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PRODUCERS' PERCEPTION OF GEOGRAPHICAL INDICATIONS AS A PRODUCT DIVERSIFICATION TOOL FOR AGRIFOOD PRODUCTS IN SEMI-ARID REGIONS OF KENYA

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Abstract

The study assessed producers' awareness and perceptions of territorial-based qualities and the economic potential of two potential origin-based geographical indications in two semi-arid counties in Kenya. Protection of the origin products as geographical indications is presented as an option for ecosystem approach in managing fragile semi-arid regions while providing producers economic incentives and social inclusion; key components of green growth. Factor analysis was conducted on Likert scale perception questions administered to producers of goats (Baringo) and mangoes (Makueni). The producers were aware of the uniqueness of their products and its geographical source. The resultant factors reveal the importance of public policies, institutions, market access and public sector actors as important to producers' perception of the success of protecting their products as geographical indications. Clustering revealed producer heterogeneity in their perceptions of protecting their respective products as geographical indications. The constitution of the clusters was significantly different based on the number of years the producers had practiced farming in the region, their awareness of the uniqueness of their goats, income received from goat production and institutional factors. Enhanced collective action for both goats and mangoes in the semi-arid regions would ensure collective reputation in the product presented to the market. The producers' perceptions emphasise geographical indications as a marketing tool rather than an environmental tool, agreeing with Principle 4 of the ecosystem approach on managing ecosystem in an economic context.

Keywords: *Agri-food product diversification; Factor analysis; geographical indications; producer perceptions; semi-arid region*
Jel Codes: Q12, Q57

1. Introduction

1.1 Background information

Product and market diversification through labelling provides agri-food producers and especially small-scale farmers with opportunities for wealth creation while providing consumers with information about the quality of their preferred products. Successful diversification leads to increased economic benefits for the producers hence reducing poverty and food insecurity. In semi-arid regions, where intensifying production is constrained by the fragile ecosystems and threatened by economic neoliberalism (privatisation, free-trade etc), sustainable management of the natural resources may be achieved by diversifying the products and markets that are adapted to the regions, without over-exploiting the environment to increase production hence incomes (Fernández & Saunders, 2018).

Ecosystem approach to management of natural resources fosters both sustainable use of the ecologies and the equitable distribution of their benefits among the population (World Resources Institute, 2005). Use of geographical indications to diversify the markets for origin products found in semi-arid regions conforms to Principle 4 of the ecosystem approach. According to the Principle, "*there is need to understand and manage ecosystems in an economic context".* This includes reducing market distortions that affect biodiversity; aligning incentives to encourage the conservation and sustainable use of biodiversity; and internalizing the costs and benefits to the extent possible within the given ecosystem (World Resources Institute, 2005).

UNDP also calls for such a holistic approach towards providing market incentives for agricultural production, which will ensure that ecosystems are preserved while contributing to poverty alleviation, environmental sustainability and inclusive rural development (UNDP, 2013). Interventions that enhance this mutually reinforcing relations between economic benefits and environmental protection would yield sustainability especially in the marginal and fragile ecosystems (Giovannucci, Josling, Kerr, O'Connor, & Yeung, 2009).

Geographical indications, a form of intellectual property, are able to provide market incentives towards ecosystem management. According to the TRIPs definition, *Geographical Indications 'identify a product as originating from a territory, or a region or locality, where a given quality, reputation or other characteristics of the product are exclusively or essentially attributable to its geographical origin'* (Trade-Related Aspects of Intellectual Property Rights, Article 22) (TRIPS, 1994). Geographical indications tend to value the land and its particular agro-ecological characteristics that impart unique organoleptic properties on a product that may be difficult to replicate in other regions or countries (Giovannucci et al., 2009).

Whereas most registered GI products are in Europe, Asia and South America, there is increased interest in Africa to protect and market origin products as geographical indications, in order to diversify markets as well as preserve the natural characteristics that contribute to the product uniqueness. According to the TRIPS agreement, each member country seeking to protect its unique products based on territory-linked characteristics is responsible for identifying the products and providing the legal framework for the protection (Blakeney, Coulet, Mengistie, & Mahop, 2012). At implementation level, producers of origin products are responsible for defining, registering, popularising and maintaining the GI registration. With strong structures and management efforts, the codes of practice accompanying each GI registration should be environmentally sustainable. Where consumers pay for the information received through the GI registration, the producers are able to conserve the ecosystem (environmental resources, biodiversity and traditional knowledge) sustainably while earning

economic benefits (Giovannucci et al., 2009), in line with ecosystems approach to natural resource management.

Producers already have experience with the unique products and have close to perfect information on the quality presented to the market based on the production decisions they make. However, in making these decisions, not all producers may present the same quality of product to the market, although the consumers may have the impression that the quality is the same. This gives rise to problems of information asymmetry and free-riding on reputation on the side of the producers. Without controls, unsustainable management of the ecosystem has also been evident as some producers exploit the environment in order to increase production and hence incomes.

GI protection is built on reduction in the information asymmetry between the producers and consumers and hence how the marketing of the product is done (Lucatelli, 2000; Pénard, 2008). This is achieved through institutionalising reputation ((Belletti, 2000; Bramley, Biénabe, & Kirsten, 2009) and territorialisation of environmentally friendly rules of production (Belletti, Marescotti, Sanz-Cañada, & Vakoufaris, 2015), indicating that geographical indications, are not an environmental tool per se. However, as an institution, they may bring efficiency in repeated trade relations by facilitating information transmission and dissemination among players. Where trade is based, solely, only on reputation of origin products, especially those produced by resource-constrained rural households, there is possibility of mass production of similar products from other regions at lower cost. This would affect producers' incomes and hence result in production decisions that may lead to unsustainable exploitation of the environment. Institutionalisation of the reputation through geographical indication protection hence can contribute to curbing such malpractices and unplanned for outcomes.

1.2 GI Protection in Kenya

In Kenya, despite existence of potential GI products from semi-arid areas, there remains a dearth of information on the producers' perceptions of the uniqueness of their agri-food products and environmental, institutional and economic attributes that they associate with successful development and sustenance of the protection. Understanding producer perceptions is important as the obligation of paying for and maintaining the protection would essentially be the responsibility of the producers (Vandecandelaere, Arfini, Belletti, & Marescotti, 2010), majority of whom are small scale in nature in Kenya (GoK, 2010). In semi-arid regions, challenges are also more complicated. Events such as severe drought situations, which might result in loss of agricultural livelihoods, can compromise the protection of the GI.

Considering the effort required to institutionalise reputation of origin products as well as the challenges that might result, producers' willingness to engage in such a process is an outcome of their previous experience with the products existing value chain. Their perceptions and general awareness provide indications of producers' subjective assessment of the reputation and the environmental, market, cultural and institutional aspects they view as important for the successful protection of their respective agri-food products as geographical indications. The objective of this study was, therefore, to assess the producers' awareness and perceptions of the ecosystem management attributes (environmental, economic, cultural and institutional) of their potential GI agri-food products. The paper focuses on two potential agri-food commodities produced in drylands of Kenya, mangoes from semi-arid lower Eastern region in Kenya and Koriema Goats from semi-arid regions of Central Rift, Kenya.

The term "Koriema goats" is widely used to refer to goats grown in a specific zone in Baringo County, located in the Central Rift region of Kenya. Goats from Baringo County generally attract higher prices among consumers and traders and reputed to be naturally salty

and tastier than goat meat from other regions. Consumers and traders perceive apple mangoes from lower Eastern region of Kenya to be sweeter and juicier compared to those from other production regions.

2 Assessment of Producer Perceptions

2.1 Theoretical Considerations

The study is based on arguments advanced by economic theories on collective action, reputation and information. Geographical indications, unlike most intellectual property rights, take into account the collective nature of a production system (Dagne, 2015). In agricultural production, this collective nature is an aggregation of individual producers' decisions and actions related to production, processing and marketing of the commodities. To successfully and sustainably maintain geographical indications, Peiffer (2015) and Bramley et al (2009) allude to the fact that these heterogeneous producers need to deliver a 'homogenous' product to the market.

According to Shapiro (1983), where consumers base product reputation on past experience, should the producers decide to make a high value product and with less information asymmetry, they will reap the benefit though in the future. This is because they have to invest in the present to build the reputation (Lucatelli, 2000; Shapiro, 1983). It is therefore possible to have a reduction in well-being due to the decision, mainly because the producers have to first establish the reputation and reduce information asymmetry before they reap tangible benefits. These economic benefits in turn provide incentives for ecosystem management.

2.2 Empirical analysis from past studies

Barreira et al (2009) applied factor analysis to summarise producer perceptions on quality of their Protected Designation of Origin (PDO) beef, determined from a 7-point Likert scale questions. The perceptions covered pre-, on-farm and post-production aspects of production. The study was based on the precept that for quality to be assured to the consumer, quality has to be respected throughout the value chain. Barreira et al (2009) observed that the attributes to consider when assessing perceptions depend on the part of the chain one is considering and the product's stage of protection.

In analysing farmers' perceptions of new agricultural technologies or concepts it is possible to profile producers' tendencies towards uptake (Blazy, Carpentier, & Thomas, 2011; Sepúlveda, Maza, Pardos, Fantova, & Mantecón, 2010). Applying factor and cluster analyses, Sepúlveda et al (2010) summarised farmers' attitudes towards their Protected Geographical Indication (PGI) lamb in Spain and profiled them based on their attitudes. The study concluded that producers' perceptions to a certain extent determine their behaviour towards the protection. Both studies targeted different GI types already registered in Europe.

Anson and Pavithran (2014) applied factor analysis to explain producer perceptions of rice production under GI protection in India. They concluded that since the burden of registering and maintaining GI protection rests with the producers, their attitudes and perceptions towards the protection is significant. They summarised nine Likert-scale variables into three factors that motivate farmers to produce traditionally linked products as GIs.

Following these studies, the important factors that would determine the producers' collective decision-making on whether to register their products as GI were identified using factor analysis. The analysis was used to summarise the farmers' perceptions regarding the

economic and non-economic factors of importance to the producers of the identified potential GI products. The assessment is important as it gives an indication of expected results from possible registration including potential influence on incomes, food security and natural resource management (Theesfeld, Schleyer, & Aznar, 2010).

Due to the subjectivity of perceptions, multiplicity of variables are often used to elicit and draw patterns from a group of respondents (Danielsen, Burgess, & Balmford, 2005). Drawing from these past studies, in the current study perceptions were based on biophysical, institutional, market-related variables. Using factor analysis, such variables are condensed and explained in terms of the common underlying "factors" (Hair Jr., Black, Babin, & Anderson, 2010).

3 Methodology

3.1 Model specification

Factor analysis was applied to producers' subjective perceptions obtained using a 5-point Likert-scale questions. Though specific based on the commodity, the questions aimed at eliciting producers' perceptions towards the geographical link, market structure, role of policies and institutions in the current product market.

The factors were summarised based on the following matrix equation specification following Joliffe (2002) and Pennings and Leuthold (2000):

$$F = \Lambda L + \delta \tag{1}$$

Where F is a $qx1$ vector of observed variables; Λ is a qxn matrix of regression coefficients (factor loadings) to be estimated; L is a $nx1$ vector of latent variables (factors) that are estimated along with coefficients; and δ is a $qx1$ vector of specific error terms corresponding to the variables to be observed.

There are different proposed methods in literature to determine the number of factors to retain (Field, 2013; Hayton, Allen, & Scarpello, 2004; Ledesma, Universidad, Mar, Valero-mora, & Valencia, 2007). In this study, the factors with Eigen value greater than 1 (one) were retained (Field, 2013; Kaiser, 1960) and factor scores were generated using the Bartlett's method.

3.2 Study Site and Sampling

The study was conducted in Makueni and Baringo Counties in Kenya (Figure 1). Site selection was based on the results of a characterisation study that subjected identified potential GI food and agricultural products to criteria that enabled selection of products for the study (Figure 2). Among the products ranked highly were Baringo goats (from the North Rift region of Kenya) and Makueni mangoes from lower Eastern region. Apple mango, which originated along the Kenyan coastline, is a chance seedling with unknown parentage and of excellent fruit quality (Griesbach, 2003). Apple mangoes are the most widely grown in Makueni County, the study area and formed the target mango variety in the study. Goat production in Baringo County, in Central Rift of Kenya, other than providing milk, meat and blood, is an important source of social and cultural value (Johansson & Svensson, 2002). The goats are well adapted to the ASAL regions of Baringo County and are reputed to be naturally salty, a trait that consumers appreciate.

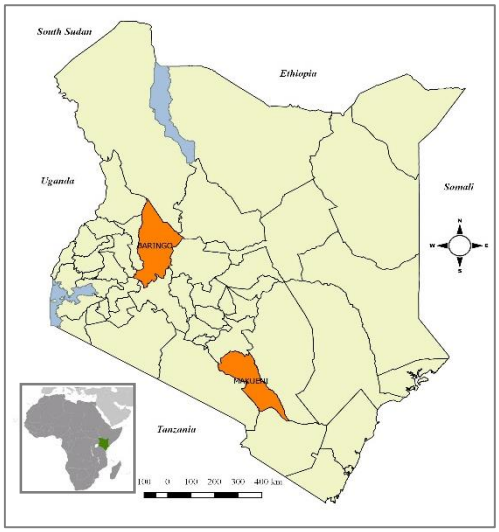

Figure 1. Map of Kenya Showing Location of Study Sites

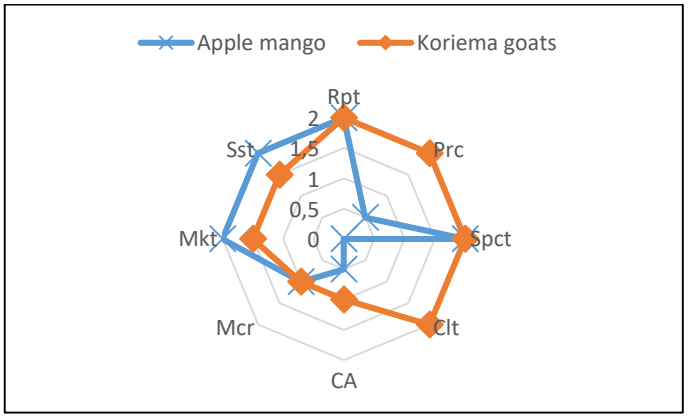

Figure 2. Summary of Characterisation Scores for the Selected Potential GI Products

Key to Figure 2: Rpt=Reputation, **Prc=**Premium price, **Spct=**Specificity/Uniqueness, **Clt=**Cultural aspects/linkages, **CA=**Collective action and institutions, **Mcr=**Macro institutions recognition and support, **Mkt=**Market attractiveness and scope of market, **Sst=**Environmental impact and sustainability.

To identify the respondents, stratification was done based on a sampling frame developed with the relevant government ministries on site, to ensure all locations where the target unique commodities are produced where proportionately sampled. Random sampling was then done within the locations resulting in a sample size of 135 respondents from Baringo Goat keeping region and 137 from Makueni mango production regions.

3.3 Data Collection and Analysis

A semi-structured questionnaire was administered to household heads or, in their absence, their spouses, to gather qualitative and quantitative primary data from the two study counties between July and August 2015. Data was collected on household demographic, farm and

production related information; as well as producers' perceptions relating to the geographical linkage, market dynamics, and policy and institutional support. The perceptions were determined based on a five-point Likert scale (*where 1=least important to 5=most important*).

Data entry and analysis was done using SPSS v24 and the factors were extracted using principal component method with varimax rotation. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was greater than 0.5 in all cases, indicating the appropriateness of factor analysis in yielding distinct and reliable factors (Field, 2013). To determine the adequacy of the sample size, communalities (shared variance) of the variables that were greater than 0.5 were considered sufficient (Field, 2013; MacCallum, Widaman, Zhang, & Hong, 1999). The factor loadings retained on the rotated component matrices had values greater than 0.4 (Stevens, 2002).

4 Results and Discussions

4.1 Producer Awareness of Product Uniqueness

The producers in both study counties generally perceived their respective products to be unique. At least 40% of respondents producing goats and mangoes were aware of possible free-riding on the reputation of their respective products by traders or producers from other regions (Figure 3). From the focused group discussion, the producers sell live goats to traders with no follow-up on where or in what form the goats and goat products are sold thereafter. In the mango production regions, intermediaries were the main buyers of mangoes from the region and the producers indicated that the intermediaries combine the mangoes from the region with those from other regions in order to sell the latter faster. Due to high perishability, distance to markets and lack of collective marketing, the producers were not able to negotiate higher prices for the fruits. The characteristics of the marketing channels for the different products may contribute to producers' perception on free-riding. Lucatelli (2000) cautions that due to information asymmetry and free-riding, potential benefits from GI registration do not always accrue to producers, who are often price takers.

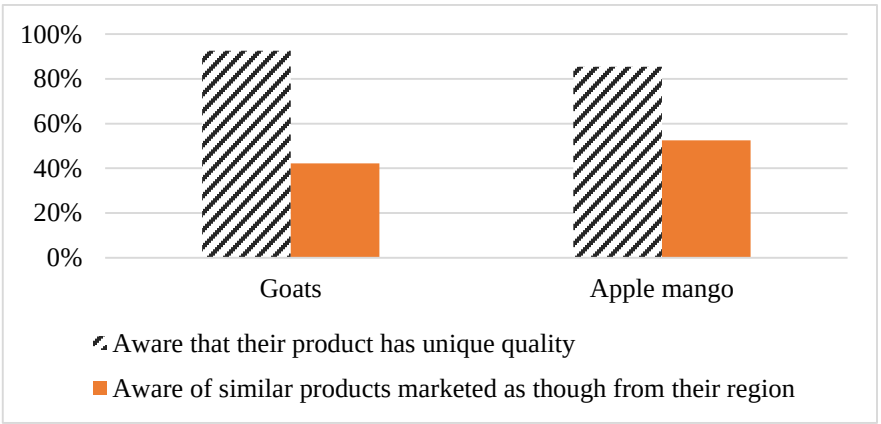

Figure 3. Producers' Awareness of the Uniqueness of Their Respective Products

Taste of final product was the single most common characteristic associated with the quality of the product uniqueness cited by at least 80% of respondents in each study area. The perceived source of the uniqueness varied from the soil characteristics to weather (temperature

and rainfall) parameters as well as natural resources on which the goats foraged and natural salt licks (Figure 4). Only two respondents among goat producers identified traditional or cultural practices as being a source of the uniqueness in the resultant goat meat quality. The producers perceive the herbs and shrubs that the goats in Baringo freely browse on to contribute most to the quality of the goat meat as they are naturally salted.

Among mango producers, the dryland conditions (including high temperatures, soil characteristics and rainfall) contribute most to the quality. They also cited field management as important for product quality and reputation as this kept the farms and fruits disease free.

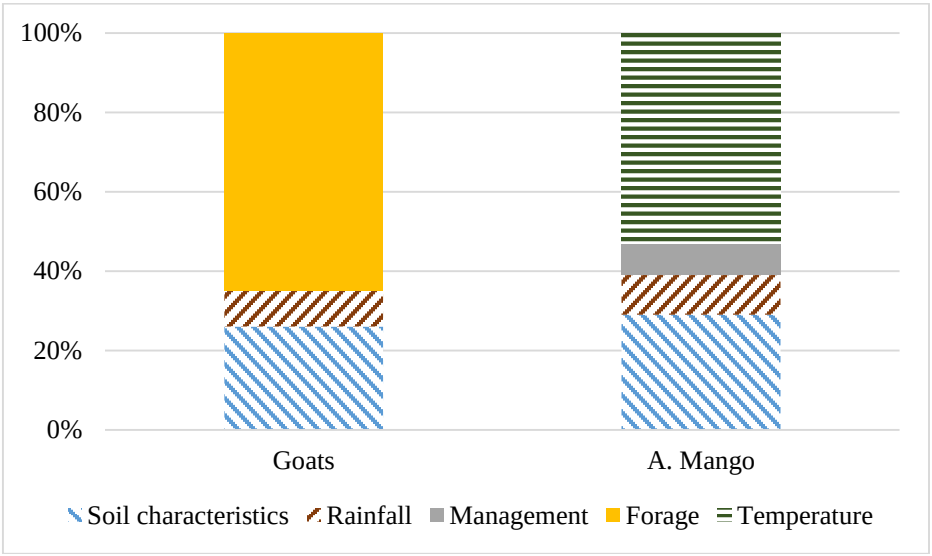

Figure 4: Producers' perceptions on the sources of uniqueness in their respective potential GI products

Giovannucci et al (2009) indicate that the first step towards a geographical indication is the ability to identify and establish an existing rationale for unique product that is truly origin-related and differentiated. Although identification for GI registration would require more scientific analysis and characterization to delineate the geographical region clearly, the results of this study provide a guide towards producers' awareness of the uniqueness of their origin products.

4.2 Producers' Perceptions of Related Institutional and Economic Attributes of Baringo Goat Meat and Makueni Mango Production

A five point likert scale was used to measure the respondents' perception of the importance of (i) characteristics of the production region; (ii) role of various stakeholders (iii) role of policy and (iv) GI and market/price related variables. The summary of producer perceptions for production region characteristics as well as the role of stakeholders is presented below on a 3-point likert scale. From the analysis, at least 43% of goat producers agreed that cultural practices related to goat production were important in preservation of the quality of the products. At least 90% of respondents in both counties perceive that the soils characteristics contribute to the uniqueness of the products. In goat production, the characteristics of the soils and the natural grazing grounds were important attributes in the quality of the resulting meat.

In mango production, characteristics of the soils, rainfall and temperature patterns were perceived as most important in the quality traits (Figure 5). Producers in both study regions appreciate that current management practices may be detrimental to the success of a GI protection.

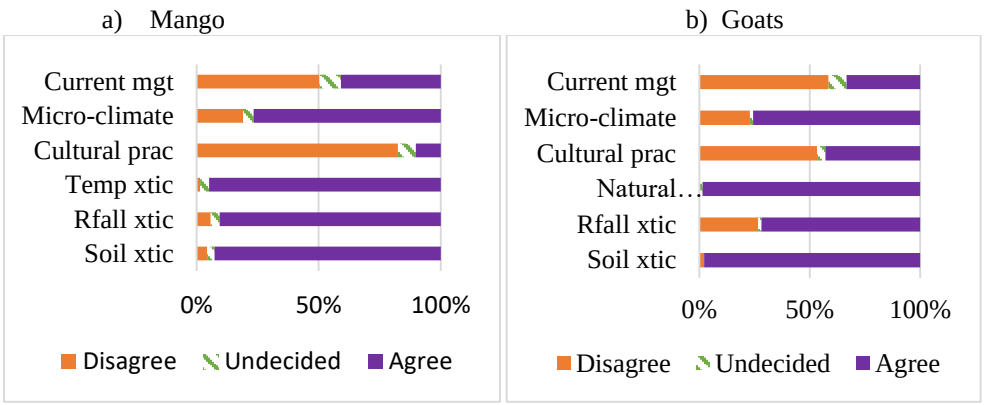

Figure 5. Producers Perceptions of Importance of Geographical Characteristics in the Quality of Their (A) Mango and (B) Goat Products Respectively

At least 80% of mango producers perceived that involvement of the public extension and the County governor's offices as well as being a member of a producer organisation were important aspects in the success of protecting their products as geographical indications. Ninety percent (90%) of the goat producers perceived the role of the governors' office, the administrative unit office and being members of a producer organisation as important to the success of the protection. Only 33% of the goat producers belonged to an agricultural producer organisation (Figure 6)

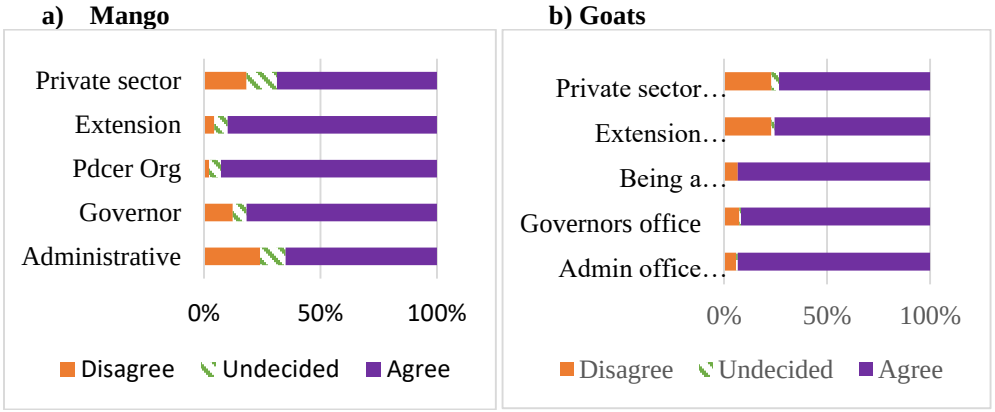

Figure 6. Producers Perceptions of Importance of Roles of Various Stakeholders in Protecting the Quality of Their (A) Mango and (B) Goat Products Respectively

Using Kaiser's criterion, six factors were retained for each of the commodities accounting for 67.7% and 72.3% of the variance in the original variables for goat and mango production

respectively (Table 1). The four important factors among the goat producers were (i) environmental sustainability, (ii) market prices and access as a result of protection; (iii) the role of state policies and (iv) natural grazing ground for successful GI registration. However, perceptions relating to collective action, including the importance of having producer associations did not form any of the underlying variables. The variable had communality less than 0.4 with no correlation with other variables and was dropped from the analysis.

Table 1. Factor Analysis of Goat Producers' Perceptions of Institutional and Economic Potential of Their Products as Geographical Indications

Factor No.	Factor description and Variable Importance of …	Factor loading
1	*Environment sustainability (α=0.67)*	*Exp σ^2= 15.7%*
	Environmental sustainability	0.71
	Micro climate in the region	0.70
	Administrative office support	0.66
	Extension services	0.65
2	*Market prices and access (α=0.52)*	*Exp σ^2=12.4%*
	Protection will result in higher selling price per kg	0.85
	Protection will result in better market access	0.67
	Importance of mode of market access	0.45
3	*State policies (α=0.53)*	*Exp σ^2=10.4%*
	Support from the state policies	0.75
	Increased inclusion of goat keepers in decision making	0.74
4	*Natural grazing grounds (α=0.32)*	*Exp σ^2=10.2%*
	Importance of natural grazing grounds	0.74
	Importance of cost of registering/maintaining GI	0.66
5	*Management practices (α=0.77)*	*Exp σ^2=9.6%*
	Importance of management practices	0.78
	Importance of governor's office support	0.77
6	*Rules*	*Exp σ^2=9.5%*
	Importance of having rules regarding quality	0.79
	Total variance explained	=67.7%
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	=0.621
	Bartlett's Test of Sphericity Chi-Square (df)	=301.1*** (91)

Analysis of perceptions for mango producers showed that importance of policies & rules and importance of administration & extension office accounted for approximately 15% and 14% respectively. The first three factors in the analysis of mango producer perceptions were related to both policies and institutions (Table 2).

Table 2. Factor Analysis of Mango Producers' Perceptions of Institutional and Economic Potential of Their Products as Geographical Indications

	Mango	
Factor No.	**Factor description and Variable Importance of …**	**Factor loading**
1	*Policies and rules (α=0.80)*	*Expl σ^2=14.9%*
	Increased support from the state policies	0.87
	Having rules regarding quality	0.85
2	*Administrative and extension office (α=0.61)*	*Expl σ^2=13.5%*
	Support from administrative office	0.76
	Increased extension services	0.71
	Labelling as a GI for better marketing	0.67
3	*Market prices and access (α=0.73)*	*Expl σ^2=12.0%*
	GI protection and better market access	0.90
	GI protection and better market prices	0.85
4	*Cost of protection (α=0.53)*	*Expl σ^2=11.7%*
	Cost of GI	0.79
	Protection of commodity as a GI by region	0.76
5	*Producer-private sector interaction (α=0.41)*	*Expl σ^2=11.5%*
	Devolve to include producers more	0.72
	Private sector participation in marketing	0.68
	Information on expected prices	0.57
6	*Micro-environment management (α=0.28)*	*Expl σ^2=8.7%*
	Microclimate contribution to uniqueness	0.80
	Current management practices	0.66
	Total variance explained	=72.3%
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	=0.62
	Bartlett's Test of Sphericity Chi-Square (df)	=446.2***(91)

4.3 Factors influencing producers' perceptions of potential of GI registration

A cluster analysis further provided a means to profile the producers in accordance to their perceptions towards the enabling factors of protecting their products as geographical indications. Among the goat producers, those in cluster 3 had, on average, practiced goat production in the region for a shorter time than those in the other two clusters and had lower income in the study year compared to those in cluster 2. They also had significantly lower factor score values for factors 2 (market access and prices), 4 (Role of natural grazing grounds), 5 (importance of management practices) and 6 (importance of rules and institutions). The producers in cluster 3 could hence be described as being more conservative towards GI protection of their goat (Table 3)

Table 3. Characterisation of the Clusters Obtained for Baringo Goat Producers

Variable	Cluster 1 (n=40)	Cluster 2 (n=50)	Cluster 3 (n=45)
Years farmed in region**	21.45ab	26.60a	17.20b
Attitudes			
FS1 (Environmental sustainability)	0.29	-0.05	-0.21
FS2 (Market prices and access)***	0.14a	0.43a	-0.59b
FS3 (Role of state policies)	-0.01	0.21	-0.23
FS4 (Natural grazing grounds)***	0.59a	0.00b	-0.52c
FS5 (Management practices)***	0.65a	-0.12b	-0.45b
FS6 (Rules and institutions)***	0.40a	0.15a	-0.52b
Perceptions (agreement with statements)			
Aware that Baringo goat is unique***	100%	98%	80%
Community livestock marketing committee will support protection***	60%	88%	53%
Abattoir owners will support protection**	63%	80%	53%
Region of production influences price**	58%	68%	40%
Aware who end users are***	5%	6%	29%
Producer characteristics			
Gender of household head (% male)	93%	90%	91%
Log of income from goat production**	9.50a	10.4b	9.7a
Member of producer association***	55%	16%	31%
Receives agricultural extension services***	73%	36%	33%

Source: Household survey among Baringo goat producers; Analysis of variance tests and Pearson Chi square tests show significant differences among the clusters at 1% (***) and 5% (**) significance level

Mango producers in clusters 1 and 3 had on average practiced farming in the region for a significantly shorter time than those in cluster two, while cluster 3 had significantly lower income in the study year compared to those in the other two clusters. Cluster 1 had significantly higher factor scores for the first three factors (policies and rules; administration and extension; and market prices and access). Those in cluster 1 had significantly positive perceptions towards the role of the first three factors in the success of GI protection on their mango product (Table 4).

5. Discussions and Conclusion

The analysis reveals potential political (legal), environmental or physical opportunities and/or threats that would be pertinent to the success of specific GI protection implementation. Perceptions of producers relating to protecting their unique products potentially as GI were summarised in six factors. Although the attributes presented to the producers in each study region were almost similar, the resulting factors were different and unique to the products, showing the importance of differentiating each origin product based on its characteristics. The producers acknowledged the importance of the environmental characteristics (territorial specificities) in influencing the quality of their unique products.

Public policies and institutions as well as public and private sector actors would play a significant role in supporting mango producers initiatives towards protecting their products as geographical indications. Environmental and public sector actors as well as market-related aspects and public policies were perceived as significant in protecting Baringo goats as

geographical indications. Clustering also showed that producers are heterogeneous in their perceptions towards GI protection hence different efforts would be required to target the different producer clusters.

Table 4.Characterisation of the Clusters Obtained for Mango Producers

Variable	Cluster 1 (n=51)	Cluster 2 (n=60)	Cluster 3 (n=26)
Years farmed in region**	21.90ab	25.56a	16.08b
Attitudes			
FS1 (Policies and rules)***	0.37a	-0.47b	0.37a
FS2 (Administration and Extension office)***	0.12a	0.17a	-0.63b
FS3 (Market prices and access)***	0.50a	0.15b	-1.35c
FS4 (Cost of GI protection)	-0.04	-0.07	0.25
FS5 (Cost of GI protection)	-0.01	0.09	-0.18
FS6 (Micro-environment management)	-0.22	0.21	-0.04
Perceptions (agreement with statements)			
Aware that Makueni mangoes are unique	86.3%	83.3%	88.5%
Mango factory will support protection***	80%	67%	12%
Influence of mango quality on price***	62%	88%	45%
Aware who end users are**	14%	16%	41%
Producer characteristics			
Age of household head**	52.55a	54.87a	46.15b
Log of income from mango production**	9.78a	9.78a	8.61b

Source: Household survey among Makueni apple mango producers; Analysis of variance tests and Pearson Chi square tests show significant differences among the clusters at 1% (***) and 5% (**) significance level

The results emphasise GI protection as a market tool as opposed to an environmental tool, shown by the producers' outlook of important perceptions based on the market characteristics. Producer perceptions mirror the actual happenings in the respective sub-sectors. The perceptions provide an indication of the areas of interest that policy makers and other enablers should focus on in order to support successful registration of each origin product as geographical indications. The rules resulting from the protection would in turn enhance environmental sustainability, supporting the ecosystem approach to natural resource management.

The results show heterogeneity in the underlying variables related to producers perceptions of registering different products as geographical indication. The heterogeneity emphasises the importance of conducting product-specific analysis in identifying the potential of registering different products as geographical indications. The results agree with other studies on factor analysis relating to different techniques (Birol, Villalba, & Smale, 2009). The cluster analysis further provides need for specific efforts to ensure consensus building and aligning expectations among the different communities.

Producers would diversify origin agri-food products from semi-arid regions as geographical indications. The role of public policies as well as public actors is important in protection of both mangoes and goat products. There is however need for enhanced collective action among the producers especially in the goat production region to ensure collective reputation of the products presented to the producers and therefore their social characteristics.

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