Heliyon

Received:
15 July 2018
Revised:
13 December 2018
Accepted:
4 February 2019

Cite as:
Fredah Wangui Maina, John Mburu, Chris Ackello-Ogutu, Henrik Egelyng. Producers' valuation of geographical indications-related attributes of agri-food products from semi-arid lands in Kenya. Heliyon 5 (2019) e01218.
doi: 10.1016/j.heliyon.2019.e01218

Producers' valuation of geographical indications-related attributes of agri-food products from semi-arid lands in Kenya

Fredah Wangui Maina [a,*], **John Mburu** [a], **Chris Ackello-Ogutu** [a], **Henrik Egelyng** [b]

[a] *Department of Agricultural Economics, University of Nairobi, P.O. Box 62053, 00625, Nairobi, Kenya*

[b] *Global Development Section, Faculty of Science, University of Copenhagen, Rolighedsvej 25, 1958, Frb. C, Denmark*

[*] Corresponding author.

E-mail address: fredah.maina@gmail.com (F.W. Maina).

Abstract

Arid and semi-arid lands comprise 84% of Kenya's land, characterised by low and erratic rainfall, and increasing human and animal population. The study sought to determine producers' willingness to pay for protection of unique *terroir-based* agri-food products from semi-arid lands as geographical indications. The sample products comprised two commodities: mangoes from lower Eastern region of Kenya and goats from Baringo in the North Rift region. Using random parameters logit model specification, choice experiments were used to elicit the producers' willingness to pay for attributes related to design of geographical indications (GI) for agricultural products in Kenya. Mango producers attached greater value to having minimum guaranteed payments for their products and receiving price information before the start of the season. Goat producers attached higher value to where to sell the produce as well as use of collective marketing. The producers therefore view GIs as a means to reduce market failures. GIs can enhance collective participation of producers in the semi-arid regions in delimiting the production region responsible for the unique characteristics; hence increase value

https://doi.org/10.1016/j.heliyon.2019.e01218

accruing to producers. The voluntary nature of GI requires effective coordination and governance through GI framework that can limit parallel protection groups of the same product in the same region.

Keywords: Agriculture, Economics

1. Introduction

Unlike high and medium potential agricultural lands where intensive production can result in increased productivity, semi-arid lands are fragile ecosystems, characterised by low and often erratic rainfall. At least 84% of Kenya is comprised by arid and semi-arid lands with limited cultivation of crops (GoK, 2010). Considering they constitute the bulk of agricultural land, and with increased pressure on and subdivision of the high and medium potential lands, management of the semi-arid lands is of importance to food security as well as economic development of the country. Sustainable agriculture from these regions needs to emanate from carefully selected high value products.

The Agricultural Sector Development Strategy (2010−2020) underscores the fact that although the semi-arid lands are fragile, the potential of the existing crops and livestock sub-sectors in the regions remains hugely untapped, thereby subjecting the producers to low productivity and prices, and consequently low incomes and poor livelihoods (GoK, 2010). The regions do have products that derive their unique qualities from the geographical regions of production and, in some cases, the cultural way of the people (for example the Baringo goats). Producers have the opportunity to exploit these *terroir*-based characteristics through use of geographical indications (GI). These can in turn provide them with additional economic, social and ecological benefits contributing to sustainable environmental management that ensures the longevity of the quality and reputation. It is this quality and reputation that consumers are increasingly seeking information about and are willing to pay a premium to access (Tregear and Giraud, 2011).

Apple mangoes from the lower Eastern region of Kenya are reputed to be sweeter and juicier due to the interaction of the existing geographical and climatic conditions. Makueni County is the largest producer of apple mangoes in the country (ABD, 2011). Whereas these mangoes do not necessarily attract higher prices in the local and urban markets, traders usually mix them with those from other regions and sell them as though they are all from lower Eastern − hence consumers are not always assured of the quality and source of the mangoes. Goats from specific regions in Baringo County are reputed to be naturally salty. These tend to attract higher prices than those from other regions. According to a focus group discussion, cattle and goat producers from other regions in the same County often take their livestock to

https://doi.org/10.1016/j.heliyon.2019.e01218

this region to lick the natural salt deposits and feed on the herbs and shrubs for increased immunity and better meat quality.

In seeking quality and reputation, consumers are not *per se* interested in the geographical region of origin as they are in the geographical attribute present in the commodity of preference (Menapace and Moschini, 2012). The study by Menapace and Moschini (2012) shows that GI certification improves the producers' ability to use reputation as a means of assuring consumers of product quality. This reduces the cost of reputation building as consumers receive more information on the product and the producers are aware of what the consumers seek and are willing to pay. Since the mango and goats described above already have pre-existing reputation, additional costs would mainly be on establishing and enforcing the rules governing participation, production, marketing and management of the ecosystem providing the desired geographical attribute. All producers in the production region would be eligible to join with little or no rivalry existing – a club-good characteristic (Benavente, 2010).

Buchanan (1965) introduced the theory of clubs, also calling it the theory of collective membership. Buchanan argues that the utility an individual derives from a good is dependent on the number of people sharing in the benefits. Therefore, the aspect of size of group is an important consideration when determining the utility derived. The theory of clubs, also called the theory of optimal exclusion and of inclusion, further cautions of the problem of free-riding, and hence raising the question of cost of membership and of exclusion. If individuals perceive that they can benefit without being members, they will be more reluctant to pay for the good or service. Geographical indications possess public good characteristics, in as far as the quality of the good is determined by the unique characteristics of the geographical region of production. However, GI have club good characteristics due its collective nature and the restriction of the production region.

Just like club goods, GIs provide collective membership in ownership of the reputation of the product. There is little or no rivalry and participation is voluntary. However, whereas club goods imply finite membership (congestible), with those not able to join being able to form a similar club, geographical indications, as described, encompass all members within the production region that exhibits the described quality in a product, on condition that the members adhere to the jointly developed codes-of-practice. This relates to the infinitely large membership, characteristic of public goods making GI semi-public goods or common poor resources as described by Saunders (2014). Therefore, unlike club goods, having different groups of producers in the same region registering the same product with GI separately is not possible. If allowed, having one unique product registered by several groups in the same region would introduce anti-competition practices and rivalry. This hence leaves the option of GI protection with congestion (Benavente, 2010).

https://doi.org/10.1016/j.heliyon.2019.e01218

As more producers join the GI protection, without careful and intentional monitoring, the congestion is likely to lead to decreased prices, and possibly quality of the product, as described in the club theory (Buchanan, 1965; Saunders, 2014). How this aspect of exclusion and finiteness of membership is handled is important and especially in semi-arid regions where land is already supporting increasingly large human and animal populations. In these regions, poverty levels are high, and due to the prevailing weather conditions, there is the additional challenge of high product perishability.

The codes of practice, and the new marketing structure, should therefore provide producers with an opportunity to benefit from GI protection without over-exploiting the fragile ecosystem. Effective development and enforcement of the sustainable codes of practice are also necessary to provide guidance and restrictions of population and practices in goat management (Baringo) and apple mango trees management (Makueni). The assumed natural outcome would be controlled goats population and number of apple mangoes trees, in a way that is environmentally sustainable. In addition to this enforcement, the producers can hence derive greater benefits by providing near complete quality information and homogenous products to the consumers who are willing to pay a premium price for the products.

The other distinction of GI protection that is important for the semi-arid lands arises from the fact that unique products pre-exist before their registration, complete with commercial relations and distribution channels. However, for most small-scale products, the producers are price-takers and hence benefit the least from the consumer prices. GI protection has the capacity to provide producers more power in setting the price and collective reputation of the product, which in turn could distort the existing channels or the characteristics of the relationships (Rangnekar, 2004). It is therefore imperative that such protection should provide extra benefits to the producers worth the shift in the distribution channels and the effort in creating or adapting new trust relationships. It should also provide near-seamless resolving of any collective action problems that may arise, especially considering that collective marketing has not been strong among both the mango and goat producers.

Another important consideration revolves around the voluntary nature of GIs, another characteristic of club goods. Since participation is voluntary, the GI protection would need to be specific on the behaviour of producers not willing to join in providing the collective reputation of the product (Benavente, 2010). Can such producers still produce the same product, away from (or within) the given codes of practice and sell it outside the production region? The codes of practice provide minimum quality standards but do not necessarily serve as a barrier to entry (Rouviere and Soubeyran, 2008). In the event that producers do not derive sufficient value from a GI protection, it is likely they may opt out of the protection, but still find alternative ways to free-ride on the reputation of the GI products.

https://doi.org/10.1016/j.heliyon.2019.e01218

GI protection in Kenya is provided for under the Trademarks Act (GoK, 2012). No products have been registered yet. The potential for exploitation of GI protection has been on the increase not only in Kenya but also in Africa. Several products have been registered including Rooibos tea (South Africa Trademark), Harrar and Yirgacheffe coffee (Ethiopia Trademarks), Oku white honey (Cameroon GI), Argane oil (Morocco GI) and Zanzibar cloves as GI. The potential is growing, providing Kenyan producers an opportunity to exploit the natural occurring geographical conditions for their benefit.

Like any other registration, GI protection for agri-foods from semi-arid lands of Kenya would accord the producers benefits while at the same time resulting in costs to be incurred for development and maintenance. Some of the envisaged costs and benefits that may accrue in the semi-arid lands of Kenya are summarised on Table 1. These costs are incurred in order to reduce substitutability of the products in the markets and in turn accord producers increased value of their products and region of production (Galtier et al., 2013).

In light of these arguments governing protection of *terroir-based* unique products from semi-arid lands with GIs, the objective of the study was to determine agricultural producers' willingness to pay for geographical indications-attributes in Kenya. The study was based on choice experiments and was conducted among producers of two different products primarily grown in ASAL regions and are characterised with having unique taste qualities that are perceived to be linked to the region of production. These are Baringo Goats, reputed to be naturally salty, and Makueni Apple mangoes, reputed to be sweeter than other apple mangoes grown in other regions in the country, as described earlier. These products are important sources of livelihood among the study population (Musungu, 2008). The production potential in both the livestock and fruit subsectors remains hugely unexploited with producers mainly selling raw products to the market.

2. Methodology

2.1. Empirical approach − application of choice experiments

Geographical indications are an intangible asset. As an intellectual property right, GI is a non-monetary resource, not physical in nature but having special rights and privileges attached to it, claimed legally only in the future. Due to their non-monetary nature and the fact that the concept is relatively new in Kenya, use of choice experiments was considered appropriate to estimate value that would accrue to producers if they registered and marketed their unique products as geographical indications.

The theoretical framework of choice modelling is based on the Lancaster consumer theory (Lancaster, 1966) and is consistent with the random utility maximisation theory (Hanley et al., 2001; Louviere et al., 2003; McFadden and Zarembka, 1974). The

https://doi.org/10.1016/j.heliyon.2019.e01218

Table 1. Summary of potential costs and benefits that may accrue from GI protection in semi-arid lands of Kenya.

A. Costs
1. Participatory demarcation of exact physical boundaries lead by producers, taking care (i) not to exclude eligible producers; (ii) to embrace the natural and socio-cultural dynamics of the region; and (iii) to be clear how to deal with free-riders. This may take several years, but is essential to provide the product specificity
2. Establishing the codes of practice for each product which provides criteria and standards that ensure quality, safety and product uniformity
3. Invest in information-education of actors at local level including the supply chain and consumers
4. Establish control and certification fees, which requires streamlining of the government agencies in charge to avoid multiple deductions
5. Costs related to marketing and promoting the GI product - taking care not to face opposition from current supply chain. They can provide market suitable GI market linkages
6. Investment in infrastructure and production for any adjustments needed (e.g. abattoir for goat meat etc − if at County level, need to differentiate the meat from different regions)
7. Adaptation to rules, methods, and specifications through collective action and group coordination - change of mindset is required; and often times this may be a multi-sectoral undertaking
8. Vigilance and maintaining protection - against misuse of the name and quality of the product, which is already rampant. Dependent on potential benefits perceived by the GI owners
9. Increased input costs since producers have to maintain certain standards of inputs as well
10. Increased investment by richer producers at the expense of the native land owners (esp poorer ones)
B. Potential benefits
1. Improved market access for the producers
2. Increased value/profitability, due to product quality but also due to economies of scale brought about by collective action and reduced transaction costs along supply chain
3. Assurance of qualities or characteristics and authenticity for the consumers
4. Traceability of product source is increased for consumers
5. Complementary effect on other products from the region from the reputation as well as from improved environmental management
6. Increased land values
7. Induced tourism
8. Increased employment and improved rural livelihoods
9. Increased differentiation or competitiveness as a "brand" especially if the characteristics are likely not reproducible elsewhere hence reducing substitutability
10. Coalesced/United and strengthened local governance

Adapted from (Galtier et al., 2008, 2013; Giovannucci et al., 2009)

theory states that utility is the satisfaction an individual derives from choices made based on characteristics that goods possess rather than the entire good *per se* (Lancaster, 1966; Louviere et al., 2003).

To model the heterogeneity that exists among the sampled producers for each study site, the random parameters logit model was used (Greene, 2016; Hensher

https://doi.org/10.1016/j.heliyon.2019.e01218

et al., 2015; Revelt and Train, 1998). This can be empirically demonstrated as follows:

An individual i (i = 1, 2…I) faces a choice amongst j alternatives in each of T choice scenarios and is assumed to choose the alternative with the highest utility, having considered a full set of presented alternatives in the choice scenario t. The mixed logit model hence takes the following formulation:

$$U_{ijt} = \alpha_j + \beta_i' x_{ijt} + \gamma' z_{it} + \varepsilon_{ijt} \quad (1)$$

Where β_i are individual random specific utility parameters; γ are individual parameters, which are fixed for all individuals within a choice set; ε_{ijt} is a parameter vector that is randomly distributed across individuals, i.e. unobserved random disturbances that result in unobserved heterogeneity.

Following Louviere et al. (2003), the probability that an individual chooses alternative j is given by:

$$Prob[choice\ j|i,t,\beta_i] = \frac{\exp\left(\alpha_j + \beta_i' x_{ijt} + \gamma' z_{it}\right)}{\sum_{j=1}^{J_t} \exp\left(\alpha_j + \beta_i' x_{ijt} + \gamma' z_{it}\right)} \quad (2)$$

The mixed logit analysis estimates the impact of the selected attributes on the producers' preference formation following Hensher et al. (2015). The cost variable was the normalising variable to determine the WTP while McFadden's ρ^2 measured the overall fit of the model (Birol et al., 2006; Greene, 2016; Louviere et al., 2003). The parameter estimates of each of the attributes (β_x) and the estimates of the cost attribute (β_y) were used to derive the producers economic value in terms of monetary value the farmers' are willing to pay to register their products as GIs. The following formulation was used to derive the producer willingness to pay value (W):

$$W = -\left(\beta_x / \beta_y\right) \quad (3)$$

2.2. Choice experiment design

The choice experiments were part of a detailed household survey, where sampling was random at population level. The attributes and their levels (Table 2) were determined through literature search, focus group discussions and key informant interviews (Oh et al., 2005; Otieno et al., 2011; Ruto and Garrod, 2009). Attributes were identified and classified as either compulsory or optional for the respective product value chain to be registered as a geographical indication. Producers can only make their choice based on those that are optional. Therefore, attributes related to environmentally sustainable practices, good agricultural practices, animal health, were not included as part of the choice experiments. The attributes used in the choice experiments were therefore (Table 2):

https://doi.org/10.1016/j.heliyon.2019.e01218

Table 2. Attributes and levels for choice experiment for the two study products.

Attribute	Levels assumed for each attribute	Products for which attribute applies	
		Goats	Mango
Collective marketing (CMKT)	0 = No collective marketing 1 = Collective marketing	Yes	Yes
Contractual arrangements with buyers (CONTRACT) (Qualitative)	0 = None/Informal/Short term contracts 1 = Formal/Long term contracts	Yes	Yes
Where to sell (WhereSELL)	0 = Directly to traders 1 = To designated abattoirs	Yes	N/A
Preferred group size (GRPSIZE)	0 = No groups (producer join association individually) 1 = Small groups (less than 70 members) [Sm_GrpSize] 2 = Large groups (more than 70 members) [Lg_GrpSize]	Yes	N/A
Expected price information received at beginning of season (ExPRICE)	0 = No prior expected price information received [NoExPrice] 1 = Information on expected prices received prior to sale [ExPriceSell] 2 = Information on expected prices received beginning of season [ExPriceSeas]	N/A	Yes
Minimum guaranteed return (MGR)	0 = No minimum guaranteed price (rely on markets) 1 = Minimum guaranteed price received	N/A	Yes
Preferred level of GI protection (PrLEV)	0 = No protection (Retain current) [CurrentPrtLvl] 1 = County level CountyPrtLvl] 2 = Regional level [RegPrtLvl]	N/A	Yes
Cost of maintaining the Protection (COST) (KES/HH/year)	Kenya Shillings (**KES**) to be paid by each household each year [100 KES appx ≈ 1USD]	100 500 1200	50 100 200

Among the goat producers, the maximum cost is equivalent to the amount the producers pay to access various services, when need be. The amount, KES 1,200 (USD 12) is the price of one kid. Among the mango producers, the maximum cost KES 200 (USD 2) is equivalent to the amount they pay for group subscription or access to value addition services. Each choice set had three alternatives comprising a pairwise combination of the orthogonal profiles (related to different levels of GI related attributes), and an opt-out alternative, which represented the status quo. The individuals were required to make a choice based on the first two alternatives, and if none was preferred, they opted for the status quo (which was the reference alternative) (Rose et al., 2014). Two alternatives reduce the problem of information overabundance that would influence respondents choice when faced by too many alternatives (Chung et al., 2011).

Following Rose et al. (2014), thirty six orthogonal choice sets organised in six blocks of six (6) sets each were developed using NGENE 1.1.2 software. Each set

https://doi.org/10.1016/j.heliyon.2019.e01218

had three alternatives. A block of the orthogonal sets was administered to each of 36 randomly selected respondents in the respective study area. Using NLOGIT 5, co-efficients for the attributes in each of the studies were determined and used to develop 24 efficient choice sets in the NGENE 1.1.2 software, with a d-error of 0.14 and 0.07 for goats and mangoes analyse respectively.

The efficient choice sets were organised in six blocks of four (4) sets each, and J = 3 alternatives (scenarios). Each respondent in the study was presented with a series of T = 4 efficient choice sets. Table 3 provides an example of a choice scenario presented to respondents in the goat production region of Baringo County.

2.3. Study sites and sample size

The study was conducted in semi-arid regions of two counties within Kenya, Baringo in the North Rift for goat production (n = 135) and Makueni in the lower Eastern for mango production (n = 137). Apple mangoes were specifically selected for this study based on feedback from traders, although geographical indications are about the region of production and not the variety. The semi-arid regions are characterised by fragile ecosystems, low rainfall and crop productivity. Whereas the export market for Kenyan goat meat prefers meat from young goats, producers in Baringo do not sell their goats young. Characterised by strong cultural linkages, they keep the goats as a sign of wealth and only sell them when in financial need or in case of a severe drought. In Makueni, mango production season lasts between November and March, starting as early as September in some parts of the County where irrigation is practiced. The short harvesting season, with peak production lasting between late December and February, is characterised by low producer prices and low bargaining power due to lack of effective collective action (USAID-KAVES, 2015). These study sites and potential GI products were selected based

Table 3. An example of a choice set presented to respondents in Baringo County (Block 6, Scenario 4).

Attribute	Alternative A	Alternative B	Alternative C (Status quo)
Where to sell goat meat	Directly to traders	To designated abattoirs	Directly to traders
Mode of market access	Each producer sells on their own	Collective marketing	Each producer sells on their own
Preferred size of group to join GI producer association	Large groups (more than 70 members)	Small-medium groups (15−70 members)	No group (producer joins on their own)
Contracts with buyers	Formal/long term contracts	No contracts/informal/ short-term contracts	No contracts/informal/ short-term contracts
Cost of registering/maintaining the GI (KES/HH/year)	KES.500	KES.1200	KES.100
I prefer alternative:	☐	☐	☐

https://doi.org/10.1016/j.heliyon.2019.e01218

on a criteria compiled from different literature sources (Bramley and Biénabe, 2013; Giovannucci et al., 2009; Vandecandelaere et al., 2010).

Collective action is low among the goat producers, with most of it revolving around setting the selling price. Current regulations relate to grazing and prices, the latter of which many producers do not enforce especially since they sell the goats when in financial need. The goats browse on communal fields covered with various herbs and shrubs and the soils provide natural salt licks all of which combine to give the unique taste in the goat meat.

Among mango producers, collective action at the time of study was strong in relation to production and weak in marketing. The Horticultural Crops Directorate and the Ministry of Agriculture provide advice on good agricultural practices governing mango production. The establishment of a mango-processing factory in the County is deemed to contribute to improved collective marketing. However, there still exists the fresh fruit market in urban regions, which brokers often use to exploit the producers.

2.4. Data collection and analysis

The choice experiment and household survey were conducted between June and August 2015. Based on the results of literature review and key informant interviews, GIS mapping was used to delineate the goat and mango production regions. A sampling frame comprising the respective commodity producers was developed and sampling was randomly done within each sub-county. The producers were mainly small scale in nature. Data was analysed using Limdep/Nlogit version 6.0. The utility parameters for all the attributes presented to the respondents were defined as random parameters with an assumed normal distribution. The cost attribute was specified as fixed in the random parameter model specification to enable derivation of the WTP distribution (Revelt and Train, 1998). The models were estimated using maximum simulated likelihood procedures of the random parameters logit with 100 Halton draws for the simulations following Hensher et al. (2015).

3. Results and discussions

3.1. Socio-economic characteristics of the households

The mean ages of the household heads were approximately 46 years and 52 years among goat and mango producers respectively, with at least 85% of the households being male-headed. The average number of years spent in formal education was between 9.5 years in Baringo and 10.7 years in Makueni counties respectively (Table 4).

Once they understood the GI concept, at least 84% of the producers in both study counties indicated their willingness to contribute for GI protection. At least 45%

https://doi.org/10.1016/j.heliyon.2019.e01218

Table 4. Socio-economic characteristics of the household heads (HHH).

Socio-economic characteristic	Goats	Apple mango
Age of HHH (in years) *(std. error in brackets)*	46.4 (16.7)	52.4 (14.0)
Male headed households	91%	85%
Household accessing extension services	47%	68%
Aware of their products uniqueness	93%	85%
HHH formal education (in years) *(std. error in brackets)*	9.5 (10.3)	10.7 (4.4)

of all producers were accessing extension services at the time of the study, which were providing credible source of information.

3.2. Random parameter model estimates

The maximum likelihood estimates for the mixed logit models for each of the potential GI commodities are presented on Table 5 and Table 6. The cost attributes for all commodities had the expected negative sign that were also significant. Further, the standard deviation of at least four and two of the coefficients for mango and goat analyses were significant, thus giving evidence of preference heterogeneity around the mean for the parameters at 95% confidence level (Johns et al., 2008).

Receiving price information at the beginning of the season, having a county level protection and having minimum guaranteed return were the variables that had the

Table 5. Coefficients and distributions of random parameter logit estimates for the utility functions of mango attributes.

Parameters	*Coefficient*±	*Std. Dev. of coeff*±
Receive expected price beginning of season	2.472*** (0.807)	1.162 (0.720)
Receive expected price at selling time	1.835 (1.294)	2.289* (1.211)
Minimum guaranteed return	2.264*** (0.477)	1.860*** (0.540)
County level protection	2.440*** (0.875)	1.944* (1.168)
Regional level protection	0.289 (0.726)	2.698*** (0.649)
Collective marketing	2.043*** (0.386)	1.317*** (0.411)
Contracts	0.677** (0.327)	2.450*** (0.135)
COST	-0.006*** (0.002)	
McFadden R^2 adjusted	0.429	
Log-likelihood	-313.4	
Chi square	471.8***	

***, **, * denotes significance at 1%, 5%, 10% level.
±standard error in brackets.

https://doi.org/10.1016/j.heliyon.2019.e01218

Table 6. Coefficients and distributions of random parameter logit estimates for the utility functions of goats attributes.

Parameters	*Coefficient*±	*Std. Dev. of coeff*±
Collective marketing	0.499*** (0.154)	0.100 (0.262)
Contracts	0.625*** (0.149)	0.403 (0.258)
Small group size	0.195 (0.232)	0.958** (0.463)
Large group size	0.496** (0.227)	1.827*** (0.337)
Where to sell	0.847*** (0.167)	0.682 (0.187)
COST		-0.002*** (0.000)
McFadden R^2 adjusted		0.168
Log-likelihood		-497.5
Chi square		200.3***

***, **, * denotes significance at 1%, 5%, 10% level.
±standard error in brackets.

most significant influence on mango producers' choices. Having contracts with traders was the least considered attribute when the respondents were making their choices (Table 5).

The RPL model coefficients for goat meat producers were significant with the exception of small group size as a preferred mode of organisation under GI protection. The attributes relating to group size and selling to abattoir were sources of heterogeneity among the producers. During the focus group discussions, it was evident that most of the goat keepers preferred not being in groups. However, although not a requirement for GI protection, enforcement of the registration and providing collective reputation to the market requires there to be collective action among the producers. In this case, the goat producers preferred to be organised in large groups of more than 70 persons. Selling the goats to an abattoir (where to sell) and having contracts with buyers were the attributes that influenced the choices by the goat keepers (producers) most (Table 6).

3.3. Producers' valuation (willingness to pay) for GI related attributes

The producers' willingness-to-pay results are based on the WALD test using Delta method and they show the significance of the WTP based on the Z-statistics. The mango producers had a higher willingness to pay for price related variables compared to those related to the region of protection and collective action (Table 7).

Goat producers attached most value to being able to sell their goats at an abattoir (where to sell) followed by having contracts with the buyers of goat meat. During the focus group discussions, the goat producers indicated that goats are a sign of wealth and they only sell when in need of finances and they do not engage in selling young goats. Due to over-supply during peak selling seasons, the prices drop.

https://doi.org/10.1016/j.heliyon.2019.e01218

Table 7. Producers' willingness to pay for GI attributes for the attributes of the two commodities.

	Mango	Goats
Receive price info beginning of season	399.3*** (122−676)	
Receive price info at selling	296.4 (-80−673)	
Minimum guaranteed return	365.8*** (98−633)	
County level protection	394.2* (-19−808)	
Regional level protection	46.6 (-197−290)	
Collective marketing	330.0*** (93−567)	207.3*** (86.2−328.3)
Contracts with buyers	109.3* (-4−223)	259.6*** (125.2−394.0)
GI registration through small groups		80.9 (104−266)
GI registration through large groups		206.1** (16.6−395.6)
Where to sell		351.7*** (208−495)
Total WTP	1,598.6	1,024.7

,* - significant at 95% and 99% level of significance.
Blank cells indicate the attribute was not part of the respective product analysis (95% confidence interval in brackets).

Having contracts would ensure that the prices are stabilised. On the downside, contracts could also deny producers higher prices in future time that is still within the contract period. However, the contracts as well as formalised selling point increase excludability for the unique potential GI product.

When asked how much the producers would willingly contribute towards protection of their unique products with GI, the total WTP derived for the attributes on Table 7 is higher than what some of the producers were individually willing to pay. This therefore points to the fact that GI protection and its voluntary nature can lead to exclusion of producers within the study region. The disadvantage this poses is that traders and consumers are able to access the unique product from within the study region but a lower price from the non-participating producers. This is especially so if there is no distinguishing characteristic of the products and the value/benefits that accrue to members of the GI protection do not equal or exceed the membership payments (Thiedig and Sylvander, 2000). The region of production provides a public good and not a private good, hence any producer in the region is capable of having the same quality product.

From the analysis, producers' willingness to pay for collective marketing for both products was KES 330 (USD 3.3) and KES 207 (USD 2.07) for mango and goat respectively (Table 7). Collective action is a major aspect for the success of GI protection (Barjolle and Sylvander, 2000; Reviron and Chappuis, 2011). By engaging in collective marketing, the producers present a joint product to the market, hence establishing exclusion and exclusion costs restricted to the production region, making it a private good. Collective marketing will affect the current supply chain and, if

https://doi.org/10.1016/j.heliyon.2019.e01218

successful, it is likely to provide the producers an advantage in setting the price and ensuring lasting reputation of the product.

Receiving expected price at the beginning of the season and having minimum guaranteed return/price were the two most valued attributes among the mango producers that would motivate them to participate in GI protection. In Kibwezi East sub-county in the mango study region, the producers were able to get at least USD 0.6 (KES.60) per piece of mango sold to exporters compared to USD 0.05 (KES 3) when selling to traders from the local markets. Having the price information at the beginning of the season (combined with contracting) is an incentive to producers to manage the product and its reputation sustainably. A GI registration would ensure little or no rivalry of prices within the production region. However, if membership increases due to the absence of rivalry, production is likely to increase and this could in turn result in reduced prices for the members in the long-term.

4. Conclusions

The study undertook to determine the producers' willingness to pay for registration and protection of different unique products in semi-arid regions of Kenya with geographical indications. The producers valued market-related attributes higher compared to those related to protection of their products. The protection should necessarily provide the market-related attributes considered important by the producers. These assure the producers of defined markets and prices that have a level of guarantee over time. Using geographical indications protection would provide the producers with an opportunity to delimit the production region responsible for the unique product characteristics. This in turn increases the value derived from their products, while at the same time providing consumers with information needed to make the choice of purchasing the product agreeing with previous observation by Galtier et al. (2013). In a study determining producer perceptions towards GI protection, the producers of goat meat highlighted the importance of environmental and institutional attributes. These included managing the environment for sustainability, having better market access and prices as well as the role of policies and institutions in ensuring the success of the registration, hence informing their willingness to pay.

The apple mango producers exhibited strong preference for price related attributes while goat producers exhibited strong preference for attributes related to the mode of selling (i.e. where to sell, contracts with traders and collective marketing). Goat producers revealed strong preference for the mode of sell of the GI product as well as how (contract marketing).

As opposed to protecting the products with collective marks, where an individual or group owns the mark, geographical indications give collective rights to all producers

https://doi.org/10.1016/j.heliyon.2019.e01218

in the region. The attributes in the analysis could apply in the possibility of protection using either collective or certification trademarks. However, collective marks would serve like a club good, as it has exclusivity on attaining the maximum number of participants. Certification mark on the other hand, especially where owned by a State department, would provide an effective way of enforcing the codes of practice. However, although all three are associated with protection of reputation as well as market distinctiveness (da Silva and Peralta, 2011), certification and collective trademarks would not necessarily attribute the product quality to the characteristics of a given production region, the essence of geographical indication protection. Especially considering the fact that the producers are mainly smallscale, a *sui generis* geographical indications law in Kenya would hence be a more appropriate protection compared to the current use of trademarks. Trademarks as currently drawn up do not provide for specificity of the product based on the region of production and would pit the less resource-endowed producers at a disadvantage as richer producers benefit from the trademarks.

Declarations

Author contribution statement

Fredah Wangui Maina: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

John Mburu: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Chris Ackello-Ogutu: Conceived and designed the experiments; Wrote the paper.

Henrik Egelyng: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Funding statement

This work was supported by funding from the Consultative Research Committee for Development Research (FFU), Grant Number 13-02 KU (DK).

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

https://doi.org/10.1016/j.heliyon.2019.e01218

References

ABD, 2011. The Mango Sub-sector in Eastern Region, Kenya: the Results of Mango Tree Census and Baseline Survey for Eastern Region. Agribusiness Development (ABD).

Barjolle, D., Sylvander, B., 2000. Some factors of success for "origin labelled products" in agri-food supply chains in Europe: market, internal resources and institutions. In: Sylvander, B., Barjolle, D., Arfini, F. (Eds.), The Socio-Economics of Origin Labelled Products in Agri-Food Supply Chains : Spatial, Institutional and Co-ordination Aspects. Le Mans, France: European Association of Agricultural Economics Seminar 67th October 28−30, 1999. INRA, Versailles, 2000. Retrieved from. https://lib.ugent.be/catalog/rug01:000696966.

Benavente, D., 2010. Graduate Institute of International and Development Studies Working Paper. The Economics of Geographical Indications: GIs Modeled as Club Assets, Vol. 10/2010. Graduate Institute of International and Development Studies, Geneva, Switzerland.

Birol, E., Smale, M., Gyova, A., 2006. Using a choice experiment to estimate farmers' valuation of agrobiodiversity on Hungarian small farms. Environ. Resour. Econ. 34, 439−469.

Bramley, C., Biénabe, E., 2013. Guidelines for selecting successful GI products. In: Bramley, C., Biénabe, E., Kirsten, J. (Eds.), Developing Geographical Indications in the South: the Southern African Experience, Vol. 1st. Springer, London, pp. 123−136.

Buchanan, J.M., 1965. An economic theory of clubs. Economica 32 (125), 1−14.

Chung, C., Boyer, T., Han, S., 2011. How many choice sets and alternatives are optimal? Consistency in choice experiments. Agribusiness 27 (1), 114−125.

da Silva, E.F., Peralta, P.P., 2011. Collective marks and geographical indications - competitive strategy of differentiation and appropriation of intangible heritage. J. Intellect. Property Rights 16 (3), 246−257. Retrieved from. http://nopr.niscair.res.in/handle/123456789/11974.

Galtier, F., Belletti, G., Marescotti, A., 2008. Are Geographical Indications a way to "decommodify" the coffee market?. In: People, Food and Environments: Global Trends and European Strategy: 12th Congress of the European Association of Agricultural Economists (EAAE). Ghent, Belgium Retrieved from. https://ageconsearch.umn.edu/bitstream/43834/2/508.pdf.

Galtier, F., Belletti, G., Marescotti, A., 2013. Factors constraining building effective and fair geographical indications for coffee: insights from a Dominican case study. Dev. Policy Rev. 31 (5), 597−615.

https://doi.org/10.1016/j.heliyon.2019.e01218

Giovannucci, D., Josling, T., Kerr, W.K., O'Connor, B., Yeung, M.T., 2009. Guide to Geographical Indications: Linking Products and Their Origins. International Trade Centre, Geneva, Switzerland. Retrieved from. https://www.origin-gi.com/images/stories/PDFs/English/E-Library/geographical_indications.pdf.

GoK, 2010. Agricultural Sector Development Strategy: 2010−2020. Government of Kenya, Nairobi, Kenya.

GoK, 2012. Trade Marks Act, Cap 506 (1982). Government of Kenya, Nairobi, Kenya [Revised 2012].

Greene, W.H., 2016. NLOGIT Version 6 − Reference Guide. Econometric Software, Inc, Plainview, NY.

Hanley, N., Mourato, S., Wright, R.E., 2001. Choice modelling approaches: a superior alternative for environmental valuation? J. Econ. Surv. 15 (3), 435−462.

Hensher, D.A., Rose, J.M., Greene, W.H., 2015. Applied Choice Analysis: A Primer, second ed. Cambridge University Press, UK.

Johns, H., Hanley, N., Colombo, S., Özdemiroglu, E., 2008. Economic valuation of environmental impacts in the severely disadvantaged areas in England. In: Birol, E., Koundouri, P. (Eds.), Choice Experiments Informing Environmental Policy − A European Perspective. Edward Elgar Publishing Limited, Cheltenham, UK, pp. 82−105.

Lancaster, K., 1966. A new approach to consumer theory. J. Polit. Econ. 74, 132−157. Retrieved from. http://www.jstor.org/stable/1828835.

Louviere, J.J., Hensher, D.A., Swait, J., 2003. Stated Choice Methods: Analysis and Application, Vol. 2. Cambridge University Press, Port Chester, NY, USA.

McFadden, D., Zarembka, R., 1974. Frontiers in Econometrics.

Menapace, L., Moschini, G., 2012. Quality certification by geographical indications, trademarks and firm reputation. Eur. Rev. Agric. Econ. 39 (4), 539−566.

Musungu, S.F., 2008. The protection of Geographical Indications and the Doha Round: Strategic and Policy Considerations for Africa, QUNO IP Issue Paper, Vol. 8. Retrieved from. http://www.quno.org/sites/default/files/resources/QUNO-PROTECTION+OF+GEOGRAPHICAL+INDICATIONS-AFRICA.pdf.

Oh, C.-O., Ditton, R.B., Gentner, B., Riechers, R., 2005. A stated preference choice approach to understanding angler preferences for management options. Hum. Dimens. Wildl. 10 (3), 173−186.

Otieno, D.J., Ruto, E., Hubbard, L., 2011. Cattle farmers' preferences for disease-free zones in Kenya: an application of the choice experiment method. J. Agric. Econ. 62 (1), 207−224.

https://doi.org/10.1016/j.heliyon.2019.e01218

Rangnekar, D., 2004. The Socio-Economics of Geographical Indications: A Review of Empirical Evidence from Europe (Intellectual Property Rights and Sustainable Development No. Issue Paper No. 8). Retrieved from. https://www.ictsd.org/sites/default/files/research/2008/07/a.pdf.

Revelt, D., Train, K., 1998. Mixed logit with repeated choices: households' choices of appliance efficiency level. Rev. Econ. Stat. 80 (4), 647–657. Retrieved from. https://eml.berkeley.edu/wp/train0797b.pdf.

Reviron, S., Chappuis, J.-M., 2011. Geographical indications: collective organization and management. In: Barham, E., Sylvander, B. (Eds.), Labels of Origin for Food Local Development, Global Recognition. CAB International, Oxfordshire, UK, pp. 45–62.

Rose, J.M., Collins, A.T., Bliemer, M.C., Hensher, D.A., 2014. NGENE Version 1.1.2 - the Cutting Edge of Experimental Design for Stated Choice Experiments.

Rouviere, E., Soubeyran, R., 2008. Collective reputation, entry and minimum safety standard. In: 12th EAAE Congress on 'People, Food and Environments: Global Trends and European Strategies. European Association of Agricultural Economists, Gent, Belgium. Retrieved from. https://econpapers.repec.org/paper/agseaae08/44465.htm.

Ruto, E., Garrod, G., 2009. Investigating farmers' preferences for the design of agri-environment schemes: a choice experiment approach. J. Environ. Plann. Manag. 52 (5), 631–647.

Saunders, F.P., 2014. The promise of common pool resource theory and the reality of commons projects. Int. J. Commons 8 (2), 636–656.

Thiedig, F., Sylvander, B., 2000. Welcome to the club? An economic approach to geographical indicators in the European Union. Agrarwirtschaft 49 (12), 428–437.

Tregear, A., Giraud, G., 2011. Geographical indications, consumers and citizens. In: Barham, E., Sylvander, B. (Eds.), Labels of Origin for Food Local Development, Global Recognition. CABI, London, UK, pp. 63–74.

USAID-KAVES, 2015. Mango Value Chain Analysis. USAID, Nairobi, Kenya.

Vandecandelaere, E., Arfini, F., Belletti, G., Marescotti, A., 2010. Linking People, Places and Products: A Guide for Promoting Quality Linked to Geographical Origin and Sustainable Geographical Indications, Vol. 2nd. FAO and SINER-GI, Rome. Retrieved from. http://www.fao.org/docrep/013/i1760e/i1760e00.pdf.

https://doi.org/10.1016/j.heliyon.2019.e01218