and children schooling decisions, who managed the apiary activities, who decided the beekeeping input sources, who owned farmland and other household assets, who hired apiary labour as well as who paid apiary labour hired. Others were who made decisions about income, asset acquisition, disposal and ownership of livestock assets. These indicators have been used by Garikipati (2008) and De Brauw et al. (2014) in the measurement of women empowerment. The indicators captured issues of use, access to and control of factors of production such as land, labour, capital and entrepreneurship that are essential in agriculture. Boelhouwer and Stoop (1999) and Krishnan (2010) have used a similar method to construct composite indices in Canada and Netherlands respectively.

In the present study, the value of Kaiser-Meyer-Olkin (KMO) statistic was 0.7547 ($\chi^2 = 3639.6;\ \mathrm{df} = 105;\ \mathrm{P} = 0.000$) implying that data were good for PCA (Krishnan, 2010). Bartlett's test of Sphericity indicated a significant correlation among the indicators (p = 0.000). This meant that PCA was appropriate for the data. From the 15 indicators of women empowerment, five principal components were retained on the basis of having an Eigen value of one or more. The five principal components represented 70.1% of the variation in the data. The proportion of total variation of the five principal components was used as weight in the calculation of a non-standardized WEI followed (Antony & Rao, 2007) as follows:

$$\sum_{i=1}^{n} \frac{VPC_i}{TV} \times PC_i \qquad (2)$$

where VPC_i is the proportion of the *i*th principal component. *TV* is the total variation or cumulative variation of the five principal components while PC_i is the proportion of variation of component *i*. The WEI from equation 2 was standardized into a positive number for ease of interpretation following Sekhar et al. (1991) and Hightower (1998) :

$$WEI_{i.....n}^{SI} = \frac{(WEI_{i.....n}^{NSI} - Min\ WEI^{NSI})}{(MaxWEI^{NSI} - Min\ WEI^{NSI})} \qquad (3)$$

where $WEI_{i.....n}^{SI}$ is the standardized women empowerment index. The computation was undertaken over all households.

Results and discussion

Respondents' socio-economic characteristics

The mean age of household heads was significantly higher among CIP than non-CIP beneficiaries (p = 0.000) (Table 2). CIP households also had significantly more experience in beekeeping compared to their counterparts (p = 0.000). It is argued that farmers with more experience and age can predict future outcomes of the enterprise based on past encounters (Affognon et al., 2015). Consequently, CIP farmers were found to be older, and exhibit more years of experience on average compared to those in the control group. In addition, Chirwa (2005) found that age was positively related to adoption of new technologies in Malawi.

Non-CIP of household heads had significantly more education than their CIP counterparts (p = 0.0885). Even though this was only significant at 10%, it was contrary to the expectation that farmers who are more educated are likely to participate in a group because they understand the benefits (Doss and Morris, 2001). CIP farmers had fewer years of formal education with a mean of 5.74 years of schooling compared to 6.42 years of schooling among non-CIP.

CIP households had a significantly higher number of economic dependants compared to non-CIP ones (p = 0.0447). A high dependency ratio implies that such a household would require more income to cater for the needs of dependants and women would have to allocate more time to taking care of the young ones (Hess, 1998). The CIP processing plant offered a market for surplus honey and purchased comb honey from farmers at a constant price of Ksh 200 per kilogram unlike other market actors who offered a lower price. This finding tallied with that of Vlek et al. (2003) who found that farmers who sold their honey through a group got more money than those who sold it as individuals. This would boost their income to cater for needs of their household.

CIP households had significantly more income on average relative to those in non-CIP (p=0.0001) Table 2. The average annual beekeeping income among CIP households was Ksh 14882 compared to Ksh 6665 among non-CIP farmer. This was more than double the revenue for non-CIP farmers that can be attributed to the development of a value chain through which the CIP beneficiaries sold their honey. Raina et al. (2008) argued that development of a value chain was vital in boosting the farmer's income security by deriving optimal returns from environmental conservation. In addition, this finding tallies with that of Affognon et al. (2015) who found that farmers in CIP had a relatively higher income from beekeeping compared to the non-CIP.

Significantly more CIP than non-CIP households had access to credit (χ^2 =7.8; p=0.0052) Table 2. Access to credit among beekeepers is important for the improvement of small holder agriculture (Otieno et al., 2010). Income levels could have been a determining factor in credit worthiness of CIP farmers hence leading to a higher eligibility potential for credit.

The main beehive types used in the study area were traditional, Langstroth and the stingless one for stingless bees. The most commonly used beehive was the traditional hive. On average, CIP farmers owned 30 traditional hives compared to 20 among non-CIP farmers. Langstroth hives owned by CIP beneficiaries were 4.55 hives compared to 0.02 hives among non-CIP on average. Stingless beehives were few among CIP farmers with an average of 0.31 and nil among the non-CIP beneficiaries. Overall, the CIP households had significantly more Langstroth beehives than non-CIP farmers at on average (p=0.000). This can be attributed to the fact that CIP farmers had already formed groups through which they accessed the beehives. In addition, CIP farmers harvested significantly more honey compared to their non-CIP counterparts at 81.6 and 46.1 kg respectively (p=0.000) Table 2. This can be attributed to better bee husbandry practices learned from the CIP training by beneficiaries.

Gender roles in beekeeping at the farm level

At the farm level, apicultural cultural practices included cleaning of the apiary, transporting, construction and repair of beehives, watering of bees as well as managing the apiary. Overall, 68.1% of CIP men compared to 82% of non-CIP men undertook apiary activities. The difference was shared between the two genders in both cases (Table 3). This finding tallies with that of Ogaba and Akongo (2001), Nel et al. (2004), Pactkenya (2010) and Shackleton (2011). They found that beekeeping is predominantly a male activity in most African countries. However, it seems that the introduction of CIP somewhat reduced male dominance in apiary activities in the study area allowing more women to participate in apiary tasks compared to their non-CIP counterparts. This can be attributed to gender mainstreaming in the CIP.

There are activities that women did not carry out such as hanging of beehives, beehive construction and repair as well as harvesting of honey (table 4). Some of the reasons given for refraining from the activities were; lack of skills, bee sting phobia, cultural constraints (taboos) that prohibited them from climbing trees and the fear of falling from a tree (table 5).These findings tally with those of Ogaba and Akongo (2001) and Shackleton (2011). However, significantly more women among non-CIP beneficiaries (97.6%) participated in honey harvesting compared to their CIP counterparts (80.8%). This finding contradicts ICIPE's expectation because issuance of bee suits and smokers was meant to address bee-sting phobia and encourage participation in honey harvesting.

Household decision making on honey production activities

In order to determine the role of women in beekeeping, those who made decisions regarding honey production were sought (Table 6). The main decisions include; who established beekeeping, negotiated honey sale price and who kept honey sales proceeds. Women involvement in the establishment of beekeeping as an income-generating enterprise showed no significant difference among CIP and non-CIP beneficiaries ($z = 0.84$ $p = 0.392$) Table 6. However, significantly more non-CIP women negotiated honey sales compared to their counterparts in CIP ($z = -1.76$; $p = 0.0762$). This could be attributed to the fact that CIP farmers sold 65.6% of the honey to the Community Based Organization (CBO) at a fixed price of Ksh 200 per kilo of comb honey. The non-CIP farmers had to negotiate the price with brokers who purchased 76.1% of their honey.

With regard to who kept revenue from honey sales, significantly more women than men did amongst both CIP and non-CIP beneficiaries ($z = 10.47$; $p = 0.000$) (Table 6). However, more women among non-CIP (73.4%) than CIP (26.5%) beneficiaries kept the sale proceeds from honey which can be attributed to the extensive involvement in negotiation of honey sale compared to those in non-CIP. In addition, among the CIP farmers, joint appropriation of honey sales proceeds was most prevalent (63.7%) which could have been because of consultations during negotiation of the honey sale price (53.9%).

Household decision making on sources of inputs

The main inputs required for one to become a beekeeper included a beehive, a smoker and bee suit. The decision to acquire a smoker was dominated by men among both CIP (90.3% men vs. 5.1% women) and non-CIP (87.6% men vs. 5% women) beneficiaries (Table 7). Similarly, the decision to acquire traditional hives was also dominated by men in both groups. However, women led in the decision to acquire modern hives among the CIP beneficiaries as evidenced the fact that 28% of men vs. 44% women made that decision. This finding tallies with that of Nel et al. (2004) that men preferred the use of traditional hives and smokers for honey harvesting. However, traditional skills and knowledge could have contributed to the preference for traditional hives contrary to modern hives that required them to be trained on management of modern hives. The preference for modern hives by women could have been due to the fact that the technology addressed some of the cultural constraints such as the Langstroth which were hoisted near the ground as opposed to up a tree for the traditional hive. In addition, separation of honey combs from the bee colony within the Langstroth beehive could have reduced bee hostility hence making the enterprise friendlier.

Empowerment of Women

The indicators used to proxy women empowerment had each a set of questions. A score was of one was given for each question answered correctly. Among the 15 indicators used, 8 had a significant difference when the treatment and control group were compared (Table 1). Women among the CIP were significantly more (P=0.042) involved in children schooling decisions. Credit access among women in the CIP was significantly more at 10% level of significance compared to the non-CIP women while ownership of beekeeping assets was significantly higher among CIP with a P-value of 0.000. However, women in non-CIP had significantly more (P = 0.082) ownership of Land and other household assets compared to those in the CIP. Management of the farm enterprises such as livestock and crop enterprises indicated that women in the CIP were significantly (P = 0.012) more involved than those in non-CIP. Significantly more women in the CIP (P = 0.000) managed the apiary enterprise which involved ensuring execution of apiary tasks at the apiary such as harvesting, watering bees, hoisting beehives among others. In addition, the decision on where to source the various beekeeping inputs such as different types of hives, smokers and harvesting gear was performed by significantly more (P = 0.011) women among the CIP compared to those in non-CIP. However, women among the non-CIP were significantly more (P = 0.003) involved in hiring of apiary labour to perform tasks such as hoisting hives, beehive repair and construction compared to those in the CIP.

The mean WEI was significantly higher among CIP than non-CIP beneficiaries (t = -2.35; p = 0.0191) where the average among CIP and non-CIP was 58.77 and 55.49 units respectively. This difference could be correlated to the pattern exhibited in decision making among women in the CIP and non-CIP households. The finding tallies with that of Nel et al. (2004) that, beekeeping can be an avenue for empowering women. Participation in CIP may have increased the labour burden of women due to their involvement in carrying out apiary activities. However, their involvement in beekeeping has a role in environment conservation, increased food and probably income security. Traditionally, women had been culturally constrained by taboos from participating in beekeeping due to bee-sting phobia and the nature of beehives kept. In the advent of modern technology, women are increasingly taking part in the enterprise management in addition to carrying out apiary cultural practices they previously shunned. According to Kabeer (1999), empowerment was measurable through evaluation of one's own choices regarding economic and social activities. The composite index (WEI) includes choices made by women regarding acquisition, use of productive resources and benefits. Therefore, the composite index shows that apart from participating in beekeeping, women are increasingly taking part in the management and use of productive resources at the household.

Conclusion

This study was undertaken to find out if participation of women in beekeeping led to re-distribution of gender roles and women's empowerment. Findings indicate that more women are participating in apiary cultural activities such as watering, cleaning and management of the apiary. In addition, their involvement in decision making on acquisition of Langstroth hives, harvesting, selling and use of honey proceeds from apiculture are contributing to their empowerment. It, therefore, seems that the CIP had a positive effect on women empowerment due to introduction of modern beekeeping technology that addressed apiary cultural constraints that hindered women from participating in this male dominated enterprise. Therefore, development projects such as CIP have the potential to change gender roles in a society if they are able to break cultural barriers and hence promote inclusion and gender equity. A consideration of gender mainstreaming in development and roll out of projects is likely to empower more women.

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Tables in the text

Table 1: Empowerment indicators used in construction of WEI on PCA

Empowerment indicators	**Non-CIP**	**CIP**	**P-Value**
****Children schooling decisions	4.39±0.66	4.57±0.05	0.042
Income, asset acquisition and disposal	5.59±0.05	5.52±0.05	0.323
Keeping of money/revenue	5.21±0.11	5.22±0.09	0.466
*Credit access	1.92±0.02	1.98±0.02	0.058
Livestock ownership	4.65±0.14	4.40±0.13	0.228
***Bee assets	0.63±0.03	1.03±0.05	0.000
*Land and other household assets	2.30±0.07	2.09±0.08	0.082
Negotiate product pricing	4.27±0.16	4.10±0.15	0.460
Determine when and where product is sold	4.28±0.16	3.95±0.16	0.141
Manage enterprise output	5.20±0.10	5.15±0.09	0.753
***Manage farm enterprises	3.01±0.17	3.61±0.16	0.012
***Manage apiary enterprise	0.82±0.10	1.64±0.11	0.000
***Decide beekeeping input sources	0.21±0.03	0.35±0.03	0.011
Pay apiary labour	0.90±0.13	0.99±0.13	0.651
***Hire apiary labour	1.68±0.16	1.04±0.13	0.003
****Women empowerment Index**	**55.49±0.91**	**58.76±1.04**	**0.019**

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Author survey, 2013

Table 2: Summary of socio-economic characteristics of survey respondents in Kitui County, Kenya

Characteristic	Mean for CIP farmers	Mean for non-CIP farmers	t-value
Household characteristics			
Dependency ratio (%)	80.51	66.16	-2.01**
Household size (Persons)	5.57	5.86	1.49
Farmer characteristics			
Age of household head (Yrs)	55.46	48.55	-5.93***
Education of household head(Yrs)	5.74	6.42	1.71*
Education of spouse (Yrs)	4.28	5.15	2.24**
Credit access by the household head (credit=1, no credit=0)	0.10	0.04	-2.81***
Accessed credit in the last 5yrs (man, yes=1, no=0)	0.08	0.02	-2.64***
Accessed credit in the last 5yrs (woman, yes=1, no=0)	0.05	0.02	-1.70*
Gender or Sex of household head (Man=1, female=0)	0.90	0.91	5.48
Experience in beekeeping (Yrs)	20.84	15.55	-5.52***
Farm characteristics			
Beekeeping income (annual in Ksh)	14882.37	6665.47	-3.99***
Income from other sources (annual in Ksh)	78437.37	65322.71	-2.19**
Quantity of honey harvested (Kg)	81.60	46.10	-3.93***

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Author survey, 2013

Table 3: Comparison of apiary activities undertaken by men, women and jointly in Kitui County, Kenya

	% responses among CIP farmers (n=251)			% responses among non-CIP farmers (n=247)			Comparison of proportions-Z values		
Apiary activity	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**
Clean apiary	69.8	9.7	20.6	86.3	2.2	11.5	-4.44***	3.53***	2.76***
Transporting of hives	69.1	4.0	26.9	78.8	5.3	15.9	-2.46***	-0.69***	2.99***
Watering of the apiary	44.8	16.9	38.3	71.7	6.2	22.1	-6.08***	3.73***	3.93***
Constructing of new hives	85.1	2.8	12.1	89.4	2.2	8.4	-1.44	0.43	1.36
Repairing of hives	87.2	3.6	12.1	88.9	2.2	8.9	-0.58	0.93	1.16
Management of apiary	52.4	6.5	42.0	77.0	2.7	20.4	-5.74***	2.02**	5.20***
Average	**68.1**	**6.1**	**25.3**	**82.0**	**3.5**	**14.5**	**-3.58*** **	**1.36**	**3.02****

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Author survey, 2013

Table 4: Comparison of apiary activities not done by women among CIP and non-CIP beneficiaries in Kitui County, Kenya

Apiary activities not done by women	% responses among CIP farmers (n=251)	% responses among NCIP farmers (n=247)	comparison of proportions-Z values
Hanging of hives	49.6	70.0	-4.64***
Hive construction	30.8	27.2	0.89
Honey harvesting	19.2	2.5	5.97***
Repairing hives	0.4	0.4	0.00

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Author survey, 2013

Table 5: Reasons for women refraining from undertaking apiary activities in Kitui County, Kenya

Reasons for not carrying out the activities	% responses among CIP farmers (n=251)	% responses among NCIP farmers (n=247)	comparison of proportions-Z values
They lacked the skills required	47.5	35.8	2.65***
Believed that culture prohibited tree climbing	31.3	23.0	2.08**
Feared falling from trees	19.6	41.2	-5.24***
Other reasons e.g., fear of bee sting	1.7	0.01	1.88*

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Author survey, 2013

Table 6: Key decision maker on beekeeping activities at the farm level in Kitui County, Kenya

	% responses among CIP farmers (n=251)			% responses among NCIP farmers (n=247)			comparison of proportions-Z values		
Key decisions	**Men**	**Women**	**Both spouses**	**Men**	**Women**	**Both spouses**	**Men**	**Women**	**Both spouses**
Who established beekeeping	50.2	8.6	39.6	55.7	6.6	36.9	-1.23	0.84	0.62
Who negotiated honey sale price	37.6	6.9	53.9	32.1	5.4	61.7	1.29	0.70	-1.76*
Who keeps money from honey sales	9.8	26.5	63.7	11.1	73.4	15.6	-0.47	-10.47***	10.96***
When and where to sell honey	41.0	8.2	50.0	31.6	4.5	63.1	2.18**	1.69*	-2.95***
Overall	**34.6**	**12.6**	**51.8**	**32.6**	**22.4**	**44.3**	**0.47**	**-2.88*** **	**1.67***

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Author survey, 2013

Table 7: Decision maker regarding acquisition of key beekeeping inputs among survey households in Kitui County, Kenya

	% responses among CIP farmers (n=251)			% responses among non-CIP farmers (n=247)			comparison of proportions-Z values		
Input	**Men**	**Women**	**Both spouse**	**Men**	**Women**	**Both spouse**	**Men**	**Women**	**Both spouse**
Smoker	90.3	5.1	3.4	87.6	5.0	6.9	0.96	0.05	-1.77*
Traditional hives	55.6	25.6	18.4	44.7	22.0	33.3	2.43**	0.94	3.80***
Langstroth hives	28.0	44.0	28.0	0	0	0	8.97***	11.82***	8.97***

NB: The asterisks denote significance level; * at 10%, ** at 5% and *** at 1%.
Source: Authors survey, 2013