Understanding Factors Leading to Farmer Non-compliance with Agri-food Safety Regulations in Kenya: A Quantitative Analysis

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Abstract

This article presents the findings of a study that examined the factors that influence farmers' compliance decisions concerning agri-food safety laws in Kenya. A total of 160 farmers in Uasin Gishu County in Kenya were surveyed using semi-structured interviews. Twelve variables were used to test the associations between farmer demographics, instrumental and normative factors as independent variables and agri-food safety regulatory compliance as dependent variable. Regression analysis revealed that deterrence factors, farmer training and extension services, and legitimacy factors are significantly related to farmers' compliance with agri-food safety regulations. These findings suggest that regulators should not only focus on enforcing and tightening regulations but also improve the provision of training and information on agri-food safety regulations for farmers. Furthermore, additional efforts should be directed to making laws simpler, clearer, relevant and appropriate for farmers.

Keywords: farmers; food safety; agri-food safety laws; compliance; Kenya

Agriculture is fundamental to food security and human health (Grace, 2017; Jaffee et al., 2019). However, agricultural products can pose far-reaching negative consequences when contaminated farm produce is consumed (Adegoke et al., 2018). Some of the health risks from consuming contaminated farm produce include contracting diseases and reduced effectiveness of antibiotic drugs on humans (Tang et al., 2017). Food contamination, including metal or chemical residues in farm produce, has been traced to non-adherence to agri-food safety regulations by food producers (Jaffee et al., 2019).

In Kenya, non-compliance with agri-food safety regulations is a major problem for the agricultural sector (Republic of Kenya, 2013). Worries about food safety have increased following serious public health concerns related to chemical, biological and physical contamination (Azziz-Baumgartner et al., 2005; Odwar et al., 2014). One notable agri-food safety scare in Kenya was an outbreak of mycotoxicosis[1] in 2004 (Lewis et al., 2005), caused by the consumption of maize contaminated by aflatoxin.[2] It affected 317 people in the eastern part of Kenya, resulting in 125 human deaths. This critical public health threat and other serious health risks have been traced to breaches of agri-food safety laws such as the non-observance of the required withdrawal or pre-harvest period before sale, where chemicals have been used on livestock or crops; the use of contaminated animal feed; or inappropriate or excessive use of farm chemicals or animal drugs (Azziz-Baumgartner et al., 2005; Nanyunja et al., 2015). The latter has been found to lead to increased resistance to antibiotics in human beings (Muloi et al., 2019). Other agri-food safety concerns cited in the literature include poor post-harvest handling of farm produce, especially maize and groundnuts, leading to contaminated farm produce (Kutto et al., 2011; Odwar et al., 2014).

The Kenyan government has introduced several agri-food safety policies to deal with these safety concerns within the agri-food chain. They include the National Livestock Policy of 2008, Kenya Health Policy of 2014, National Food Safety Policy of 2013, National Policy on Prevention and Containment of Antimicrobial Resistance of 2017 and the National Trade Policy of 2009. Despite these agri-food safety policies, many farmers still fail to comply with food safety regulations. Worse still, attempts to introduce robust agri-food safety regulations such as the Dairy Industry Regulations of 2019 (dealing with sales by producers) and Crop (Food Crops) Regulations of 2018, have been met with resistance from farmers (Mwere, 2019).

The rising incidences of illness and diseases associated with contaminated farm produce, coupled with farmers' resistance to agri-food safety laws point to the need to understand the factors that shape compliance behaviour among food producers. Responding

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[1] Mycotoxicosis occurs when a person consumes or ingests food contaminated by fungi or mould (Peraica et al., 1999). In Kenya, it is mostly caused by consumption of contaminated cereals especially maize and groundnuts, or indirectly through the consumption of milk or meat from livestock infected by feed that is contaminated by fungi. It has also been linked to liver cancer in human beings (Peraica et al., 1999; Republic of Kenya, 2019).

[2] Aflatoxin is a toxic chemical produced by fungi that grows on maize, groundnuts and other food crops (World Helath Organisation, 2016). It has serious health consequences for human beings and animals including death. In Kenya, it most occurs from improper storage of farm produce especially grains (Republic of Kenya, 2019).

to this problem, this article presents the results of a study of the factors that influence the decisions farmers make about compliance with regulations aimed at protecting consumers, within a developing country context. Specifically, the article presents the results of a study of farmers in Uasin Gishu County in Kenya. Investigating factors associated with farmers' decisions whether or not to comply with agri-food safety regulations provides an opportunity to recommend focussed, effective, and acceptable food policies and enforcement strategies to improve food security, protect consumers and ultimately enhance economic growth.

Background to the study

Globally, farmers are located in different environmental and social contexts that inform how they operate and make decisions. According to Mercado, Hjortsø and Honig (2018, p. 652), "food safety compliance is problematic in the context of local production". This is because several localised factors, such as the level and type of farmer organisation, existing local food norms, scale of production, among others, affect how food producers respond to regulations.

In Kenya, the agricultural sector is the most important source of food security and economic development (Kenya National Bureau of Statistics [KNBS] 2020). Specifically, the sector contributes approximately 34.1 percent of the Gross Domestic Product (GDP), accounts for 65 percent of total exports and more than 75 percent of rural employment annually (KNBS, 2020). It also contributes significantly to household income, nutrition and food security (KNBS, 2019). Over 70 percent of the population is engaged in farming, with the majority being small-scale farmers (KNBS, 2019).

Three major factors are important to understanding farming communities in Kenya: the scale of farm operations, ethnic diversity of the communities and the informal sales of farm produce (Hoffmann et al., 2013; Roesel & Grace, 2014). Consequently, addressing food safety in Kenya requires an understanding of these local dynamics (Hoffmann & Jones, 2018).

Regarding the scale of operations, the majority of Kenyan farmers are small-scale producers who farm less than three hectares of land mainly for home consumption and local sale (World Bank & International Center for Tropical Agriculture [CIAT], 2015). In terms of diversity, there are more than 42 ethnic communities in Kenya with different cultures and beliefs about food that strongly influence their food safety decisions, particularly in rural areas (Roesel & Grace, 2014). For example, communities such as the Maasai of Kenya believe in the consumption of raw meat and animal blood (Chege et al., 2015) while other ethnic groups have deep beliefs and practices regarding the use and storage of certain farm produce, especially from livestock. Yet, other communities have informal methods of assessing the safety of farm produce, especially from livestock. For example, among the Kikuyu community, meat safety was traditionally assessed by feeding the meat to a cat. If the

cat consumes the meat, it is considered safe. Yet others use ashes, soil, or red ants to assess meat safety, especially to confirm if it is anthrax[3] free (Roesel & Grace, 2014).

In terms of markets, over 80 percent of Kenyan farm produce is sold in local markets (Hoffmann et al., 2013; Karanja et al., 2014). Local outlets for small scale farmers include village and urban open farm produce markets, green grocers, peri-urban roadside markets, hotels and restaurants, brokers and other middlemen. Factors contributing to the prevalence of spot market transactions and focus on local markets include the long distance between farms and formal urban markets, high transportation costs, the need for quick cash, the difficulty in finding formal buyers, stringent regulations, and delayed payments, among others (World Bank & CIAT, 2015).

The above social and economic factors explain the unique and complex setting in which agri-food safety compliance behaviour among Kenyan farmers is examined. While a few recent studies have attempted to explore why farmers in Kenya fail to comply with food safety regulations or resist new laws (Edewa, 2016; Muriithi et al., 2011; Okello & Swinton, 2005); few have directly acknowledged the diversity of farming communities in Kenya. Moreover, the majority did not investigate compliance behaviour among farmers who produce for local consumption. The present study addresses these gaps in the literature by examining the factors that influence the compliance decisions of farmers who produce for the Kenyan local market.

Determinants of compliance by farmers

A substantial volume of socio-legal literature on agricultural regulatory compliance focuses on the motivations and capabilities of farmers to comply with regulations (Bartel & Barclay, 2011; Foundjem-Tita et al., 2014; Winter & May, 2001; Yan et al., 2016). Some of the factors that influence how farmers respond to regulations include the cost of compliance, the benefits of non-compliance, implementation and enforcement factors, personal norms and social and cultural issues (Toma et al., 2013; Yan et al., 2015). However, the majority of these studies are based on developed countries, with very few examining compliance within a developing country context like Kenya. Those that deal with developing economies fail to address the multi-dimensionality of compliance behaviour. The two main dimensions of interest are instrumental and normative.

The instrumental explanation of compliance behaviour argues that an individual's decision whether or not to comply with regulations is a classical problem of choice involving an analysis of cost and benefits or opportunities and risks (Hauck, 2008). It is consistent with rational choice theory (Clarke & Cornish, 1985), which views regulated actors as utility-

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[3] Anthrax is a rare, serious, and fatal zoonotic disease caused by bacteria that produces toxins that cause haemorrhaging and swelling. It affects mostly livestock and wildlife but humans can contract anthrax by consuming infected carcasses or coming into contact with infected animal tissue. (Otieno et al., 2021; World Helath Organisation, 2008).

maximising agents, where the incentive to maximize benefits or avoid excessive costs is the main motivating factor in the compliance decision-making process. The instrumental explanation is also consistent with deterrence theories, which posit that to change a person's behaviour or ensure people comply with the law, detection probabilities and the severity of sanctions or punishments must be increased. Some of the factors considered by the regulated actors in deciding whether or not to comply include costs or benefits of compliance, the risks of detection and the severity of the penalty (Arias et al., 2015; Yan et al., 2015). In this study, it was expected that farmers consider financial benefit and deterrence (i.e. risks of detection and severity of punishment) in their decisions to comply with agri-food safety regulations. Consequently, the following two hypotheses were developed for testing based on the instrumental dimension of compliance behaviour:

> H1 There is a positive association between financial benefit and farmers' compliance with agri-food regulations.

> H2 Deterrence, specifically risk of detection and sanction severity, is positively related to compliance with agri-food regulations.

Normative factors have been found to influence how an actor responds to the law (Bartel & Barclay, 2011; Davies & Hodge, 2006). One such normative factor is the regulated actor's perception of a regulator as legitimate, trustworthy and fair in their enforcement or general administration of the law (Ramcilovic-Suominen & Hansen, 2012; Winter & May, 2001; Yan et al., 2016). Winter and May (2001) observed that if laws are too legalistic, vague, prescriptive, and complex, compliance declines.

Other normative factors that have been found to influence agricultural regulatory compliance are education, information provision and extension services for farmers (Longo, Akyoo, & Sørensen, 2019; Muriithi et al., 2011). Longo et al. (2019) examined awareness and compliance with feed quality standards among 107 chicken farmers in Tanzania and found that compliance was significantly related to access to extension services, the health consciousness of farmers, and farmers' awareness of the law. In Kenya, Muriithi et al. (2011) investigated the determinants of awareness and compliance with European food safety standards among bean producers. Interviewing 103 farmers, the authors found that compliance with international food standards was significantly related to initial compliance costs, access to extension services, farm size, and financial capability in terms of capital.

Studies have also shown that farmers are likely to comply with regulations when social norms are consistent with formal rules (Burton, Kuczera, & Schwarz, 2008; Siddiki, Basurto, & Weible, 2012; Winter & May, 2001). Social norms in this study cover both injunctive and descriptive norms. Injunctive norms refer to what an actor is expected to do by significant others such as fellow farmers, family members or community members; while descriptive norms involve all that an actor believes to be sensible (Mawanga & Ntayi, 2010). Specifically, in this study, it was expected that what an individual farmer has learned through socialisation or belonging to a community or group such as farmer cooperatives would instil

certain norms on the behaviour of the farmer, which will in turn affect how he or she complies with agri-food safety regulations. It was also expected that the conviction of contaminating food or fear of the impact of unsafe food (in terms of illness or loss of life) would increase agri-food safety regulatory compliance. This conviction of doing the right thing has been known to affect compliance with public health regulations (Murphy et al., 2020). Cumulatively, these social norms (injunctive and descriptive norms) should strongly influence the actors' compliance behaviours.

In addition to the above factors, studies have focussed on the relationship between compliance and regulated actors' knowledge of the law (see, for example, Kaine, et al., 2010; Winter & May, 2001; Yan et al., 2016). Kaine et al. (2010) noted that if farmers are aware of what the law seeks to address and the law itself, compliance levels increase.

Following the normative factors identified in the literature as influencing compliance decisions of regulated actors, the following hypotheses were developed for testing:

H3 Legitimacy, specifically perception of regulations and the regulator, are positively correlated with farmers' compliance with agri-food regulations.

H4 Social norms that drive actors to behave contrary to formal agri-food regulation requirements, have negative relationships with farmers' compliance.

H5 Awareness of food safety regulations has a positive relationship with farmers' compliance with agri-food regulations.

H6 There are positive associations between the provision of information, extension services and training for farmers, as normative factors and compliance with agri-food regulations.

Research Model

Figure 1 provides a visual presentation of the hypothesised relationships among the study variables. In the research model, agri-food safety regulatory compliance is influenced by the instrumental factors of perceived financial benefit (profit or income generated) and deterrence (risk of detection and severity of punishment). The normative factors affecting compliance are information, extension services and training (support with agri-food safety law); social norms (injunctive and descriptive norms); legitimacy (perception of regulation and the regulator) and awareness of law (knowledge of agri-food safety regulations). These independent variables represent the plausible factors identified in the literature that shape agri-food safety regulatory compliance, the dependent variable.

It is also important to note that this study utilises a subjective approach rather than an objective evaluation approach to understanding compliance behaviour as it does not measure actual behaviour. Specifically, it focuses on understanding the perceptions of the regulated

actors towards compliance with agri-food safety regulations. This approach has been used by several researchers (see, for example, Arias et al., 2015; Yan et al., 2015) and is a reliable and valid strategy for understanding compliance behaviour.

Figure 1

Theoretical model of the relationship between variables
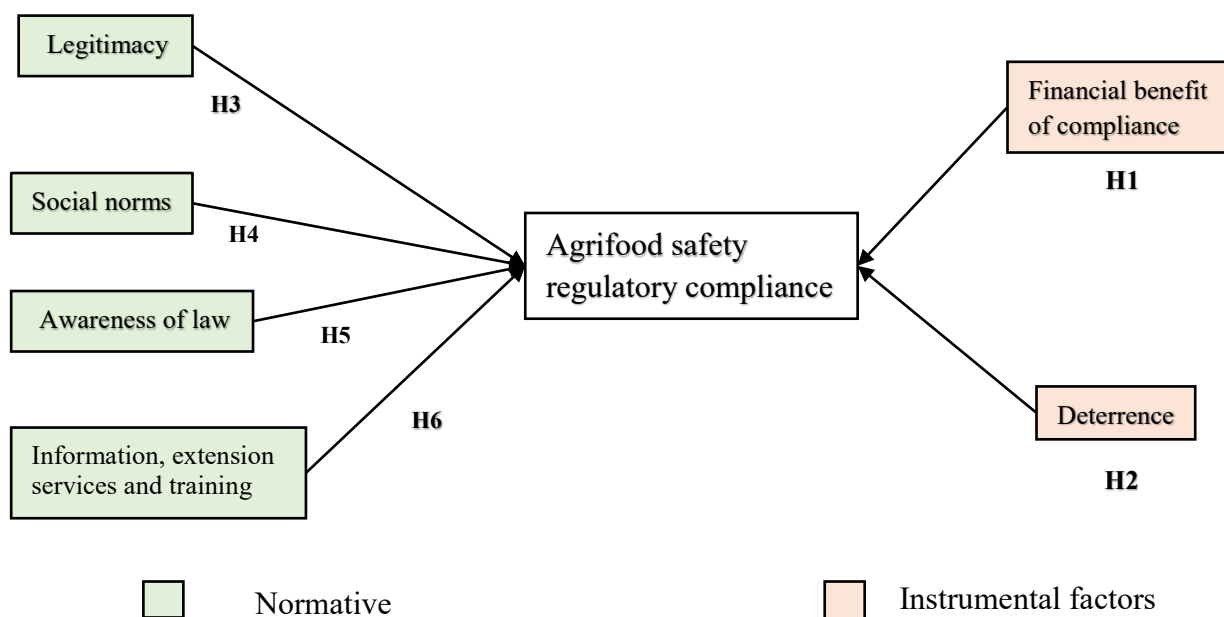
Method

Research location

The study was conducted in Uasin Gishu County (UG County), a major food-producing county in Kenya[4] (see Figure 2 for the location of UG County in Kenya). Approximately 141,547 (46 percent) of the 304,943 households in this County engage in some form of farming (KNBS, 2019) and over 134,490 hectares of land in the County are under crop and livestock production (County Government of Uasin Gishu [CGUG], 2018). The majority of households (approximately 52%) in Kenya, including those in this County, generate income from local sale of livestock and crops such as maize, wheat and vegetables (KNBS 2019). Only a few households generate income from other sources such as work within government agencies (mostly in education and health) and private businesses, especially transport, retail and real estate (CGUG, 2018).

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[4] Kenya comprises 47 Counties. Two or more sub-counties make a County. Two or more wards make a sub-county. Two or more locations make a ward. Two or more sub-locations make a location. Two or more villages make a sub-location.

The average farm holding in this County is five acres and farm sizes range between 2 and 400 acres (CGUG, 2018). This average farm size tends to increase with rurality of the location. Small scale farming accounts for 75 percent of the total agricultural produce in UG County. These characteristics render this region in Kenya most suited to this study.

Instrument and data collection process

Data-gathering involved face-to face-interviews with 160 farmers. Both stratified and random sampling methods were used. The sample was stratified by size of each of the six sub-counties in UG County for appropriate representation by population density, ethnic composition and remoteness (see Figure 2 above and Table 1 below).

Figure 2

The study site
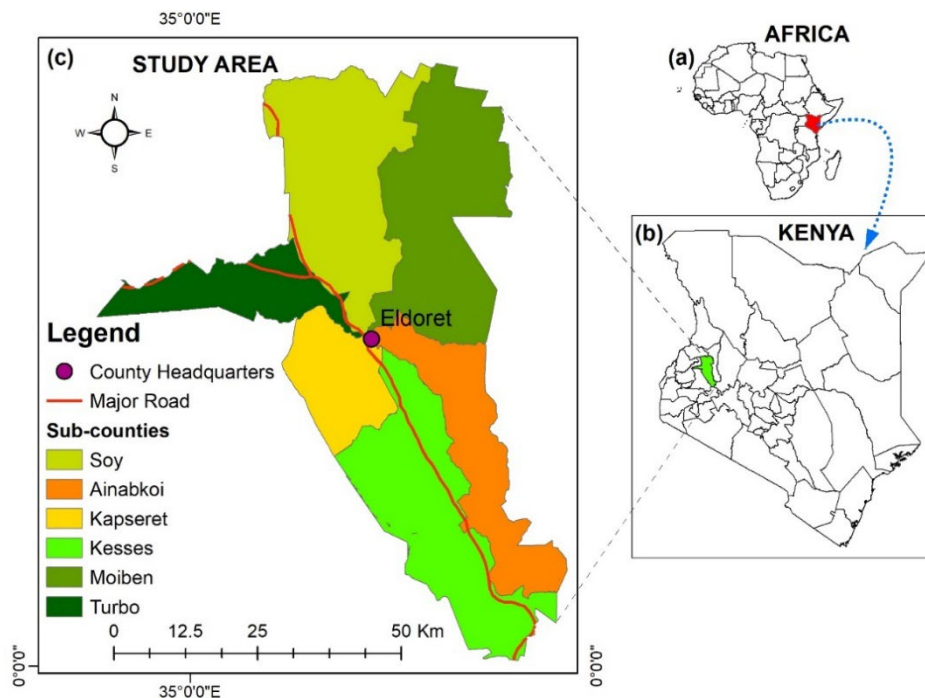
A four-stage sampling technique was utilised to generate the sample. First, proportionate sampling was used to arrive at a sample size for each sub-county. To do this, the total population of farmers engaging in farming was used. Second, one ward[5] was randomly selected from each sub-county. The selected wards were Tembelio in Moiben, Ziwa in Soy, Kapseret in Kapseret, Kaptagat in Ainabkoi, Cheptiret in Kesses and Tapsagoi ward in Turbo Sub-county (see Table 1). Third, one location was randomly selected from

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[5] It is the lowest electoral unit within a sub-county that is delimited for purposes of representation in the County Governments of Kenya in accordance with Article 89 of the *Constitution*. It is usually represented by a person elected as Member of County Assembly for five years. There are 1,450 wards across Kenya and 30 in UG county (County Government of Uasin Gishu, 2018; Republic of Kenya, 2010)

each ward sampled. Fourth, participants were randomly selected from the list of farming households in each location. The sampling frame was generated from the list of farmers accessing government services within the selected locations. Participants in the final list were contacted by their mobile phone numbers and invited to participate in the study. Contact details of farmers were derived from the list of farmers accessing government services within the selected locations. Those who agreed to participate in the survey were invited to a face-to-face interview with the primary researcher. Only three participants declined to participate in the study due to sickness and unavailability within the study period. These participants were randomly replaced from the list of farmers.

Table 1

Distribution of sample size by sub-counties and sampled wards

Sub-counties	Total Households engaging in any form of farming	Proportionate Sample size	Sampled ward
1. Turbo	26,235	30	Tapsagoi
2. Soy	33,352	38	Ziwa
3. Kapseret	16,891	19	Kapseret
4. Kesses	24,309	27	Cheptiret
5. Moiben	22,915	26	Tembelio
6. Ainabkoi	17,845	20	Kaptagat
Total	141,547	160	

Data collection was carried out from September to November 2019. The semi-structured interview questionnaire had five major sections: farmer demographics, farmers' opinions on agri-food safety issues; farmer's attitudes towards food safety regulations and farmers' opinions on factors associated with selling contaminated food.

The survey was administered in either English or Kiswahili language (depending on the language most comfortable to the participant). Interviews were the most feasible method for data collection as literacy levels are low among farmers and many would not be able to complete a questionnaire on their own. Furthermore, the postal system and internet are not reliable for administering questionnaires in Kenya and few farmers have access to the internet or a postal address for a mail survey.

Measurement of variables

The dependent variable, agri-food safety compliance behaviour was measured by asking the question: "do most Kenyan farmers comply with agri-food safety laws"? A Likert-scale was used to measure the response as follows: '4 =Usually', '3=Sometimes', '2=Rarely' and '1=Never'.

There were six independent variables based on the hypotheses and literature review (Winter & May, 2001; Yan et al., 2016). Of these six independent variables, five were single items (i.e. financial benefit of compliance; deterrence; information, extension and training; social norms; and awareness of knowledge). These were measured as dummy variables with a value of one, if the participant identified any as a factor that affected compliance, and zero otherwise. The sixth variable 'legitimacy' comprised two items: one item measured perception of agri-food safety laws, and the other, perception of the regulators' effectiveness in enforcing regulations. The item on the perception of agri-food safety laws required participants to rate the statement: (1) "agri-food safety laws in Kenya are very clear and understandable" on a 5-point Likert scale from 1 = strongly disagree to 5 = strongly agree. The second item on attitude towards the regulator was a dummy variable which took the value of one if the respondent mentioned that the regulator was not effective and zero if not.

Five demographic factors were included in the study as control variables. These were age (1= less than 30 years to 5 =more than 60 years) gender (0= male; 1= female;), education level (1= not gone to school to 5 = completed post-secondary school), religious status (0 = not affiliated to any religion; 1 = affiliated to Islam, Christianity or traditional religion), and farming experience (1= less than 10 years to 5 = more than 50 years). The use of these factors as control variables was based on previous compliance studies and theoretical predictions which have shown that they significantly influence compliance decisions (see for example Murphy et al., 2020; Yan et al., 2015).

Appendix 1 summarises the profile of the survey sample. Of the 160 participants, there were more males (71%) than females (29%). The majority of participants (60.7%) were aged between 30 - 50 years (Mean 48.59 years; SD 11.17 years) and (63.5%) had been farming for less than 20 years (Mean 22.28 years; SD 12.11 years). On education status, the greater proportion of participants (38.8%) had been educated up to secondary level. Regarding religion, 90 percent of participants were Christians. The characteristics of the sample are similar to previous farmer surveys in Kenya (Woolverton & Neven, 2014) and are representative of reported statistics for Uasin Gishu county (CGUG, 2018).

Data analysis

Data were analysed using the Statistical Package for Social Scientists (SPSS) version 26 software. Descriptive statistics were used to describe the independent and dependent variables while hierarchical multiple regression analysis was used to identify factors (independent variables) that influence compliance with agri-food safety regulations by farmers. Prior to conducting a hierarchical multiple regression analysis, relevant regression assumptions were assessed. The results showed that normality, linearity and multi-collinearity were within acceptable limits. Appendix 2 summarises the descriptive statistics and correlation analyses between the study variables.

A three-step hierarchical multiple regression was conducted with agrifood safety regulatory compliance as dependent variable. The demographic factors (i.e. age, gender, level

of education, religious status and farming experience) were loaded into the regression equation as the first block, followed by the instrumental variables (financial benefit of compliance and deterrence) in the second block. Finally, normative variables (social norms, awareness of law, information, extension and training; and legitimacy) were added to the model in the final block. The order in which variables were entered into regression model was based on the literature review, which showed that instrumental factors have stronger influence on farmers' compliance with agri-food safety regulations than normative factors (Longo, Akyoo, & Sørensen, 2019).

Results

Compliance rates

The results showed that many participants (42.8%) believed that farmers rarely comply with agri-food safety regulations in Kenya. Sixty-four participants (40.2%) believed that farmers sometimes comply with food safety laws, while 11 percent thought farmers never comply with food safety laws. Only six percent were of the view that farmers usually comply with agri-food safety regulations. Overall, this finding shows that farmers rarely comply with agri-food safety regulations and therefore, there is need to understand the factors that determine their compliance decisions.

Regression results

Table 2 reveals how the 12 independent variables relate to the dependent variable: compliance with agri-food safety regulations. Overall, the independent variables accounted for 20.1 % of the variance in the dependent variable.

In the first block, all the five demographic factors (i.e. that were controlled) were not significantly related to agri-food safety compliance. Cumulatively, these demographic factors (i.e. gender, level of education, religion status, age and farming experience) explained 1.4 % of the variance in agri-food safety compliance.

The addition of instrumental factors (i.e. perceived financial benefit of compliance and deterrence) increased the explained variance to 6.5 % ($R^2 = 0.065$, adjusted $R^2 = 0.018$, F statistics = 1.383) with deterrence ($\beta = 0.318$, $p < .05$) being significantly related to compliance with agri-food safety regulations. However, demographic factors remained statistically insignificant when instrumental factors were introduced.

When normative variables were introduced in block 3, the variance increased to 20.1% ($R^2 = 0.201$, adjusted $R^2 = 0.129$, F statistics = 2.792). Of the four normative factors, two factors were significantly associated with farmers' compliance with agri-food safety regulations: information, training and extension services ($\beta = 0.270$, $p < .05$) and perceptions of regulations as clear, relevant, understandable and appropriate (an element of legitimacy) ($\beta = 0.199$, $p < .001$). Also, the presence of normative factors weakened the predictive values of

the instrumental factors with deterrence ($\beta = 0.279$, $p < .05$) remaining statistically significant.

Table 2

Summary of Hierarchical Regression analysis for variables predicting Agrifood safety compliance

	Block 1 β	Block 2 β	Block 3 β
Demographic factors:			
Gender	0.046	0.052	0.052
Age	-0.054	-0.022	0.008
Education background	0.037	0.071	0.045
Religious status	-0.086	0.010	0.055
Farming experience	-0.009	-0.017	0.014
Instrumental factors:			
Financial benefit of compliance		0.131	0.145
Deterrence		0.343 *	0.279 *
Normative factors:			
Social norms			0.021
Awareness of law			0.134
Information, extension services and training			0.270 *
Legitimacy			
Perceptions of regulator			0.019
Perceptions of regulations			0.199 *
R^2	0.014	0.065	0.201
Adjusted R^2	0.000	0.018	0.129
R^2 change	0.014	0.051	0.136
F change	0.405	1.383	2.792
Significance	0.119	0.217	0.002

Model 1: Demographic factors
Model 2: Demographic factors+ instrumental factors
Model 3: Demographic factors+ instrumental factors + normative factors
*p<.05; **p<.01; ***p<.001
*p<.05; **p<.01; ***p<.001

Discussion and policy implications

Twelve variables (i.e. five demographic characteristics, two instrumental factors and five normative factors) were examined to assess their influence on agri-food safety compliance in Kenya. Based on prior research, demographic factors were controlled in the regression analysis. Of the independent variables, three variables were significantly associated with agri-food safety compliance: deterrence; provision of information, extension and training; and perception of regulations. The other nine variables were not statistically significant. Consequently, of the six hypotheses tested, three were supported and three were rejected. The hypotheses supported focused on the role of deterrence, provision of information, training and extension services and farmers' perceptions of regulations.

From the above analyses, four major findings emerged. Deterrence plays a significant role in achieving compliance with agri-food safety regulations. Specifically, risk of detection, punitive measures and predictable penalties are necessary for compliance. In this study, loose application of the law and lack of penalties for violators of agri-food safety regulations motivate non-compliance. In other words, if risk of detection is minimal, likelihood of punishment is remote or punishment is not severe, actors would find it beneficial to violate the law because there is no retributive impact. These findings mirror those of previous research on agricultural regulatory compliance elsewhere in the world (see Ramcilovic-Suominen & Hansen, 2012; Yan et al., 2016). For example, Yan et al. (2016) found that deterrence measures, compliance costs, legitimacy and personal morals greatly influence the compliance decisions of farmers.

Closely connected with deterrence measures is the role of persuasive strategies such as education, training and information provision in enhancing compliance by farmers. Specifically, this study has shown that farm extension services have a positive effect on farmers' compliance levels and decision-making. This implies that the more the regulators and other service providers are in contact with farmers, the more likely they will comply with agri-food safety laws. This also shows that regulators should not focus on enforcement strategies alone but they should also consider persuasive strategies to improve compliance by farmers. One overarching strategy is education and information provision, which in this study largely involves extension services. This is consistent with what other agricultural regulatory compliance scholars have found regarding extension service and compliance (see for example, Longo et al., 2019; Muriithi et al., 2011). Longo and fellow researchers reported that extension services were significantly correlated with compliance with chicken feed standards in Tanzania.

Another major finding that emerged from this study is that farmers' perception of agri-food safety regulations has an impact on how they make compliance decisions. Specifically, if farmers perceive regulations as understandable, clear, appropriate and relevant they are likely to comply. The findings also show that the way regulations are designed determine how those who are regulated comply. If farmers perceive regulations as irrelevant, difficult to understand and inappropriate, compliance levels will be low. This means

regulators should pay attention to the design of safety laws in terms of the language used and clarity of expression. This finding is similar to previous research by Siddiki et al. (2012) who reported that good attitude and perceptions of regulations as fair enhance farmers' compliance behaviour. This is also consistent with Kaine (2010) who observed that the more positive a person's perception of regulatory and policy outcomes, the higher the likelihood of compliance.

Lastly, normative factors have a complementary association with instrumental factors. This was demonstrated by a decrease in the predictive value of instrumental factors when normative variables were added to the regression model. This implies that as farmers gain knowledge of the law and what is expected of them, the need for deterrence measures would decrease. It also indicates that regulators should put more effort into improving the relationship between farmers and regulators, enhance training and improve the design of regulations.

The findings from this study are consistent with rational choice theory. Specifically, the lower the likelihood of punishment, the lower the intention to comply. In terms of procedural justice, the finding supports the view that if regulated actors perceive regulations as fair, they are likely to comply with the regulations. This observation is supported by the finding that the more the regulations are perceived as understandable, relevant and appropriate, the greater the likelihood of compliance. It is also supported by the finding that if farmers are trained about agri-food safety laws and why problems are being policed, they are more likely to comply. These observations provide important insight into how compliance strategies should be targeted. Consequently, more effort should be given to increasing deterrence, providing education and information, creating awareness of regulations among farmers, and improving the way laws are designed.

Limitations and suggestions for future studies

There are some limitations of this study that should be considered when interpreting the findings. Given the time and cost constraints, this study focused on Uasin Gishu County, an intensive agricultural county in Kenya. As such, the findings cannot be generalised beyond this county. However, they provide an insight into factors affecting agri-food compliance by farmers to guide further research in other developing economies. Hence, future research could seek to replicate the study with a larger sample in Kenya. Second, since this study relied upon participants' opinions about compliance, one potential limitation is the risk of socially desirable answers (Maxfield & Babbie, 2015). To minimise this limitation, the questions were designed using "the other people" approach (Lynch & Addington, 2011). This is an approach that seeks the opinion of participants about what they think others are doing and not themselves. Future studies might include compliance intention as a precursor to the actual compliance. This can improve reliability and validity of the findings of this study, and hopefully improve the adjusted R^2.

In addition, future research needs to be conducted to verify and refine the different scales that were used to measure instrumental factors and normative factors. Importantly, in relation to deterrence, future studies might utilise the three sub-scales (i.e. detection, punitive measure and predictable punishment) used in this study to improve their applicability, reliability and validity. Likewise, future research studies need to consider the perception of regulation as a multiple item, especially in relation to understandability, clarity, relevance and appropriateness. Lastly, as it was found that perception of regulations and regulators influence farmers' compliance with food safety regulations, future research studies could consider this as a starting point to study farmers' compliance behaviour in relation to agri-food safety.

Conclusion and recommendations

This study sought to determine the factors that shape farmers' compliance with agri-food safety regulations within a developing country context. Specifically, the study examined the factors that motivate farmers to comply with agri-food safety laws in Kenya. The results indicate that deterrence factors, access to farm extension services and farmers' perceptions of regulations, significantly influence compliance with agri-food regulations. Deterrence measures, especially the risk of detection, the likelihood of being punished if laws are violated, and the severity of sanctions in terms of fines and imprisonment were significant to explaining the compliance intentions of farmers. In addition to deterrence measures, persuasive measures such as providing extension services for farmers in terms of training and information provision were significantly related to compliance. The findings also show that, the way farmers perceive regulations has a significant impact on their compliance decisions. For this study, farmers' perception of agri-food safety regulations as relevant, clear, understandable, accessible, current and appropriate were significant motivating factors.

In conclusion, these findings imply that regulators should not only pay attention to increasing deterrence measures but also help farmers understand the regulations and the problems policed. For example, in addition to designing good laws, regulators can utilise persuasive strategies to motivate farmers to comply. Also, regulators should pay attention to how laws are designed in terms of understandability, clarity, relevance and appropriateness. This study contributes to the agricultural compliance literature by examining compliance within a developing country context. It also contributes to the growing literature on food and agriculture criminology.

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Appendicies

Appendix 1

Demographic profile of the survey sample (N = 160)

Variable	Categories	Frequency	Percentage (%)
Gender	Male	114	71
	Female	46	29
Age (years)	Less than 30	18	11.3%
	30-39	47	29.4%
	40-49	48	30.0%
	50-59	26	16.3%
	More than 60	21	13.1%
Education background	Not gone to school	8	5.0%
	Primary school completed (8 years)	51	31.9%
	Secondary school completed (12 years)	62	38.8%
	Completed post-secondary education	39	24.4%
Religious status	No affiliated to any religion	13	8.1%
	Affiliated (Christianity, Islam or tradition religion)	147	91.9%
Farming experience (Years)	Less than 10	54	34.8%
	11-20	52	32.5%
	21-30	32	20.0%
	31-40	17	10.6%
	41-50	4	2.5%
	More than 50	1	0.6%

Appendix 2

Descriptive statistics and correlations between dependent and key independent variables

Variables	Mean	Std. Dev.	1	2	3	4	5	6	7	8
1. Agrifood safety regulatory compliance	2.403	0.764	1							
2. Financial benefit of compliance	0.656	0.476	0.089	1						
3. Deterrence	0.686	0.466	.177*	.172*	1					
4. Social norms	0.725	0.448	0.013	-0.004	0.066	1				
5. Awareness of law	0.522	0.501	0.146	-0.008	0.089	-0.101	1			
6. Information, extension services and training	0.413	0.494	0.074	-0.142	-.181*	-0.024	-0.114	1		
7. Perception of regulator	0.522	0.501	0.105	0.085	0.121	0.055	0.112	-0.254**	1	
8. Perception of regulations	2.881	1.270	.370**	0.046	.186*	-0.014	.189*	-0.142	.344**	1

*p<.05; **p<.01; ***p<.001