Determinants of farmers' compliance with coffee eco-certification standards in Mt. Kenya region

By

Kirumba, E.G. and Pinard, F.

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Kirumba E.G.*[1]and Pinard F.[1]

[1]World Agro forestry Centre (ICRAF) PO BOX 30677-00100 Nairobi, Kenya
Corresponding author's email: gathoni_edith@yahoo.com

Abstract. This paper sought to investigate determinants of farmers' compliance with coffee eco-certification standards in Mt. Kenya region. Socio-economic, institutional and farm factors were analyzed and the binary logistic regression model was used to predict factors enhancing compliance. The findings show that perception of benefits, coffee as the main source of income, annual coffee production, and the number of times a farmer sprayed annually; were the main drivers of compliance. The findings point towards a growing concern that certification projects focus on 'progressive' farmers rather than seek to uplift and integrate 'weak' farmers. This calls for concerted efforts among all key stakeholders to enhance inclusivity and participation.

Key words: determinants, farmers, compliance, coffee, standards

INTRODUCTION

Increasing public concern for the quality, safety and methods of agri-food production have combined with increasingly globalized commodity chains to result in a greater demand for goods produced according to private standards. Among these are standards branded on their ability to promote sustainable development and provide incentives to farmers in form of premiums and better markets; such as Organic, Fair Trade, Rainforest Alliance, Utz certified among others (Giovannucci and Potts et al., 2008). Coffee is not only one of the world's most important traded commodities; it is also the leader in both market share and sustainability experience. Though in most countries the joint market share of certified coffees is still modest, it has grown at a much faster pace than any other segment of the coffee industry (Giovannucci, Byers & Liu, 2008). As standards grow rapidly into billion-dollar segments and scale up to meet the demands of mainstream market channels, understanding their actual effects becomes more important. This is particularly true for producers who are faced with this growing array of choices without the necessary understanding or data to make informed choices. As a result, farmers as well as consumers, policy-makers and companies, lack objective information on what it really means to become compliant with social, economic and environmental sustainability initiatives. In the coffee sector alone, about 20 million of the world's rural poor depend upon its production for their livelihoods; making the need for improved information on field level impacts increasingly urgent (Giovannucci and

Potts et al., 2008). UNCTAD[1] (2007) reported that requirements for compliance with standards can be a barrier for developing countries to participate in trade and more seriously, may lead to the exclusion of small-scale producers in developing countries from global supply chains. This study thus focused on investigating factors that influenced farmers' compliance with coffee eco-certification requirements in Mt. Kenya region.

Of importance to us was the fact that to date, very little has been done to assess factors that influence a farmer's compliance with coffee sustainability standards. While this research may not be considered an adoption study, we heavily borrowed literature from past studies on determinants of compliance and adoption of agricultural innovations studies. With regard to certification studies, of note are Lazaro et al (2008) who in a study conducted in East Africa, noted that compliance with coffee sustainability standards was dependent on: basic knowledge and skills on how to deal with environmental issues, social issues and record keeping necessary for traceability, and producers who were convinced of returns on their investments. Further, for smallholders, it was found that the cost of certification and of maintaining records as per requirements of the different standards required specialized skills and was likely to be a limiting factor to the majority of producers. As well, in a study conducted in Uganda, Bolwig et al (2008) found that determinants of participation in organic certification included specific household endowments relating to coffee production, farm altitude, and farm instruments. Moreover, additional literature shows that compliance with voluntary standards also depends on economic incentives, education and encouraged innovation through participation (Ardiel, 2008; Burton et al., 2008; Osterburg, 2005).

In coffee related studies conducted in Kenya on adoption[2] of coffee production recommendations, Ngatia and Kabaara (1976) observed that resource constraints, ignorance, extension influence, seasonality, off-farm employment, and conditions attached to rural credit were major determinants of adoption of coffee production recommendations. Besides, Njagi (1980) observed that availability of cash, access to inputs on credit, risk aversion, and availability of manure affected adoption of soil fertility management recommendations. Likewise, Kamau (1980) reported that adoption of weed control recommendations was

[1] United Nations Conference on Trade and Development

[2]In a wide sense adoption studies are intended to analyze the process of farmer decision making in deciding to adopt new technologies. The concept of "adoption" in this study is used to refer to the decision by farmers to use or not to use agricultural technologies irrespective of the levels at which the technologies are used (Kalyebara, 1999).

influenced by availability and cost of labour, and cash flow constraints, and that adoption of pruning recommendations was influenced by labour availability, opportunity cost of labour, ignorance, and risk aversion. Other general studies (Place et al., 2004; Place et al., 2003; Franzel, 1999; Rogers, 1983) on adoption of agricultural innovations across Africa reveal that various factors affect the uptake of agricultural innovations. These factors can be broadly stated as: socio-economic, demographic, farm and institutional factors. These include: farmers' perception of soil fertility problem, off-farm income, level of education, ability to hire labour, security of tenure, access to and control of resources, and exposure to information about the technology, household size, age, contact with extension agents, access to credit and membership in a farmer's group.

We worked with Tekangu Farmers Cooperative Society, located in Karatina division of Nyeri District. In the 2007/2008 coffee season, the society received Utz Certified certification. What was unique about this cooperative society was that it made a distinction between farmers who 'cooperated'[3] ('A'[4] farmers) in implementing the certification requirements and those that did not ('B'[5] farmers). The main reason given was that those that did not 'cooperate' declined to keep records and take good care of their coffee and were thus not certified. Further, there was also a demotion strategy put in place to ensure that 'A' farmers who did not comply were relegated to 'B' status. Our interest was to examine if there were other factors that determined a farmer's predilection towards compliance with certification requirements, especially at the onset of a project as was the case. Given that a study of this nature had not yet being conducted in Mt. Kenya region, our research sought to fill this gap in knowledge and potentially contribute to policy by analyzing socio-economic, institutional and farm factors that influenced farmers' compliance with coffee eco-certification requirements.

[3] Cooperation refers to a farmer's acceptance of the Utz Certified project and the compliance with agricultural, social and environmental standards that have to be implemented at farm level.

[4] 'A' farmers sold their coffees directly and as Utz certified. It was expected that they would receive better prices than 'B' farmers whose coffee was sold through the auction. However, this did not always happen and will be the subject of discussion in our upcoming publication.

MATERIALS AND METHODS

Study area

The study was conducted in Karatina Division of Nyeri District, located in the highlands of Central Kenya, which border Mt. Kenya. The study site was ideal, given that it produces the bulk of the country's total coffee production annually and in the recent past, there have been sustained efforts aimed at certifying farms through cooperatives found in the area. Coffee Arabica generally does well in this region and flourishes best in the rich and deep volcanic soils which are well drained. The region lies at an altitude of 1400-2000M above sea level, with rainfall that is well distributed and ranges from 40 inches to 50 inches a year. The area is located in Upper Midlands 1, 2, and 3, and is characterized by bimodal rainfall patterns with long rains between March and May and short rains between October and December. There are two distinct flowerings each year, shortly after the beginning of rains in March/April or September/October. In most regions, the main crop ripens from October to December. The early crop starts in May /July (Coffee Board of Kenya, 2009). Mt. Kenya region has a high human population density that ranges from about 100 persons per Km in the dry lowlands to 1,000 persons per Km in areas with high agricultural potential (Jaetzold and Schmidt, 1995).

Sampling selection and procedure

Tekangu farmers' cooperative society[6] had 3200 farmers, the majority of whom produced Arabica coffee. A total of 1024[7] farmers, comprising 32% of the study population were not certified or labelled 'B' farmers while 2176, forming 68% of the total, were certified and accordingly categorized as 'A' farmers. Farmer membership records availed at the cooperative society formed the sampling frame of this study. A sample size of 150 farmers was selected for this research; with 75 farmers being non-certified while the other 75 was certified. This sample size was considered representative since the population was found to be homogenous, with regards to the variables under study. Stratified sampling was done to separate certified and non-certified farmers, after which 75 farmers were drawn from each of the two strata formed through simple random sampling.

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[6] The cooperative society had three wet mills, namely: Tegu, Ng'unguru and Karogoto. The farmers were spread over the villages of Igotha, Giakinai, Gathiru, Giaituu, Ibiriri, Kahara, Gathagana, Kaigu, Kamatu, Kanyama, Iruma, Kiamuhari, Thiyu, Mbogo-ini, Ng'unguru and Rugoka (Source: Cooperative data).

[7] Figures provided by Tekangu cooperative official in April 2009. These figures may have changed in recent times (Personal communication with cooperative officials).

Data collection and analysis

Data was collected from both primary and secondary sources. Primary data sources were semi-structured interview schedules and key informant interviews with cooperative officials and farmers; while secondary sources comprised journals, newsletters and articles on the topic of research. The data collected was then analyzed using the Statistical Package for social scientists (SPSS) version 15. The data was first cleaned, and afterwards descriptive statistics such as frequencies, means and tables were run. Bi-variate analysis was done by means of Chi-square[8] and T-tests tests at ($P<0.05$) to establish whether there were significant relationships between variables under study and compliance. Multi-variate analysis relied on the logistic regression model, to determine variables that could significantly predict farmers' willingness to comply with certification requirements.

Logistic regression model specification

The logistic regression model[9] is a non-linear regression model that has a binary response variable. It is a very useful tool especially in situations in which one wants to predict the presence or absence of a characteristic or outcome based on values of a set of predictor variables (Agresti, 1996). According to Borooah (2002), logistic regression is similar to linear regression but is suited to situations in which the dependent variable is dichotomous. Logistic regression coefficients can be used to estimate odds ratios for each of the independent variables in the model. As such, logistic regression was most appropriate for this study due to its unique ability to account for both categorical and dichotomous dependent variables. According to Pampel, (2000), the model equation is as: Logit (E [Y]) = Logit (P) $=X^T \beta$

Where:

Logit (E [Y]= is the binary response/independent variable

Logit (P) = the natural log of the odds of success

[8] Whenever the expected chi-square values in some classes were less than 5, the chi-squared test failed to produce accurate results. In this case, chi-squared tests were replaced by Fisher exact tests providing an exact *p*-value (Triola and Triola, 2006).

[9] The logistic regression model has been applied in various adoption studies in Africa to predict adoption patterns by analysis of various variables posited to influence adoption. The wide usage of this model in agricultural research and analysis indicates its reliability and applicability (Chinangwa, 2006).

X^T = the explanatory/dependent variables

β = is the regression co-efficient

The dependent variable was a dichotomous variable depicting the farmer's certification status and took the value of 1 if the farmer was certified ('A' farmer) and 0 if not ('B' farmer). The independent variables included socio-economic, farm characteristics and institutional factors. The hypothesized effects of these factors on adoption are as shown in Table 1.

Table 1: Hypothesized results of determinants of farmers' compliance with coffee sustainability standards

Variable	Type	Expected sign
Socio-economic factors		
Perception of benefits	Categorical	Positive
Awareness of certification	Categorical	Positive
Record keeping	Categorical	Positive
Coffee as main income	Categorical	Positive
Had title deed	Categorical	Positive
Hired labour	Categorical	Positive
Farming as occupation	Categorical	Positive
Age of household head	Continuous	Positive
Household size	Continuous	Positive
Years of schooling	Continuous	Positive
Adults working on farm	Continuous	Positive
Off farm employment	Categorical	Positive
Farm factors		
Farm size (hectares)	Continuous	Positive
Area under coffee	Continuous	Positive
Average annual production	Continuous	Positive
Number of trees on farm	Continuous	Positive
Number of cattle	Continuous	Positive
Number of goats and sheep	Continuous	Positive
Frequency of spraying	Continuous	Positive
Institutional factors		
Access to agricultural credit	Categorical	Positive
Access to extension services	Categorical	Positive
Training on certification	Categorical	Positive

RESULTS AND DISCUSSION

Overview of sample characteristics

The results indicated that majority (70.7%) of the households in the study area were male headed[10], while 29.3% were female headed[11]. The average farm size was found to be 1.5 hectares, while the mean number of coffee bushes was 200. The main coffee varieties cultivated were SL 34 and SL 28 (96% of farmers), while Ruiru 11 variety was cultivated by 4% of the sample population. Over the last five years, 71.3% of farmers interviewed had maintained the same number of coffee bushes, while 18.7% had reduced and 10% had increased. Subdivision and land shortage were cited by 54% of respondents as the main reason lack of change or decreased coffee bushes. Expanding room for food crops (32%) also contributed to decreased coffee bushes, while coffee bushes were mainly increased for higher income purposes (14%). Other than coffee, farmers also grew crops such as maize, beans, fruits, Napier grass, potatoes, cut flowers, and French beans. Cattle, poultry, goats and sheep were also reared for income. Dairy farming was gradually complementing coffee as a source of household income with 54% of farmers selling their milk daily.

Introduction of Utz Certified Certification

In the 2007/2008 coffee season Utz Certified[12] as a certification program was introduced in the cooperative society by its marketing representative Coffee Management Services (CMS) with the financial backing[13] of Solidaridad, Netherlands and the Coffee Support Network. Once the management of the cooperative had endorsed the project, the idea was floated to farmers during the annual general meeting and agreed on. The project intended to improve coffee prices through premiums and market visibility. In spite of this, not all farmers supported the project and some eventually pulled out of the cooperative citing unilateral decision making by the cooperative management (Personal communication with cooperative

[10] Husband is permanently present and makes most of the decisions pertaining the running of the household.
[11] Household fully run by a female as a result of divorce, widowhood, separation or singlehood.

[12] Utz certified's vision is to achieve sustainable agricultural supply chains, that meet the growing needs and expectations of farmers, the food industry and consumers alike. With its in-depth Code of Conduct, the program gives independent assurance of sustainable production and sourcing and offers online real-time traceability of agricultural products back to their origin (Utz Certified Website, accessed on 22nd March 2010)

[13] Farmers benefited through fully sponsored training (on good agricultural practices, book keeping, and coffee quality management), extension services, information technology, and cooperative society infrastructure (Personal communication with cooperative official).

official). By the end of the crop season, 78.7% of all farms had been assessed to determine if the farmers qualified to join the Utz program. By 2008/2009 coffee season, this number had risen to 85.3%. The majority of farmers (86%) reported that the assessors primarily focused on agricultural and environmental issues and record keeping. Of the certified farmers interviewed, 93.3% stated that they complied in the hope for better prices, while 4% expected farm inputs in return. The rest (2.7%) complied because they were convinced by the cooperative to do so. Those that were not certified mentioned varied reasons such as: coffee was not profitable, did not have financial capacity to manage their coffee better, and that compliance requirements were complicated, especially record keeping[14]. Farmers who joined the Utz program were only those who complied with its requirements after assessment.

Factors influencing farmers' compliance with coffee eco-certification standards

The hypothesized factors that were analysed for purposes of this study were as presented in Table 1. Table 2 provides chi-square analysis of socio-economic factors determining compliance.

Table 2: Chi-square results of socio-economic factors influencing compliance with coffee eco-certification standards as of April 2009

	Non-certified (N=75)		Certified (N=75)		Chi-square
Socio-economic factors	**No.**	**%**	**No.**	**%**	χ^2
Perception of benefits					
Yes	16	21.3	66	88	67.250***
No	59	78.7	9	12	
Coffee main income					
Yes	11	14.7	67	89.3	83.761***
No	64	85.3	8	10.7	
Title deed					
Yes	51	68	48	64	0.267 ns
No	24	32	27	36	
Hired labour					
Yes	39	52	66	88	23.143***
No	36	48	9	12	
Farming occupation					
yes	68	90.7	67	89.3	0.074 ns
No	7	9.3	8	10.7	

Key: ns= not significant; * = significant at p<0.1; ** = significant at p<0.05; ***

[14] On average, majority of farmers had a primary level education (10.8 years of schooling)

The results in Table 2 reveal a highly significant relationship between perception of benefits and certification. Farmers who perceived certification as beneficial financially were more likely to comply with expected requirements. Furthermore, there was a highly significant association between farmers whose main source of income was coffee and compliance with certification requirements. Households that depended heavily on coffee put in a lot more effort in taking meeting certification requirements than those that had other sources of income such as labourers in other neighbouring farms or micro-businesses. As well, farmers who were able to hire labour were significantly more likely to be certified than those who did not, probably so, because they had external assistance in tending their coffee. No significant relationships were noted between security of tenure (title deed) and farming as the main occupation of the household head; with being certified.

Table 3: Chi-square results of institutional factors influencing compliance with coffee eco-certification standards as of April 2009

	Non-certified (N=75)		Certified (N=75)		Chi-square
Institutional factors	**No.**	**%**	**No.**	**%**	**χ^2**
Access to credit					
Yes	25	33.3	62	82.7	37.466***
No	50	66.7	13	17.3	
Extension services					
Yes	54	72	67	89.3	7.224***
No	21	28	8	10.7	
Training					
Yes	29	38.7	66	88	39.300***
No	46	61.3	9	12	

Key: ns= not significant; * = significant at p<0.1; ** = significant at p<0.05; ***

In addition, according to findings in Table 3, highly significant links were observed between certified and non-certified farmers, with regards to: access to credit, extension services, and training. Certified farmers were noted to have better access to credit, more contact with extension agents and more certification related training opportunities in comparison to non-certified farmers.

Table 4: T-test results of socio-economic and farm factors influencing compliance with coffee eco-certification standards as of April 2009

	Non-certified (N=75)		Certified (N=75)		
Socio-economic factors	**Mean**	**SD**	**Mean**	**SD**	**T-statistic**
Age of HHH	56.12	14.05	57.56	12.91	0.654 ns
HH size	5.56	2.58	5.51	2.00	0.142 ns
Years in school	10.08	2.75	11.53	2.32	3.501***
Adults working on farm	1.97	1.2	2.39	1.15	2.160**
Off farm employment	1.45	1.81	1.80	1.71	1.210 ns
Farm factors					
Farm size (hectares)	1.35	0.81	1.54	1.02	1.206 ns
Area under coffee	0.36	0.23	0.50	0.37	2.770***
No. of coffee bushes	188.49	143.72	211.71	155.93	0.948 ns
Annual production	246.84	399.57	943.15	966.65	5.770***
No. of trees on farm	22.67	25.23	34.47	35.74	2.340**
No. of cattle	0.85	0.94	1.24	1.14	2.270**
No. of goats & sheep	0.69	0.99	1.36	1.59	3.090***
Spraying freq. (yr.)	1.79	1.03	5.32	1.71	15.33***

Key: ns= not significant; * = significant at $p<0.1$; ** = significant at $p<0.05$; ***

There was no significant relationship noted between the mean age of certified and non-certified farmers. However, on average, certified farmers were slightly older than non-certified ones. The same trend was noted for household size, though certified households were slightly smaller than non-certified households. Further, there was a highly significant relationship between the mean number of years spent in school for certified and non-certified farmers. Also, results showed no significant connection between mean number of household members on off-farm employment, farm size in hectares and the number of coffee bushes; for certified and non-certified farmers. Nevertheless, certified farms had larger farm sizes, more coffee bushes and more household members on off-farm employment than non-certified farms. Significant relationships were observed between the mean area under coffee in hectares, annual coffee production, number of adults working on farm, number of cattle owned, number of goats and sheep owned, and the frequency of spraying done annually, with certification. Additionally, certified farmers had more animals, sprayed more often, produced

more coffee annually, had more land under coffee, and more adults working on their farms in comparison to non-certified farmers.

Table 5: Binary logistic regression results of factors influencing compliance with coffee eco-certification standards as of April 2009

Variable	β	S.E.	Wald	df	Sign.	Exp(β)
Hired Labour	1.703	1.179	2.087	1	0.149	5.493
Years of schooling	0.248	0.196	1.600	1	0.206	1.281
Area under coffee	1.602	1.841	0.757	1	0.384	4.963
Annual production	0.001	0.001	3.163	1	0.075	0.999
No. of goats & sheep	0.599	0.523	1.308	1	0.253	1.820
No. of trees on farm	0.014	0.019	0.558	1	0.455	1.014
Adults working on farm	0.454	0.436	1.084	1	0.298	1.575
Extension services	-2.015	1.27	2.518	1	0.113	0.133
Access to credit	0.868	1.033	0.705	1	0.401	2.381
Freq. of spraying	1.000	0.341	8.590	1	0.003	2.720
Coffee main income	4.211	1.553	7.353	1	0.007	0.015
Perception of benefits	2.700	1.119	5.818	1	0.016	14.881
No. of cattle	0.045	0.442	0.010	1	0.920	1.046
Constant	-7.634	2.890	6.975	1	0.008	0.000

Key: β (odds ratio); S.E: (standard error); Exp (β): (exponential beta); Wald: wald statistic; df: degree of freedom

Source: Survey data, April 2009

Variables that were found to be significant at bi-variate analysis level were then subjected to multi-variate analysis by use of the binary logistic regression model. A test of the full model versus a model with intercept (constant) only was statistically significant at $p<0.01$ according to the model chi-square statistic ($\chi^2 = 165.22$, $p = 0.000$) and correctly predicted 94.7 % for both certified and non-certified farmers. This implies that the model predicted 94.7% of the total variations in determinants of farmers' compliance with certification requirements and was therefore very reliable. The Exponential beta (β) or odds ratio indicated the proportion with which adoption could occur, while the beta (β) sign predicted whether the variable influenced adoption decisions positively (+) or negatively (-). The model predicted that compliance with certification requirements significantly and positively dependent on: frequency of spraying done annually, reliance on coffee as the main source of income, and perception of benefits. The average annual production of coffee was also found to be significant at $P<0.1$.

In addition, the results' exponential beta shows that farmers who depended on coffee as the main source of income were 0.02 times more likely to comply with coffee eco-certification requirements in comparison to those that did not. Moreover, farmers who perceived certification as beneficial were 14.8 times more likely to comply with certification requirements, as opposed to those that did not. Also, a unit increase in the number of times a farmer sprayed his coffee annually favoured the odds of complying with certification standards by a factor of 2.72. Finally, if the annual average coffee production was increased, it was likely to result in increased compliance by a factor of 1.

CONCLUSIONS

The results of this study indicated that the key determinants of farmers' compliance with coffee eco-certification requirements were: perception of benefits, coffee being the main source of income, number of times in a year the farmer sprayed his/her coffee, and the annual average production of coffee. These results were indicative of the dynamics of implementation of certification projects especially at the initial years. Since farmers had to comply before they were admitted into the certification program, the determining characteristics as discussed were consistent with 'progressive' farmers and less so with 'weak' farmers. For instance, certified farmers produced four times more coffee annually than non-certified ones and were able to purchase inputs with which they could spray their coffee five times annually compared to twice by non-certified ones. As a result, certified farmers could count on coffee as their main source of income unlike non-certified ones who said that they mainly worked as labourers in other people's farms or ran small businesses. Farmers who depended heavily on coffee as a source of income were also very likely to only accept projects that they perceived as beneficial to them. As such, it appears that certification maybe potentially more beneficial to 'progressive' farmers than 'weak' ones. There is therefore a need for future certification projects to focus on integrating and uplifting 'weak' farmers, in order to reach a wider target and influence more livelihoods.

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