Evaluating Agribusiness Regulatory Compliance among Vegetable Producers in Kenya Against Consumers' Willingness to Pay for Food Safety

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ABSTRACT----

Purpose: For many years the failure of actors such as farmers to comply with regulations that promote public good, such as adherence to safe practices in the use of agrochemicals was only understood from a position of weak enforcement and surveillance. The study sought to evaluate agribusiness regulatory compliance and consumers' willingness to pay for a food safety premium among vegetable producers in Kenya.

Methodology: The researcher adopted a cross-sectional survey design to randomly recruit a sample of crop farmers (n=118) and vegetable consumers (n=235) from Kirinyaga and Kiambu counties in Kenya, respectively. Data on consumer willingness to pay for safe agricultural produce as well as logistical issues regarding proximity to markets and social status of the crop farmers were collected using a researcher-administered questionnaire in a one-on-one interview. A similar approach was adopted to interview consumers' social status and vegetable consumption patterns.

Results/Findings: The study found that the present commercialization of tomatoes and kales is driven by low-income earners' bid to earn a livelihood. However, their capital limitations push them to farm outside planned areas such as forests fringes, riverbanks or low potential zones in which they face extraordinary pressure from pests and diseases, which in turn compel them to abuse agrochemicals. This finding also explains their marginalization from county government extension services, high costs of market access and potential to experiment with classified agrochemicals. The study revealed that high income consumer from Westlands (91.44%) were likely to consider agrochemicals in their decisions to purchase vegetables compared to medium and low-income from Kasarani and Embakasi (2.21% and 6.35%), respectively. Majority of the vegetable consumers were not aware of varied agrichemical used by fathers as well as their health and environmental effects.There is reason to believe that both farmers and consumers could be heavily exposed to which the study proposes a population-based survey to assess agrochemical poisoning.

Unique contribution to theories, practice and policy: This study finds compelling evidence to suggest that livelihood and farming outcomes of vegetable farmers are a key consideration among consumers purchase decisions. The findings also suggest that these factors significantly incentivize the farmer to comply with agribusiness ethics regulations.

The paper recommends a training of extension officers and advocate for more budgetary allocation on agriculture. The extension officers will in turn train farmers on god farming practices as well as implementation of mitigation measures in relation to toxic pesticides. The researcher feels that there is a need to for a research to be conducted to understand the involvement of farmers in the formulation of policies and agribusiness practices rules in order to gain knowledge on the level of acceptance of these polices among farmers in Kenya.

Keywords--- Consumers, Producers, Food-safety, Premium

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1. INTRODUCTION

The commercialization of fresh vegetables is crucial in enhancing revenues from crop farming and ensuring reliable supply of high-quality produce for consumers. However, this can be possible if the agribusiness regulatory compliance and consumers' willingness to pay for a food safety premium among vegetable producers is made a reality. Several theories have been advanced to describe consumer behavior towards aspects of vegetable commercialization, agribusiness ethics and chemical safety of foods. However, their limitation is their inability to offer an integrated explanation that combines commercialization factors from the producer and consumer as well as, ethics and safety. For this reason, the researcher adopts the Utility Maximization Theory (UMT).

According to the theory, consumers are increasingly choosing among alternative goods within their limited incomes (Chernov & Hamilton, 2009) with the aim of spending each last cent on products that yield the highest marginal utility (or satisfaction) possible (Stigler, 1950). Utility theory bases its beliefs upon individuals' preferences. It explains behavior of individuals based on the premise people can consistently rank order their choices depending upon their preferences. Each individual will show different preferences, which appear to be hard-wired within each individual.

Studies on vegetable commercialization attribute its advent and popularity on government and donor efforts to increase production and offer a means to alleviate poverty among small farm-holders (Gebru *et al.*, 2019) in rural areas. In a sense, therefore, commercialization could be seen as a push-pull affair aided by the entire market with the aim of maximizing product penetration (quantity and quality).

Given that poverty is multidimensional, its alleviation through commercialization could consider much more than direct costs of production including other livelihood needs such as healthcare. The socioeconomic burden of disease due to agrochemicals is already incredible enough to erode the benefits of commercialization (Dewbr, 2010). Globally, for instance, more than 350,000 people globally suffer acute poisoning due to herbicide and insecticide (Ko *et al.*, 2018) and this costs Kenyan farmers about 47% of their household income (Macharia, 2015). Interestingly and despite the intensive use of agrochemicals, commercialization in the horticulture industry has been shown to increase household income and asset value for Kenyan farmers (Muriithi and Matz, 2014) and contribute to poverty alleviation. This underscores the significance of strict safety regulations particularly for export market and urban supermarkets. Otherwise, the burden of agrochemicals undermines the industry's contribution to alleviate poverty and in turn hinders commercialization. In the context of UMT, agrochemical safety presents an objective rationale for vegetable producers to maximize satisfaction for consumers.

Henson & Jafee (2008) argue that food safety management and agribusiness ethics compliance are becoming complex and dynamic. Though there is endless pressure due to multiple factors such as global trade, competitive markets, increasing public and private safety and quality requirements, consumer trust and emerging health hazards such as rising cases of cancer, still there is much to be done in the sector (Desmarchelier & Szabo, 2009). This pressure is to design, control, improve, and assure production and preparation of healthy, authentic, and palatable food that is safe. In reality, the food industry puts much effort in ensuring profit in returns and thus food safety is no longer a priority despite many concerns raised by government and researchers (Carvalho, 2017).

Government sets product, process, and system requirements in legal frameworks, which public authorities should enforce by inspections using different incentives (ranging from sanctions to support) but corruption and lack of responsibility always get in the way (Jacobs, 2005). Conversely, the rampant food scandals, foodborne outbreaks, and other food safety and integrity issues indicate that a deeper approach and understanding of factors determining the Food Safety Management System performance is still needed (WHO, 2019). Multiple studies have provided evidence that behaviors of people operating in the Food Safety Management System are important factors contributing to the food safety and quality performance.

In developing countries, like Kenya, the demand for safe and nutritional vegetables is increasing in response to the growing population, rising incomes, and the supply of fresh vegetable food that occurs via different outlets (Vipham *et al*., 2018). There is no formal mechanism for monitoring the supply of vegetables at any point in the supply chain and the increasing demand poses a challenge for the industry to increase production and improve production conditions in order to meet the market, consumer, and legal demands of ensuring food safety in the country (Okello, Narrod, & Roy, 2007). The horticultural sector is undeniably faced with many challenges. Common problems are a lack of knowledge by producers as the majority of producers are illiterate, a shortage of government extension officers, unethical business-oriented agrichemical sellers, and lack of commitment by the concerned government agencies.

There are numerous reports of excessive agrochemical residues in food in Kenya. As argued by Will and Guenther (2007), food standards are categorized as compulsory or deliberate. Compulsory standards for food and agricultural goods have been established by technical teams whose administrative departments are at the KEBS (KEBS, 2005). Food standards dictate the guidelines for constituent requirements of food products, microbial regulation, the acceptable amounts of contaminants, packaging and labeling, and hygienic requirements for manufactured products. The standards applied in Kenya are taken from the International Organization of Standards (ISO), using the basic guidelines of the Technical Barriers to Trade (TBT), Sanitary and Phytosanitary Standards (SPS), and the World Trade Organization (WTO) (Frohberg *et al*., 2006). Deliberate standards are set up through recognized harmonized procedures by significant stakeholders in the supply chain such as business associations. These standards may not be compulsory according to the law; however, some have become like essential requirements (Will and Guenther, 2007). In planning national standards, priority is given to relevant international standards as a base on which national standards may be agreed to suit the national food safety situation (WHO, 2012).

In a study by Wagura, (2015) 'Smallholder Dilemma on the Emerging Kenyan Food Safety', found that the majority of fruits and vegetables have deposits of substantial metals and pesticides. Such deposits are unsafe, prompting birth deformities or diseases like cancer. Horticulture demands substantial utilization of pesticides, the greater part of which is ineffectively managed. This begs for a stringent regime of traceability. Consumers should be well-versed with the origin of the food, how it was produced, and the chemicals used, transportation, handling, preservation and storage.

Metropolitan areas in the developing countries exemplify some of the fastest growing target markets for vegetables (FAO, 2010), and urban and peri-urban farming is emerging as significant, particularly for the supply of vegetables. Globally, urban and peri-urban farming contributes substantial livelihood opportunities, not only for urban farmers but also for traders, input suppliers and other service providers along the value chain for domestic produce (Scott *et al*., 2004). Nevertheless, vegetables for local consumption in urban and peri-urban centers of the developing countries are linked with excess of food safety hazards. Access to clean water for irrigating vegetables is a great challenge. Usage of contaminated water from residential areas or rivers is prevalent. Undeniably, it is estimated that over 20 million hectares are cultivated with polluted water globally (Nabulo *et al*., 2008). In Nairobi, for instance, about 3,700 farmers within a 20km range of Nairobi Centre practice irrigation agriculture and 36% of them use raw sewage water (Karanja *et al*., 2010). Sewage water has a variety of pathogens, many of which can live for quite a few weeks when discharged to the fields (Amoah *et al*., 2006). Other dangers associated with fresh vegetables consumed in urban areas include contaminants originating from pesticides and other agrochemical residuals in vegetables (Kariathi *et al*., 2016). Demand for aesthetic qualities such as pigment, size and spot-less leaves by consumers has also encouraged excessive use of pesticides and chemical fertilizers. From a perceived food safety viewpoint, a dual situation seems to be emerging, in which perceived food safety conditions at supermarkets markets are very different from traditional markets, which may also have consequences for international trade of food products between developed and developing countries. A study done in Nairobi by Kutto *et al*. (2010), demonstrates that postharvest and retailing practices are the main contributors to the occurrence of microbiological contamination in fresh vegetables and although the prevalence of pathogens were higher in traditional markets as compared to supermarkets, the levels of *Escherichia coli* were as high as the 20% level even at high-end markets such as supermarkets and specialty stores.

2. STATEMENT OF THE PROBLEM

Sutinen and Viswanathan (1999) seminal work on formulating a socio-economic theory of regulatory compliance (SRC) is an outstanding effort to bridge what has been for years an indelible mark in the rich subject of why states and non-state actors comply with laws (Etiene, 2011). For many years the failure of actors such as farmers to comply with regulations that promote public good, such as adherence to safe practices in the use of agrochemicals was only understood from a position of weak enforcement and surveillance. SRC, on the other hand, succeeded in defining these variables against the violator's perception of the potential to be detected or the severity of penalties or both. The theory was very effective at this because it integrated already existing, though divergent thoughts such as utilitarian, normative as well as liberalist views. It also managed to analyze phenomena at both large and small-scales enabling researchers to analyze states as well as individual actors.

Nonetheless, SRC faces huge contradictions that threaten it application in future. For instance, SRC still grapples with the dilemma to explain why a huge portion of the observed compliance is never really driven by the presence or severity of enforcement. The theory also fails to explain why other violations still persist in the presence of severe enforcement. This contradiction has huge impacts on related concepts and their application by policymakers. For example, interventions proposed by the Pests Control Product Act only consider willingness to pay for quality to only their aversion non-compliant products. The numerous cases supporting this logic such as XYZ (2016) neglected the contribution of WTP or analyzed it within non-generalizable models.

This study argues that this contradiction shall only be overcome if the incentives for compliance are analyzed beyond or besides the benefits of violation or the costs of compliance. To achieve this, I propose to redefine WTP within the context of small fresh vegetable farmers as a significant incentive to compliance.

3. RESEARCH OBJECTIVE

The specific objectives of the research are: i) To assess agribusiness regulatory compliance in agrochemical utilization among vegetable producers in Kenya, ii) To evaluate consumers' willingness to pay for a food safety premium on vegetables; and iii)To draw correlations between farmers' state of compliance and consumers' willingness to pay for food safety

4. RESEARCH METHODOLOGY

4.1. Research Design

The study adopted a mixed methods approach. The descriptive design describes the state of affairs as it exists at present (Kothari, 2004).

4.2. Target Population

The target population consisted of all households in Nairobi, Kiambu and Kirinyaga counties. The accessible population comprised of 1,405,092 household units and is summarized in Table-1 below:

Table 1: Population in Counties

County	Population
Nairobi (Westlands)	860,464
Kirinyaga	134,719
Kiambu	409,909
Totals	**1,405,092**

Source: (KNBS, 2013)

4.3. Sample Size

A total of 384 households in the three counties were interviewed. The following formula was adopted in calculating the sample size (Delice, 2002).

$$n = \frac{NZ^2 \times 0.25}{d^2 \times (N-1) + (Z^2 + 0.25)}$$

Where, n=sample size
N= Target population
d= precision level normally expressed in terms of 0.05
Z= number of Standard Deviation (SD) units of the sampling distribution correct to desired confidence level
N=1,405,092
d=0.05
Z=1.96

$$\frac{1405092 \times 1.96^2 \times 0.25}{0.05^2 \times (1405092-1) + (1.96^2 + 0.25)}$$

n=384 household unit
The sample size for each county was then allocated in proportion to the population of each county as shown below:
Kiambu County (Producers)

$$\frac{409909}{1405092} * 384 = 112$$

Kirinyaga County (Producers)

$$\frac{134,719}{1405092} * 384 = 36$$

Nairobi County (Consumers)

$$\frac{860,464}{1405092} * 384 = 235$$

4.4. Sampling Procedure and Technique

The study used three main sampling techniques; judgment sampling stratified sampling and simple random sampling which are both non-probabilistic and probabilistic in nature. The study applied judgment sampling to select Kirinyaga, Kiambu and Nairobi Counties.

4.5. Data Collection Tools

Self-administered questionnaires and personal interview schedules were used during data collection, applying both open-ended and closed-ended questions.

5. DATA ANALYSIS AND PRESENTATION

Data from the field were coded, cleaned and classified. This was done with the help of MINITAB software program. Data was analyzed using descriptive statistics such as frequencies, percentages, tables, bar graphs and bar charts.

6. RESULT AND DISCUSSION

6.1. Producer Characteristics

The study interviewed 140 farmers from Kirinyaga (n=38, 27.14%) and Kiambu (n=102, 72.85%) counties. On average, farmers had about 7 years farming experience with 42.29% of all farmers had between 5-7 years farming experience. This hints to a rich knowledge they possess about the industry and the study area as well as a rich understanding of agrochemicals. Farmers in Kirinyaga (=7.684 min=1 max=17years) had a slightly longer farming experience than farmers in Kiambu (=7.671 min=2 max=25years). Nonetheless, a vast of majority (98.66%) of farmers were not members of producer/marketing association.

Table 2: Household Characteristics of Vegetable Farmers in the Study Area

Variable	***Characteristics***	***N***	***%***
Residence	Kirinyaga	*38*	*27.14*
	Kiambu	*102*	*68.46*
Sex	Female	*65*	*46.42*
	Male	75	53.57
Age	18-22	0	0.00
	23-27	5	3.36
	28-32	19	12.75
	+33	125	83.89
Marital Status	Single	54	36.23
	Married	95	63.76
Household Head	Self	130	87.25
	Other	19	12.75
Education	College/ university	39	26.17
	Secondary	58	38.93
	Primary	40	26.85
	None	12	8.05
Economic Activity	Crop Farmer	131	87.92
	Mixed	18	12.08

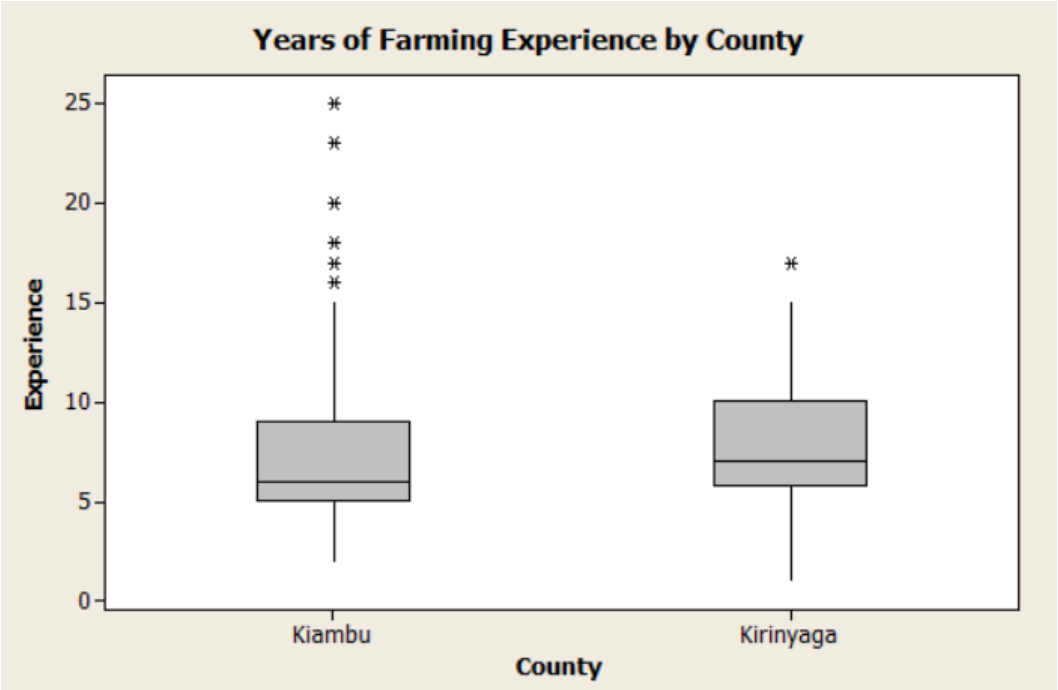

Figure 1: Respondents' Farming Experience by County

As anticipated, there were clear differences between the two groups of farmers in aspects such as household income, farm size and proportion of land committed to crop or mixed farming as illustrated in the boxplots below. Income, for instance, further emphasized the distinctions between rural and urban residents. Farmers in Kiambu earned KShs 106,207 on average (min=10,000 max=350,000) compared to those in Kirinyaga ($\bar{X}$=98,421 min=20,000 max=300,000) monthly.

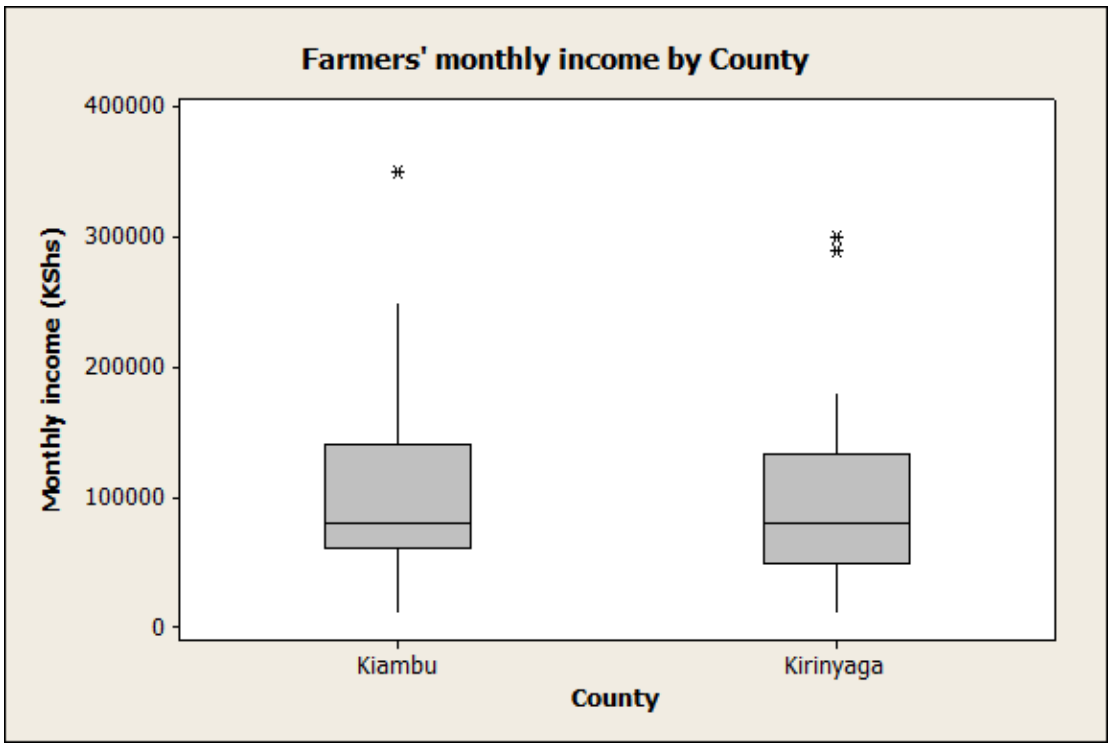

Figure 2: Comparisons in Farmers' Monthly Income between Kiambu and Kirinyaga Counties

However, there were no substantial distinctions in household size, level of education, age, years of experience or proportion of land farmed in vegetables between the two counties (see figures 3-6 below).

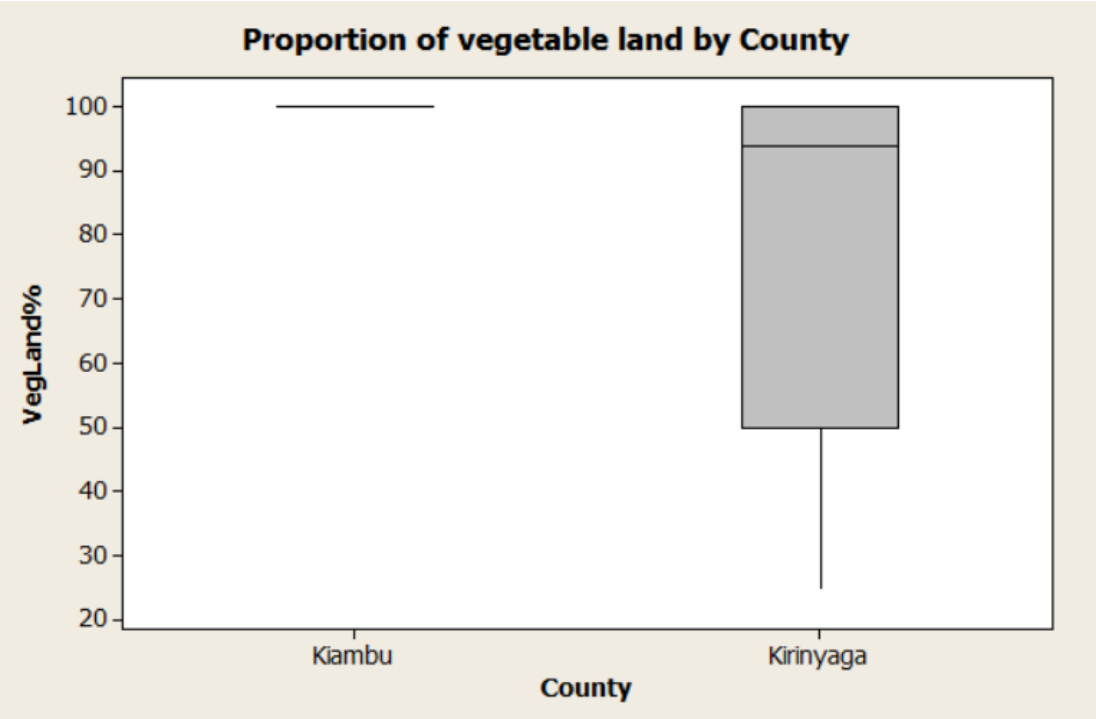

Figure 3: The proportion of Land Committed to Vegetable Farming

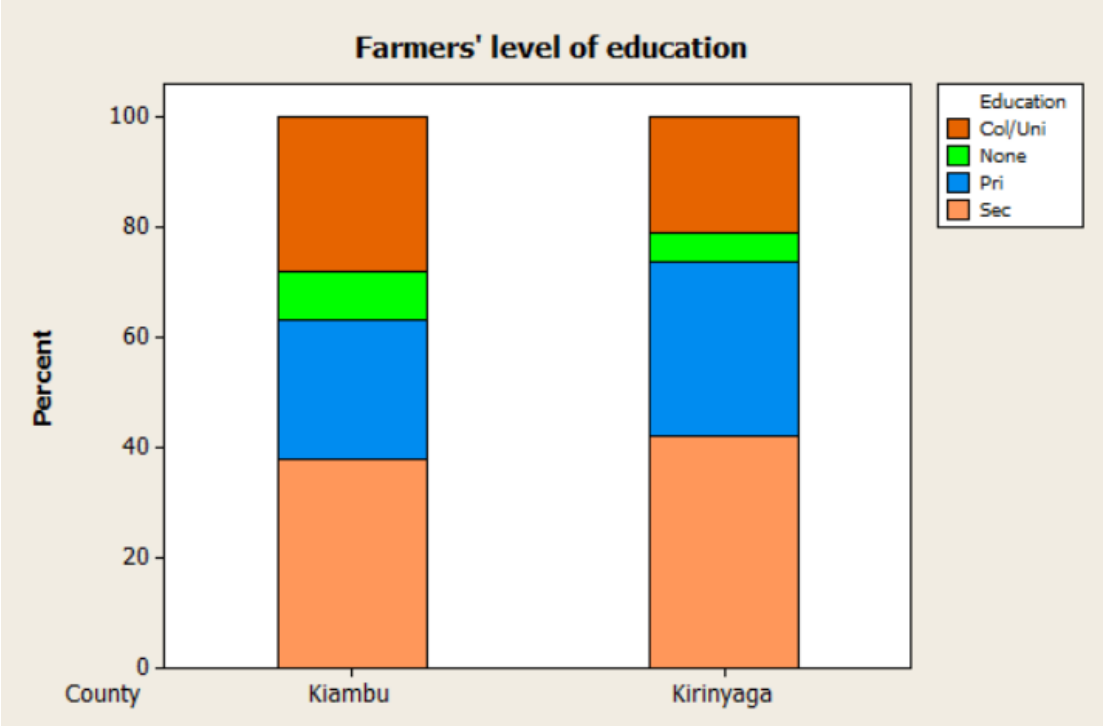

Figure 4: Distribution of Farmers' Level of Education

About half (53.02%) were male and 46.98% female. The majority (83.89%) were at least 33years while 12.75% and 3.36% were 28-32 and 23-27years old, respectively. This was replicated at the county-level as could be seen with about 83.78% of farmers in Kiambu and about 84.21% of farmers in Kirinyaga being at least 33 years, respectively.

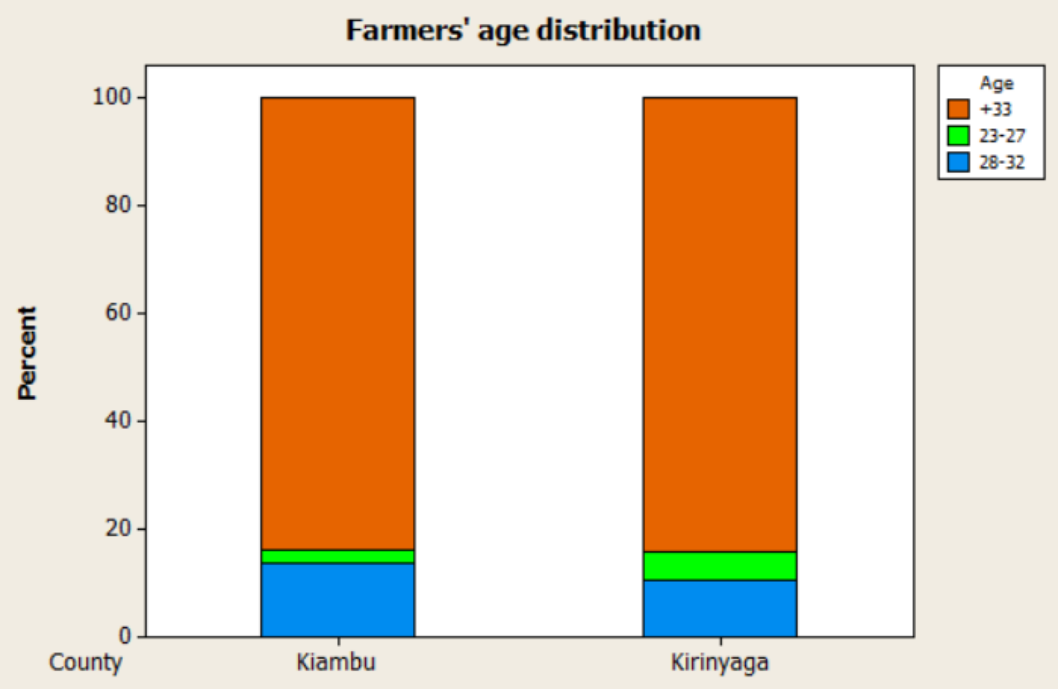

Figure 5: Age Distribution of Tomato and Kale Farmers

A minority (26.17%) had upwards of a college education, whereas 65.78% had at least primary school education and about 8.05% had no formal education. Married farmers (63.76%) greatly outnumbered those who reported being single (34.24%) as illustrated in Table 3 below. Household size varied incredibly with a majority (84.57%) reporting to have a home of about 3-6 members. The mean household size was 4.757 whereas the least and largest reported 1 and 10 members, respectively. Male-headed households were, on average, larger at about 5.218 members (SE=0.170 Min=2 Max=10pax) compared to female-headed households that housed about 4.243 members on average (SD=0.157 Min=1 Max=8pax).

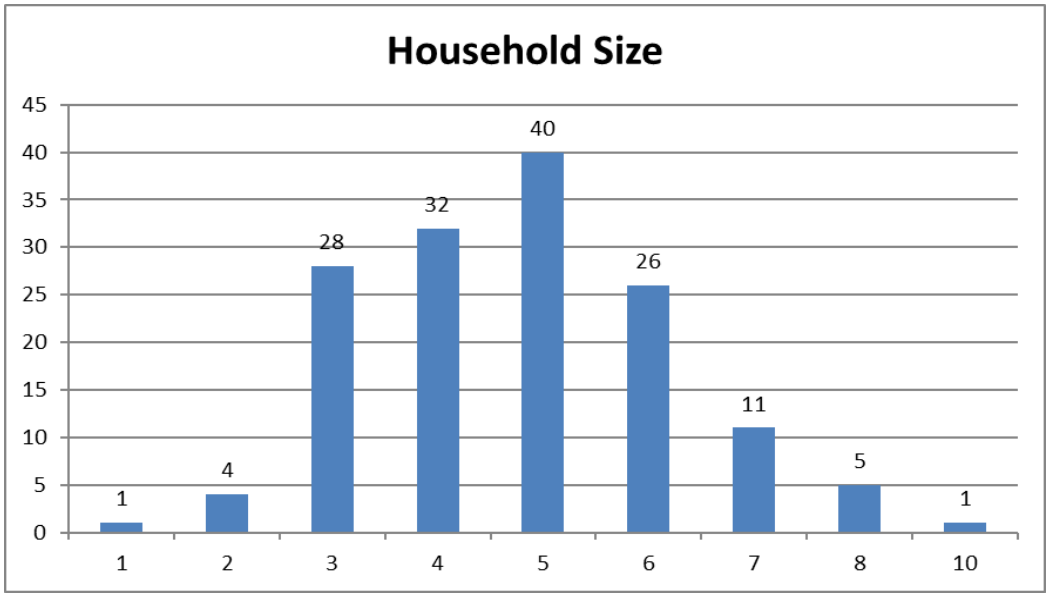

Figure 1: Farmers' Household Size

Household income was equally variable with the least recording an income of Kshs. 10,000 and the highest recording KShs. 350,000, yielding a mean monthly income of about KShs. 39,909. Likewise, men earned appreciably more than women translating to a higher mean monthly household income for men of about KShs 117,797 (SE=7,843, Min=10,000, Max=350,000). Women earned about KShs 88,900 (SE=5,533, Min=10,000, Max=240,000) translating to a mean monthly income difference of about KShs. 28,897 less for female-headed household.

Land size varied considerably from 0.125 to as much as 7.0 acres and was more pronounced among rural farmers in Kirinyaga than Kiambu County. A majority of respondent farmers (61.07%) reported holding less than 1 acre with most of them (22.82%) holding 0.5 acres or less. Farmers in Kirinyaga held relatively larger farms (mean=2.487, min 0.50 max=7.00 acres) almost twice the size of their counterparts' in Kiambu (Mean=0.9735, min=0.125 max=5.00 acres).

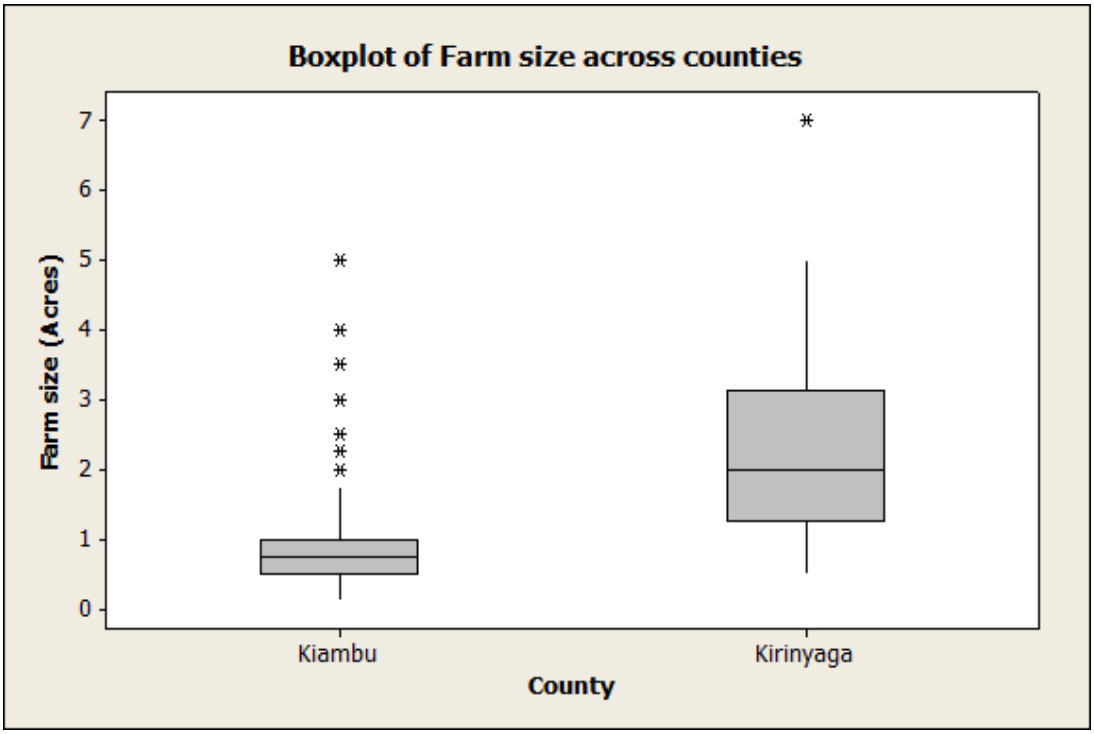

Figure 2: Farm-Size Among Respondents

Farm size varied with the sex of the household-head or respondent. In which case men owned approximately 1.490 acres on average (SE=0.124, Min=0.125 Max=5.00) compared to women who on average owned about 1.212 acres (SE=0.153, Min=0.250, max=7.00). On average, men owned about 0.278 acres of land more than women.

Likewise, the portion of land dedicated to vegetable farming followed a similar trend varying from as little as 0.125 to 3.5acres the majority of which (68.24%) was farmed on less than 1.0acres. On average, farmers in Kiambu grew their vegetables on approximately 0.81 acres translating to about 92.01% of their total land. On the other hand, farmers in Kirinyaga committed a larger share of their land to vegetable farming or about 1.763 acres, translating to about 77.36% of their land to vegetable farming.

All farmers interviewed reported growing the target vegetables with a majority growing Kales (69.13%) followed by those that grew both Kales and Tomatoes (19.46%) and by those that only grew Tomatoes (11.41%). This is consistent with the farmers' report that a majority (87.92%) were crop farmers.
Interestingly, tomato farmers utilized larger farms (Mean=2.853 min=0.5 max=7.00 acres) than kale farmers ($\bar{X}$=0.91 min 0.125 max 4.00 acres) or even those that grew both kales and tomatoes ($\bar{X}$=2.078 min=0.25 max=5.00). On the flip side, it was kale farmers who utilized the greatest share of their farms for vegetable farming. For instance, kale farmers committed about 94.62% of their farms to vegetable farming (min=42.86% max=100.00%). This was substantially larger than what is seen with their counterparts who grew tomatoes ($\bar{X}$=72.18% min=33.33% max=100.00%) or both kale and tomatoes ($\bar{X}$=75.28% min=5% max=100.00%) committed.

Table 3: The Farmers' Utilization of Land on Vegetables

Variable	*Category*	$\bar{x}$	*SD*	*Min*	*Max*
Farm size (Acres)	Both	2.078	1.304	0.25	5.00
	Kales	0.9107	0.6388	0.125	4.00
	Tomato	2.853	1.719	0.50	7.00
Vegetable land (%)	Both	75.28	30.35	5.00	100
	Kales	94.62	12.25	42.86	100
	Tomato	72.18	25.61	33.33	100

Farm size and the share of land dedicated to vegetable farming influenced the benefits accruing therefrom in a substantial way. To demonstrate this association, the researcher performed Correlation (Pearson's) tests against farm size, share of vegetable land, household and monthly income. As expected, farmers owning larger pieces of land derived greater financial benefits. Farm size returned a Pearson correlation coefficient of 0.278 (p=0.001) and 0.272 (p=0.001) for Household and Monthly Income, meaning that evidence was statistically significant to suggest that up to a quarter of the variation in household and monthly income, respectively, could be explained by land size alone.

Interestingly, the scale of intensification, that is, the share of land a farmer dedicated to vegetable farming the target vegetables in raw acres (VegShare) or as a percentage of total land (VegLand%) had mixed results on income accruing to the farmer (Monthly income) or his household (Household income). Share of vegetable land in raw acres (VegShare) had a strong correlation with a farmer's monthly income (r=0.196, p=0.016) but none on a household's income (r=0.130, p=0.115). Proportion of vegetable land (VegLand%) was positively correlated to a farmer's income (r=0.220, p=0.007) and that of the household (r=0.194, p=0.018). This has huge implications in understanding how equitably members of a household participate in adopting commercialization and in sharing its benefits. For instance, it could mean that commercialization and its benefits accrue only to those who own the land where vegetable farming occurs in raw acres. On the flipside, when vegetable commercialization is a factor of percentage share of total land, it could mean that other members of the household, not necessarily owners of the land, also enjoy control over the nature and benefits of commercialization. This could explain why farmer's income and household income were at parity for respondent's whose commercialization followed VegLand% unlike those who followed a VegShare trajectory. The researcher considered this a demerit of formal indicators in assessing the nature and/or extent of commercialization. The study considered how remotely the production of vegetables occurred with the aim of appreciating logistical challenges associated with farming on informal land and whether they influenced the abuse of agrochemicals. This was achieved by analyzing the distance to market in kilometers by count of production, type of vegetable and farmer's sex. Farmers in Kiambu County farmed vegetables furthest from the market at about 9.313km (SE=0.507 Min=0.50km Max=35.00km) compared to those in Kirinyaga at about 7.803km (SE=0.771 Min=0.50km Max=19.00km). The variations were not as marked as shown in figure 8, below.

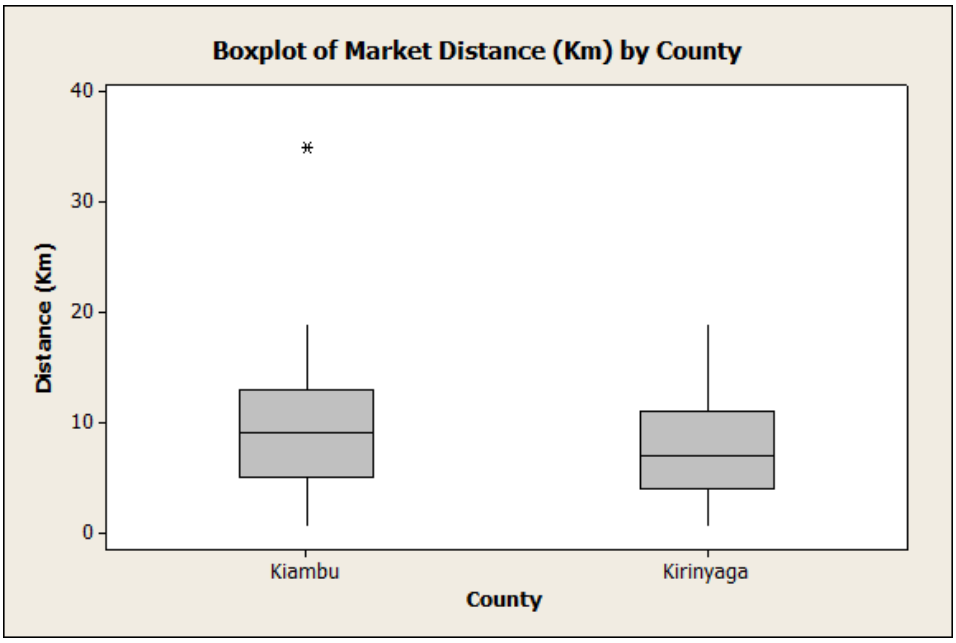

Figure 3: Remoteness From Market

On average kales were grown the furthest from market at about 9.541km (SE=0.526 min=0.5km max=35.00km) followed by a combination of both kale and tomato at 7.638km (SE=0.978 Min=0.5km Max=19.00km) and least remote or closest to market was tomato at 7.412km (SE=0.891 Min=3.00km Max=15.00km). Female-headed households or farms were, on average, more remote at about 9.500km (SE=0.674 Min=0.50km Max=35.00km) than their male counterparts at 8.421km (SE=0.541 Min=1.00km Max=19.00km).

A Pearson's Correlation was used to test whether remoteness influenced the market prices of vegetables and perhaps motivate farmers to intentionally farm on these areas for higher revenues. However, the correlations for both tomatoes (Pearson's R=-0.063 p=0.483) and kales as well (R=-0.149 p=0.093) were not only very weak but also inverse, suggesting that only farmers closer to the markets fetched better revenues.

6.2. Consumers' Characteristics

The study engaged a total of 235 respondent consumers in Nairobi County of which, 49.79% were men while 50.21% were women. A majority were above 33 years of age (49.36%), followed by 28-32 (31.06%) and 18-22year olds (10.21%). The respondents hailed from Embakasi (26.81%), Kasarani (57.87%) and Westlands (15.32%) wards which as depicted in the boxplots below (Figure 9), represented the low, medium and high-income areas of the county, respectively.

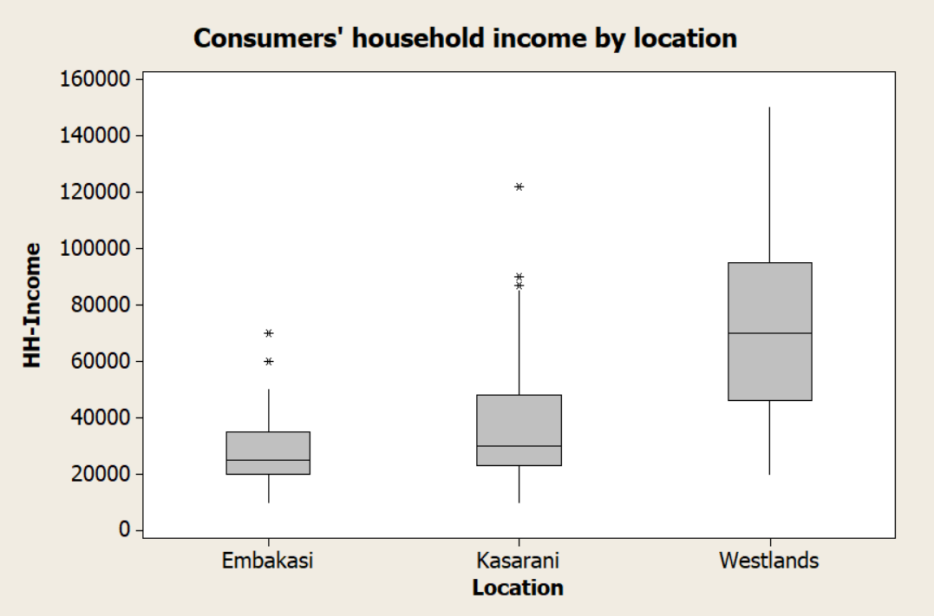

Figure 4: Consumers' Household Income by Location

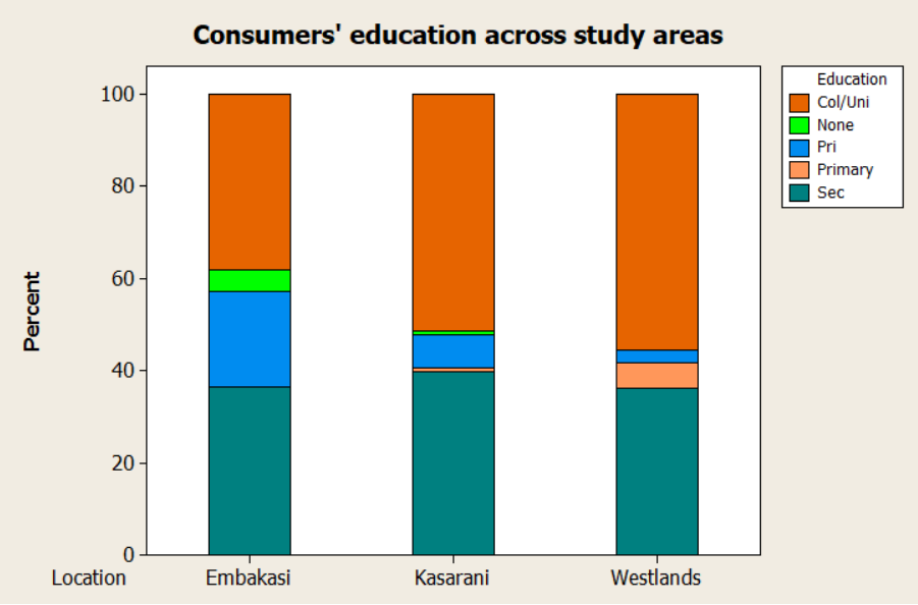

Figure 5: Consumers' Education Levels Across Study Sites

Respondents had a fair academic background with a majority (98.3%) holding at least primary school education as illustrated in the bar-graphs in figure 10 above. Interestingly, consumers' level of education was positively correlated with the area's income levels. For instance, respondents reporting no formal education were more likely to hail from lower income areas as opposed to those reporting college or university education more likely to hail from higher income areas.

Consumers' households were small, typical of urban areas, for instance, 66.81% of households had between 3 - 5 members. Male-headed households were slightly larger with about 4.043 members on average (SE=0.146 min=1 Max=10pax) compared to female-headed ones with about 3.28 members on average (SE=0.134 Min=1 Max=7pax). They did not show any substantial variations across the three income zones as indicated in the boxplot (Figure 11) below.

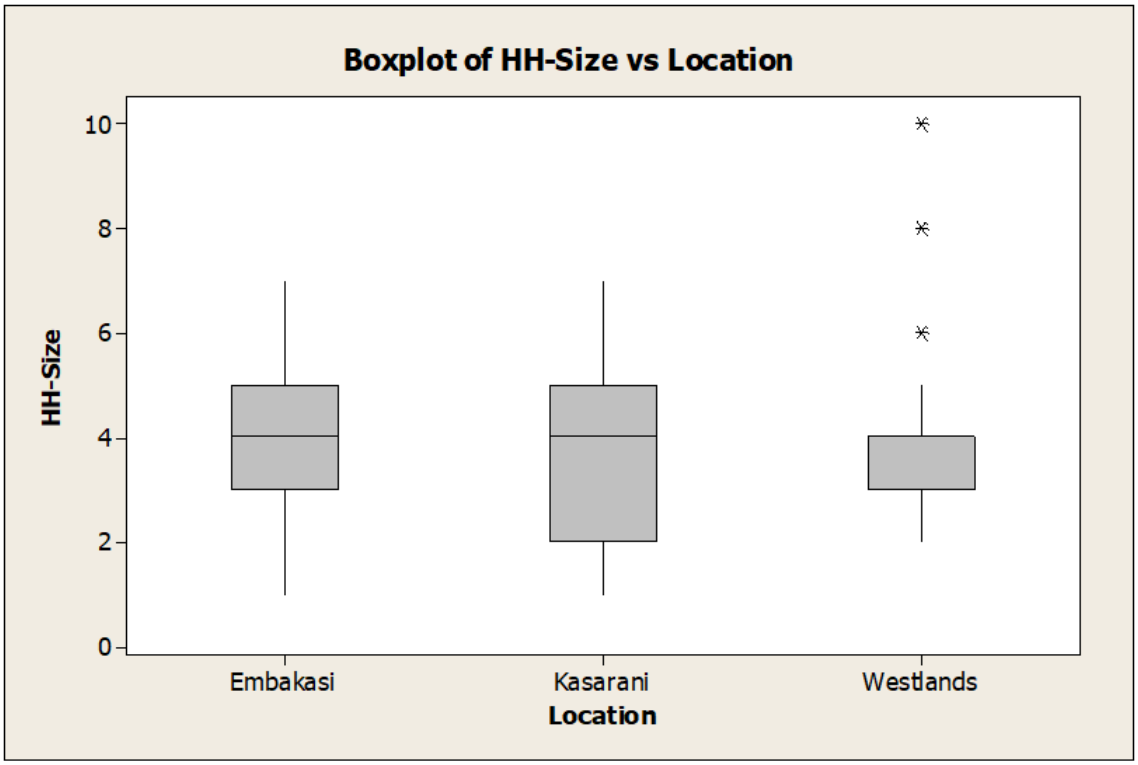

Figure 6: Consumers' Household Size

About 85.11% of consumers' households were headed by the respondent and only 14.89% headed by others. Likewise, 63.76% of all respondent consumers were married as opposed to 34.23% that were single. A majority of the married respondents hailed from *Kiambu* (72.63%) suggesting that these groups had settled with their families on the lands on which they farmed vegetables. This was a useful characteristic because, in a majority of cases, it meant that feedback from respondents was rich with a real-life understanding of the household's income and vegetable consumption decisions.

Likewise, about 50.64% were employed compared to 48.94% that were self-employed. They collectively earned a monthly income of between KShs 10,000 to 350,000 and a mean monthly income of Kshs 104,221. Income varied from KShs 10,000 – 70,000 in Embakasi, KShs 10,000 – 122,000 in Kasarani and KShs 20,000 – 150,000 in Westlands with mean monthly incomes of KShs 28,381 (SE=1,781), 37,183 (SE=1,799) and 70,361 (SE=5,805), respectively.

Table 4: Sex, Age and Marital Status of Vegetable Consumers

Variable		All Households		Embakasi		Kasarani		Westlands	
		Counts	*%*	*Counts*	*%*	*Counts*	*%*	*Counts*	*%*
Sex	Female	118	50.21	38	60.32	68	50.00	12	33.33
	Male	117	49.79	25	39.68	68	50.00	24	66.67
Marital Status	Married	140	59.57	36	57.14	76	55.58	28	77.78
	Single	95	40.43	27	25.71	60	54.29	8	22.22
Age	18-22	24	10.21	4	6.35	20	14.71	0	0.00
	23-27	21	8.94	9	14.29	10	7.35	21	5.56
	28-32	74	31.49	27	42.86	34	25.00	74	36.11
	+33	116	49.36	23	36.51	72	52.94	116	58.33
Employment	Employed	119	50.64	32	50.79	31	49.21	0	0.00
	Self	115	48.94	31	49.21	67	49.26	17	47.22
	Both	1	0.43	0	0.00	0	0.00	1	0.43
Access to Information	Mobile phone	130	55.56	40	63.49	76	55.89	14	40.00
	Computer	41	17.52	16	25.40	25	18.38	0	0.00
	Both	61	26.07	7	11.11	35	25.74	19	54.29
	None	2	0.85	0	0.00	0	0.00	2	5.71

6.3. Vegetable Intake

As illustrated on figure 12, vegetable intake in a household greatly correlated with income levels, with the higher-income groups of and Kasarani, respectively. These patterns also correlated with the households' monthly expenditures on vegetables. Consumers from Embakasi (low-income area) spent the most (Mean monthly vegetable expenditure $\bar{X}$=KShs 3,495) ranging from about KShs 3,000 – 8,000. High-income consumers of Westlands came in second ($\bar{X}$=KShs 3,236 min=Kshs 1,500 max=KShs 5,000), followed by Kasarani spending the least ($\bar{X}$=KShs 2,946 min=KShs 3,000 max=KShs 7,000). Westlands seen to consume vegetables daily and more often than low and medium-income areas of Embakasi.

On the other hand, the kind of vegetable consumed varied with income. Consumers from Kasarani reported consuming about 100% of Kale and about 57.87% of all tomatoes consumed in the study areas. Embakasi came in second, having consumed about 26.81% of all tomatoes while Westlands came in third, reporting to have consumed about 15.32% of the tomatoes. Similarly, Kasarani led in the share of those combining the consumption of tomatoes and a kale at 57.33% followed by Embakasi 27.16% and last was Westlands at about 15.52%.

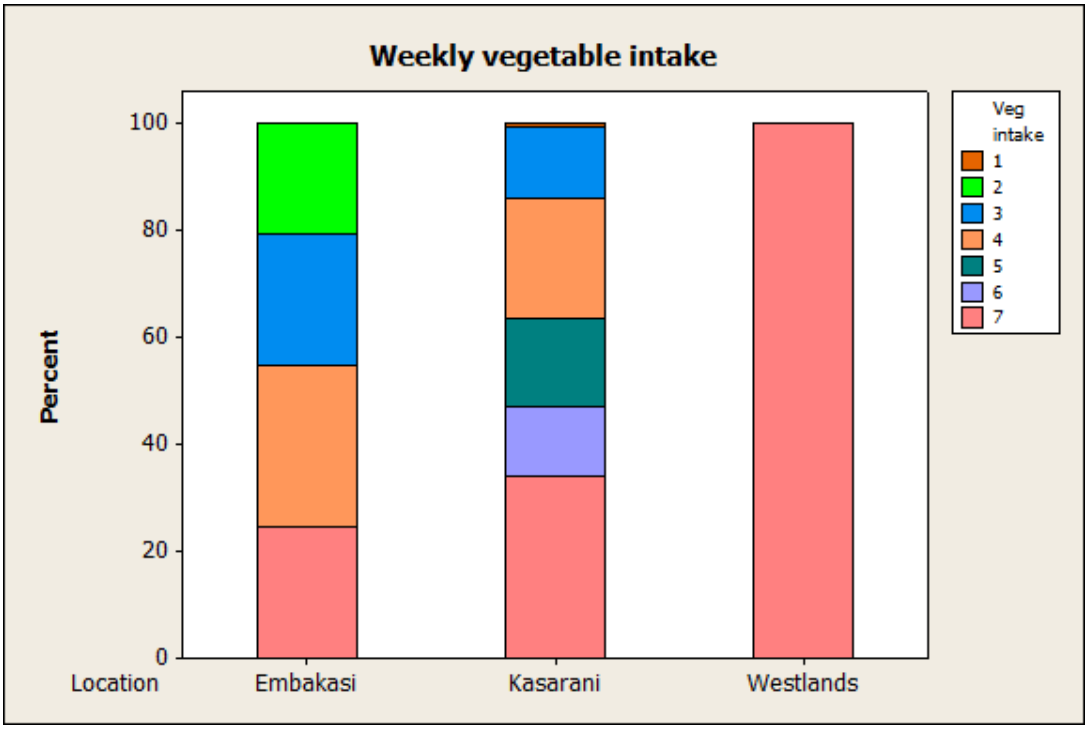

Figure 7: Bar Graphs Illustrating Vegetable Intakes Across Consumer Sites in Nairobi County

6.4. Sources of Vegetables Consumed

Clearly, all vegetables consumed in the study area were sourced from outside the county, most likely grown from Kiambu and Kirinyaga counties and purchased from nearby markets at the village (nearby markets), county markets (County markets), supermarkets, or a mixture of all sources (All). As indicated in the bar-graphs below, more than three-quarters of all households sourced their vegetables from Nearby markets (76.60% of all sources) followed by All (13.62%), supermarkets (9.36%), and least from County markets (0.43%).

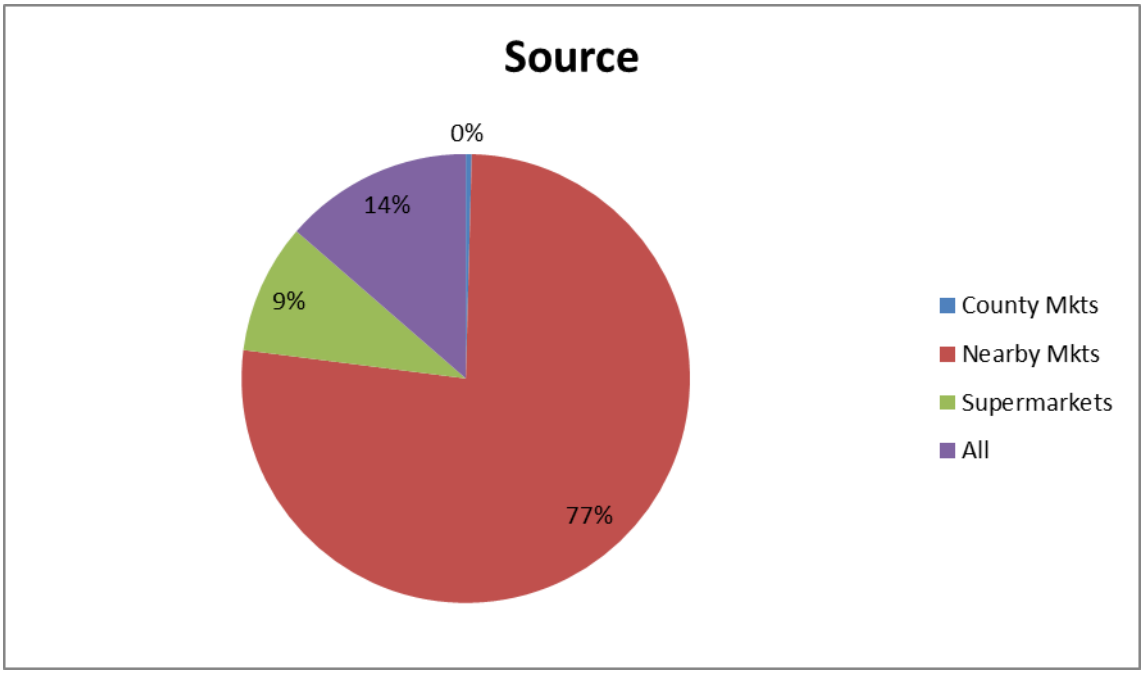

Figure 8: Vegetable Outlets for Consumers

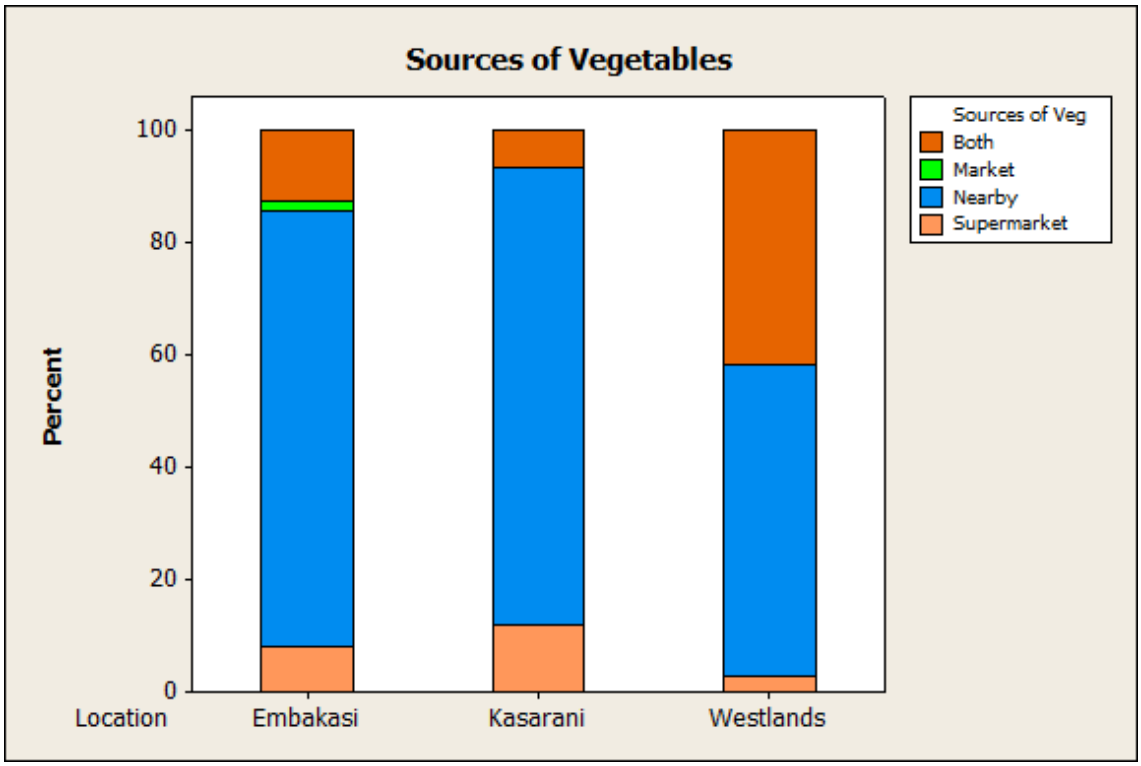

Figure 9: Sources of Vegetables by Study Area

This pattern was replicated in low income areas with most consumers in Embakasi (77.78%) and Kasarani (81.62%) compared to about 55.56% from Westlands. Strangely, low (Embakasi=7.94%) and medium-income areas (Kasarani=11.76%) seemed inclined to more often source their vegetables from supermarkets than high-income areas (Westlands=2.78%). Similarly, shopping vegetables from county markets was least preferred by consumers in low-income areas (Embakasi=1.59%) and none at all in Kasarani (0.00%) and Westlands (0.00%) as is illustrated on the bar-graphs above. Those indicating All markets, are believed to have been sourcing their vegetables from Nearby mkts and supermarkets. They were the most important source of vegetable for Westlands (41.67% of the vegetable sourced), followed by Embakasi (12.70%) and least for Kasarani (6.62%).

6.5. Agribusiness Regulatory Compliance in Agrochemical Utilization Among Vegetable Producers in Kenya

Nearly all farmers interviewed (97.02%) reported using agrochemicals in producing vegetables particularly kales and tomatoes. This is typical of farmers in developing countries such as Kenya and has been observed in similar jurisdictions such as Tanzania (Kariathi, Kassin and Kimanya, 2017) and the Philippines (Hara *et al.*, 2013). However, a majority (44.12%) felt that their compliance was low and only 29.41% rated their compliance as medium. Similar studies have gone ahead to characterize the pesticides under application and have for instance, found that more than one-sixth of the pesticides in use were extremely hazardous, or the waiting period was flouted among nearly two-thirds of the growers.

According to the farmers interviewed, the reasons for the poor compliance were attributed to the following factors: lack of training (reported by 89.71% of the farmers interviewed), failure to use personal protective equipment (PPE; 51.47%), limited access to government extension services (76.47%), limited access to agrochemical use information (70.59%), lack of agrochemical disposal facilities (92.65%) and the fact that compliance was not required by target markets (98.53%). Strangely, though, a majority (60.29%) reported having sufficient experience in handling agrochemicals.

This concurs with existing literature that reveals a majority of growers lacking any official training on pesticides and that nearly one-third doesn't read information available in pesticide labels (Shrestha, Koirala & Tamrakar, 2010).

A majority of respondents (97.88%) reported that the task of ensuring compliance was squarely that of government regulators. However, many (88.09%) were skeptical about the diligence of regulators and felt that regulations alone didn't enhance food safety (93.62%). Additionally, many respondents (85.53%) felt that other key stakeholders were not doing enough to inhibit the reckless use of agrochemicals in the production and trade of vegetables. Nonetheless, they could not identify these other stakeholders.

6.6. Consumers' Willingness to Pay a Premium on Ethically Produced Vegetables

Generally, a majority of respondents were satisfied with the quality of vegetables (93.2%) they consumed and had little concerns about its safety (26.38%) or its reliable supply (1.7%). This arose given that a majority of concerns with agrochemical residues were not expressed directly but were rather implied as illustrated in the table below. Despite the high satisfaction, for instance, when asked whether they considered pesticide residues in their purchase decisions, many consumers responded with either ***disagree*** or ***I don't know***.

Of peculiar interest was the correlation between this implied concern for pesticide residues and socioeconomic status of the household. In this case, high-income households (from Westlands) were more likely to consider agrochemicals in their decisions to purchase vegetables unlike their counterparts in medium and low-income areas of Kasarani and Embakasi, respectively.

Table 5: Household Concerns with Agrochemical Residues in Vegetable Purchase Decisions

Location	I consider pesticide residue in my purchase decisions				
	SD	***D***	***I***	***A***	***SA***
Embakasi	4.76	87.30	1.59	4.76	1.59
Kasarani	0.74	63.97	33.09	2.21	0.00
Westlands	0.00	13.89	86.11	0.00	0.00

The few that raised concerns with safety worried about chemicals or pesticides that were used during production and storage. Likewise, most of the respondents (96.6%) did not know about agrochemicals or their effects on health or the natural environment (73.19%). Nevertheless, a majority preferred consuming organically produced vegetables (91.92%) although many (92.34%) didn't know where to source such safe vegetables.

Table 6: Confidence of Household Heads on Vegetable Suppliers' Ability to Deliver Safe Products

Location	I trust a supplier				
	SD	***D***	***I***	***A***	***SA***
Embakasi	0.00	95.24	0.00	4.76	0.00
Kasarani	0.00	65.44	0.00	17.65	16.91
Westlands	0.00	63.40	0.00	25.53	11.06

At this point the researcher probed the respondents further to assess whether commercial vegetable production used agrochemicals and whether this affected the consumers' perceptions of safety. To this, the respondent reported as follows:

Majority (62.98%) agreed that vegetables produced for commercial trade utilized agrochemicals and 34.47% strongly agreed while only 0.85% and 1.7% disagreed or did not know, respectively. Nonetheless, the majority (96.17%) did not know the particular agrochemicals applied and had not observed any short-term effects resulting from consuming the target vegetables (65.53%). That notwithstanding, many (94.47%) felt that the agrochemicals applied were unsafe inasmuch as they did not consider agrochemical safety in their purchase decisions (64.25%) nor trust the supplier (63.40%) nor know the source of the vegetables (99.57%). For these reasons, as much as 94.05% emphasized the usefulness of information in realizing food safety.

At this point, the researcher asked directly whether consumers would be willing to pay a premium price for vegetables grown with strict adherence to agrochemical ethics. To this, a majority (66.38%) responded in the affirmative while about a third (33.62%) declined. The vast majority of those who declined (96.20%) were those currently consuming both kale and tomato on a regular basis and only a fraction (3.80%) those that consumed kale only. On the flipside, only those that currently consumed kale and tomato answered in the affirmative that they would be willing to pay more for safe products. None that consumed kale only was willing to pay more for safe vegetables.

Table 7: Consumers' Willingness to Pay a Premium for Safe Vegetables

Category	Sub-category	*Willingness to pay more for safer vegetables*	
		Yes	***No***
Vegetable	***General***	66.38	33.62
	Kale	0.00	100.00
	Tomato	0.00	0.00
	Both	100.00	0.00
Location	***Embakasi***	53.97	46.03
	Kasarani	64.71	35.29
	Westlands	94.44	5.56
Sex	***Female***	62.71	37.29
	Male	70.09	29.91
Consider agrochemical residues in my purchase decisions	***Strongly agree***	92.05	7.95
	Agree	83.33	16.67
	Indifference	96.10	3.90
	Disagree	48.98	51.02
	Strongly disagree	100.00	0.00
Consider it Government's role to ensure vegetable safety	***Strongly agree***	92.05	7.95
	Agree	50.70	49.30
	Indifference	0.00	0.00
	Disagree	0.00	100.00
	Strongly disagree	100.00	0.00
I trust a supplier	***Strongly agree***	92.31	7.69
	Agree	95.00	5.00
	Indifference	0.00	0.00
	Disagree	50.34	49.66
	Strongly disagree	0.00	0.00

The sex of the consumer, it seemed, didn't vary the willingness substantially although men were more willing than women to pay for safer vegetables by about 8 percentage points. Lastly, willingness to pay for safe vegetables was rated by socio-economic status of the residence. Low-income areas had the least support at about 53.97% followed by Kasarani (Medium-income areas) at 64.71% while Westlands (high-income areas) offered the greatest support at about 94.44% of consumers. This suggests that willingness to pay for safety could be related to household income.

The researcher integrated other sentiments thought to be crucial in weighing the ethics of producers and suppliers (such as their sense of trust) and inclusion in governance of the sub-sector. In the first case, the consumer responded to a 5-point Likert question rating how much they trusted a supplier to consistently deliver safe vegetables. Surprisingly, as indicated in the table 7 above, those that trusted a supplier were less willing to pay for premium vegetables.

7. SUMMARY OF MAJOR FINDINGS

In this section, presentation of various key findings is made. The presentation in based on key thematic areas teased from the study's objectives and research questions.

7.1. Agribusiness Regulatory Compliance in Agrochemical Use

The study finding reveals that majority (97.02%) of the framers use agrochemicals in producing vegetables particularly kale and tomatoes despite the low (32.21%) compliance to the regulation stipulated and ethical agribusiness practices. Important to note, more male farmers (31.65%) complied twice as much compared to their female counterparts (15.71%). Interestingly, those who farmed tomato were the least likely comply (17.65%) compared to those farming kale (29.13%). Furthermore, the study found out that aaccess to market information was primary in enhancing agrochemical ethics and therefore it materialized farmers' compliance was depended on their level of education as well as access to information. Findings show that farmers exporting their vegetable were more likely to comply with the regulation and ethical agribusiness practices while only 22.54% producing for local consumption middling complied. The study revealed that all farmers registered to farming association or marketing associations' compliance complied with the ethical agribusiness practices.

Majority of the farmers (63.89%) reported that the access to extension services from County governments such as provision of planting materials, information and gear enhance the utilization agrochemicals. Furthermore, majority (68.39%) of the farmers (68.39) reported the use of PPE in agrochemical applications resulted highest compliance levels in the study. Regular visit by agricultural officer to the framers resulted to increased compliance to the agribusiness practices and production of vegetable for there was easy inquiries and skill learning. Majority of respondents (97.88%) reported that the task of ensuring compliance was left upon the government to regulate. However, many (88.09%) were skeptical about the diligence of regulators and felt that regulations due to increased corruption by government officials.

7.2 Consumers' Willingness to Pay for Premium Agribusiness Ethics

The study found out that over four fifths (93.38%) of the respondents were satisfied with the quality of vegetables they consumed and their supplies. Ninety seven percent of the respondents were concerned since agrochemical residues were not expressed directly but were rather implied for they reduced their purchase decisions of buyers. The study revealed that high income consumer from Westlands (91.44%) were likely to consider agrochemicals in their decisions to purchase vegetables compared to medium and low-income from Kasarani and Embakasi (2.21% and 6.35%), respectively. Majority of the vegetable consumers were not aware of varied agrichemical used by fathers as well as their health and environmental effects.

Majority (97.45%) of the respondents agreed vegetables produced for commercial trade utilized agrochemicals with 34.47% being strongly agreed while only 0.85% disagreed that commercial production of vegetable use agrochemical. Surprisingly over four-fifths (96.17%) of the consumers did not know the particular agrochemicals used. The study found out that majority (66.38%) were affirmatively ready to pay more to received standardized vegetable grown in adherence to given rule while over third (33.62%) considered consuming the available vegetable. Majority (96.20%) of the consumers who decline were consuming only kales. Substantially, more men were willing to pay more for vegetable compared to women. The readiness to pay for safe vegetables was contributed by socio-economic status of the residence. Low-income areas had the least support (53.97%), other had moderate support (64.71%) and high support (94.44%).

8. CONCLUSION

This section provides empirical conclusions as drawn from the study findings

8.1. Agribusiness Ethics Compliance in Agrochemical Use

Majority (97.02%) of the framers used agrochemicals in producing kale and tomatoes which led to the low (32.21%) compliance to ethical agribusiness practices. Findings show that male farmers (31.65%) complied more compared with their female farmers (15.71%). Remarkably, tomatoes farmers didn't comply in comparison to kale framers. Furthermore, the study concludes that access to market information was primary in enhancing agrochemical ethics. The study established that farmers exporting their vegetable were more likely to compile with the ethical agribusiness practices as well as the farmers who had being registered to farming association or marketing association.

Finally, provision of extension services by County Governments such as planting materials, information and gear enhance the utilization agrochemicals enhanced the compliance to ethical agribusiness practices. Accordingly, low compliance was attributed to the lack of or limited awareness and access to information, capital and requirements posed by the market, lack of membership in farmers' cooperatives, and low adoption of personal protective equipment.

8.2. Consumers' Willingness to Pay for Premium Agribusiness Ethics

Majority (93.38%) of the respondents was satisfied with the quality of vegetables they consumed and their supplies thus the study concluded the quality provided to the consumers determined the demand for the vegetables. The study concluded that most of the consumers were concerned of agrochemical residues and their health implications which highly determined their buying decisions. High income consumer were likely to consider agrochemicals in their buying decisions while medium and low-income did not consider such agrichemical which was high implicated by the available options. Therefore, the study concluded that majority (73.19%) of buyers were not aware n agrochemicals and their effects on health or the natural environment and those who knew about then preferred consuming organically produced vegetables.

Finally, majority (97.45%) of the buyers agreed vegetables produced for commercial trade utilized agrochemicals therefore the study concluded that consumers did not have sufficient knowledge of the particular agrochemicals used in growing but the high-income consumers were willing to pay more to gets better vegetable with lesser agrichemical. The study concluded that the readiness to pay for safe vegetables was contributed by socio-economic status of the residence.

9. RECOMMENDATIONS

There is need for provision of training of extension officers and advocate for more budgetary allocation on agriculture. The extension officers will in turn train farmers on god farming practices as well as implementation of mitigation measures I relation to toxic pesticides.

Research needs to be conducted to understand the involvement of farmers in the formulation of policies and agribusiness practices rules in order to gain knowledge on the level of acceptance of these polices among farmers in Kenya.

Affirmative action should be implemented at both national and county level to encourage farmers adopted ecological and sustainable practices. This initiative would be made fruitful through training, provision of extension services and provision o better prices for vegetables.

Policy-makers in both county and central governments should be supported in putting into practice and accepting agro-ecological practices like crop rotation, soil fertility management, push–pull technology, and crop selection adapted to local situations.

10. ACKNOWLEDGMENT

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