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Research Application Summary

Smallholder keepers' preference for cattle insurance in Botswana: An application of conjoint analysis

Ramolefhe, O.S.[1], Irungu, P.[1] & Nyikal, R.A.[1]

[1]Department of Agricultural Economics, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya
Corresponding author: oreeditseshirleyramolefhe@gmail.com

Abstract

The cattle population in Botswana has deteriorated from 2.8 million to 2.1 million over the years. The deterioration results from various risks including re-occurring drought and high disease prevalence. As a result of these perils, a livestock insurance policy should be developed to compensate farmers for losses incurred. A conjoint analysis method was employed on 182 randomly selected smallholder keepers to characterize their preference for a cattle insurance policy. The results revealed that keepers regarded type of insurance cover and time of compensation as important attributes for an insurance pol icy. The WIBI (type of insurance) was positively significant (p= 0.00), keepers preferred a weather index base insurance policy with a compensation pay out pa id within three months after the loss of a cow. Keepers were not willing to wait for a long duration to be compensated. The willingness-to-pay for livestock insurance product was $11.45 per cow per month. Policy implementers should work closely with veterinary officers, conduct awareness workshops and use radios to disseminate information and sensitive farmers about the policy

Key words: Botswana, cattle insurance, conjoint analysis, preference, smallholder, central district, Botswana

Resume

Le cheptel bovin du Botswana s'est détérioré au fil des ans, passant de 2,8 millions à 2,1 millions. Cette détérioration résulte de divers risques, dont la sécheresse récurrente et la forte prévalence des maladies. En raison de ces périls, une politique d'assurance du bétail doit être développée pour indemniser les agriculteurs des pertes subies. Une méthode d'analyse conjointe a été employée sur 182 petits éleveurs sélectionnés aléatoirement afin de caractériser leur préférence pour une police d'assurance bétail. Les résultats ont révélé que les éleveurs considèrent le type de couverture d'assurance et le temps de l'indemnisation comme des attributs importants pour une politique d'assurance. L'indice WIBI (type d'assurance) était positivement significatif (p= 0,00), les éleveurs préféraient une police d'assurance basée sur l'indice météorologique avec une indemnisation versée dans les trois mois suivant la perte d'une vache. Les éleveurs n'étaient pas prêts à attendre une longue période pour être indemnisés. La disposition à payer pour un produit d'assurance bétail était de 11,45 dollars par vache et par mois. Les responsables de la mise en œuvre des politiques devraient travailler en étroite collaboration avec les agents vétérinaires, organiser des ateliers de sensibilisation et utiliser les radios pour diffuser l'information et sensibiliser les agriculteurs à cette politique.

Mots clés : Botswana, assurance bovine, district central, analyse conjointe, préférence, petit exploitant.

Introduction

The beef sub-sector in Botswana transcends many other sectors of the economy and contributes about 80 % to the overall agricultural GDP (Kgosikoma *et al*., 2016). Livestock also play a key role in the livelihoods of rural dwellers, providing food, income, employment and wealth to unskilled people (Khan *et al*., 2013; Mahabile *et al*., 2014). Roughly 70 % of households in Suh-Saharan Africa (SSA) own and depend on livestock for food, income and draught power (Ng'ang'a *et al*., 2013). Among rural Batswana, cattle are mostly kept for cultural ceremonies, paying bride price and occasionally sold to meet household cash needs like paying children school fees. For the past ten years the cattle population has been oscillating between 2.5 million to 1.7 million (Statistics Botswana, 2018).

The decline in cattle population is largely attributed to the pervasive animal diseases (Foot and Mouth Disease), lack of agricultural investments, poor grazing land, high stocking rates, climatic shock (recurring droughts) and low adoption of technologies that enhance and improve productivity (Temoso el al., 2015 ; Bahta el al., 2017). The outbreak of FMD in the year 2007 and 20 11 led to culling of cattle in the North East District to prevent the spread of the disease to other parts of the country. Botswana was banned from exporting beef to the EU market resulting in loss of foreign exchange and income for smallholder farmers who solely depend on cattle (Masole, 2018). The re-occurring outbreak of FMD and Rift Valley Fever (RVF) in Kenya often catise considerable losses of cattle as noted by Otieno (2011). Botswana's predominantly semi-arid climate intensifies the country's susceptibility to re-occurring drought and pose a serious threat to small-scale farmers who lack alternative economic sources of income (Masike and Urich, 2008). The climate variability negatively impacts production and livelihoods of agro-pastoral communities who are highly dependent on cattle (Kgosikoma and Batisani, 2014).

The livestock sector in Botswana is mainly categorized into commercial and traditional production systems. The commercial farmers produce livestock in freehold farms or ranches primarily for sale (Bahta *et al*., 2013 ; Orlowski and Sigwele, 2014). In contrast, traditional farming is practiced by subsistence-oriented (smallholder) farmers, extensively rearing livestock in communal grazing areas (Bahta *et al*., 2013 ; van Engelen *et al*., 2013; Mahabile, 2014). Traditional farming dominates the beef sub-sector (Temoso el al, 20 15; Statistics Botswana, 2018), yet it is characterized by poor management practices, little inputs provided by farmers and disease vaccination instigated by the government (Ouina *et al*., 2003).

Livestock farming is a risky enterprise requiring diverse risk mitigating measures. Most risk is attributed to climate variability, increase in operational costs; death of draught animals due to pests and diseases and changes in government policies (Kahan, 2018; Mahboob *et al*., 2019). Khan (2013) adds that farmers face risky situations during livestock farming due to climate extremities and disease epidemics leading to reduced livestock productivity. In an attempt to deal with the risk, Botswana Insurance Company (BIC) in 2010 set up a livestock insurance policy aimed at compensating livestock farmers for occasional livestock losses due to adverse effects of natural calamities such as drought, disease incursions and predation by wildlife (van Engelen *et al*. , 2013). However, since its inception, only a handful of traditional livestock keepers have adopted the policy because the policy is designed on a managerial condition which excudes smallholder keepers. Existing studies conducted focused on coping mechanisms to deal with livestock loss, but failed to address the issue of livestock insurance, hence the formal risk management strategy of smallholder keepers has not been explored. Masole (2018) determined smallholder producers' perceived risk factors and the role of factors on choice of ex-post response to outbreak of the 2011 MMD in North East District. Additionally, Mogotsi *et al*. (2011) identified factors limiting subsistence agro-pastoralist from adequately coping and adapting to droughts in the Kalahari. The current study sought to assess awareness of livestock insurance by smallholder keepers and characterize their preferences for attributes of cattle insurance policy in the

Central district of Botswana.

The contributions of the study will also be towards Botswana's long term pillar of a sustainable development economy and realization of international commitments of improving livelihood by building risk resilient systems (The Malabo[1] declaration), reducing poverty and ending hunger (SDG' number I and 2). Policy designers will be able to identify preferred attributes and design an insurance pol icy most suitable and affordable to smallholder cattle keepers.

Materials and methods.

Study area. The study was conducted in the Central District of Botswana which is the largest district in the entire country covering 147,730 kind of area. The district is divided into six sub- districts namely Bobonong, Boteti, Mahalapye, Orapa, Serowe Palapye and Tutume. The climate of this district is semi-arid covered by acacia shrubs and Mopane trees while the land surface ma inly consists of loam and clay soil. In general, the climatic conditions and soils are favorable for both arable and pastoral farming. According to Statistics Botswana (2015), the district produced the highest output of millet, maize, pulses and melon also attributed to average annual rain fall ranging from 180 mm to 210 mm (Department of Meteorology, 2010).

Choice of the study area was based on the district s highest num ber of traditional cattle kept in Botswana, approximately 49% of the country cattle population and the highest cow mortality recorded in the entire country. Currently there are conflicts between agricultural expansion and protection of indigenous wildlife within the Central District. This conflict is caused by increasing population of livestock and wildlife animals simultaneously yet the land size is constant. A total of 1,010 cattle were lost due to predators (Statistics Botswana, 2018). Since the district recorded the highest mortality rate, cattle keepers in this area were the best group to elicit a hypothetical insurance policy suitable for smallholder cattle keepers. Other economic activities in the district are mining, tourism, construction and manufacturing.

Sample procedure. The sample size was determined using Yamane's (1967) sample size formula which is appropriate when the population size is known:

$$n = \frac{\mathrm{N}}{1+\mathrm{N}(e)^2} \qquad (1)$$

where: n is the desired sample size, e is the acceptable margin of error 0.05 (at 95% interval) and N is the known population size of smallholder cattle keepers. A sample of 168 smallholder cattle keepers were selected to be included in the study but to cater for non-response error, 182 respondents were interviewed.

Sampling technique. A multistage sampling technique was used in the study to select respondents. The Central district was purposively selected because it has the highest number of smallholder cattle keepers and traditional cows in the entire country. The agricultural sur vey condticted in 2013 (Statistics Botswana, 2015), indicated Mahalapye, Palapye and Serowe villages to have the highest number of cattle holdings and cattle population in the district. Correspondingly these villages are in the green zone for FMD, thereby can trade their livestock to BMC without any restrictions. The high cattle population in these villages validated livestock production as one the major economic activity practiced. A proportionate-to-size approach was used to determine the sample size appropriate for each represented village. Finally, a simple random selection procedure was applied to select respondents in each village. Names of cattle keepers (provided by livestock advisory officers) were randomly selected without replacement until the desired sample size was attained. Sampling procedure used

[1]Ensuring that at least 30% of frams and households are resilient to risks by the year 2023.

[2]Sustainable De› elopn4ent Goal

gave each individual cattle keeper in the population an equal probability of being included in the proposed sample size (Kimalu *et al*., 2014).

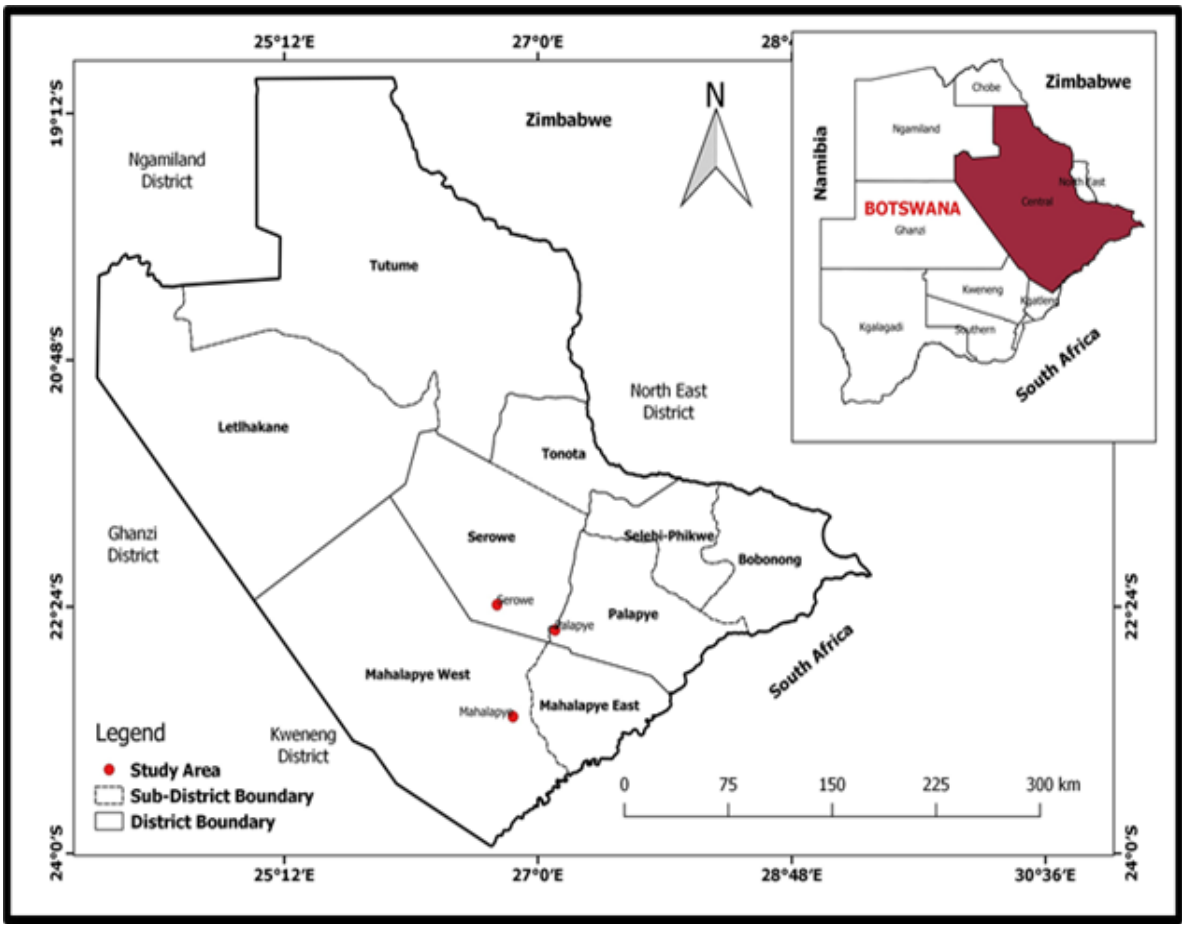

Figure 1. A map of central Districts in Botswana

Conjoint Analysis. To characterize smallholder farmer preferences for attributes of cattle insurance policy, the Conjoint Analysis method (CA) was seen fit to meet the objective. Conjoint Analysis method is a stated preference format requiring the utility of a good or service to be fragmented into various components or attributes (Lotiviere, 1988). lt is supported by Lancaster's (1966) consumer theory explaining that the good itself does not provide utility to the consumer, but utility is derived from the attributes of that good. Conjoint analysis has two distinguishing features: the trade-offs among multiple attributes that simulates real life situations and a distinct feature based on decompositional approach, which allows researchers to estimate the structure of individual or group preferences (Wang *et al*., 2003).

Profiles are formed by combining different levels of attributes of the good or service where each attribute is described by its level (a level is an assigned value for an attribute) and utility derived from a good or service (Mitchell and Carson, 1989 cited by Kairu-Wanyoike *et al*. , 2014). Utility is determined by the partial utilities (part-worths) contributed by each attribute level (Krystallis and Ness, 2005). According to Fischer *et al*. (2009) and Vaca Moran (2014) products possess specific attributes levels, a respondent's "liking" for a product is modeled as the sum of the respondent's "utilities" for each of the attribute levels. Attribute importances reflect utility differences between the best and worst levels for attributes (Orme *et al*. , 1997). Conclusively, during the decision process an orthogonal profile card provides two essential categories of information: the utility of each attribute level and the importance of each attribute (Wang *et al*., 2003; Krystallis and Ness, 2005).

Up to today conjoint analysis technique is broadly applied in environmental economics and marketing studies principally for quantifying preferences for non-market goods and services (Alvarez-Farizo *et al*. , 2002; Bridges *et al*. , 2011). This is because it is less obtrusive and has the ability to ask realistic questions that mimic the tradeoffs made by respondents in the real world. But some implications associated with Conjoint Analysis is its failure to distinguish differences in preferences between groups of respondents (Tano, 2003). Respondents may consider most important attributes hence exaggerate differences importance between the most and least important factors. Fischer *et al*. (2009) further adds that Conjoint Analysis at times errors in compelling individuals to pay attention to every attribute, whether important or not, which result in Conjoint Analysis importance being too flat.

In the current study, stated preference was used because the intended smallholder livestock insurance policy is a non-market commodity and keepers were not familiar with prices form mating. Dofonsou *et al*. (2008) confirmss conjoint analysis has several advantages: it is consistent with the theory of utility maximization and can be used to study tradeoffs between product attributes. Conjoint Analysis has the ability to combine the examined attributes traits of a potential livestock insurance scheme with explanatory socio-economic variables of the respondents to give more profound insights into the design of a suitable and adaptable livestock insurance policy.

Selection of attributes. In a preliminary survey, focus group discussions (FG Ds) in five different villages in the Central District of Botswana were conducted to determine the main attributes of a cattle insurance policy that farmers would be willing to have. Six insurance policy attributes and their respective levels were detennined. The SPSS Orthogonal Design procedure (1997) was used to generate combination profiles from the product attributes and their levels. All possible combinations of the attributes and their levels form a full factorial design called profiles. Through minimal orthogonal designs, a fractional factorial design containing the least number of profiles needed for ranking (using the number of attributes and their levels) are generated (Kairu-Wany oike *et al*., 2013). The four attributes varying at two levels and two attributes vary ing at three levels, cumbersome and impossible to rate all of the profiles, therefore an orthogonal factorial factor design was applied in SPSS Conjoint 8.0 (SPSS, 1997). Ultimately 16 insurance profiles were created as shown in Table 5.

The policy profiles were translated into pictorial representations for farmers to understand the diverse attributes properly. These pictorial representations were printed and presented to respondents during the survey. The enumerator explained to the respondent each profile policy until clearly understood, then placed all pictures on a flat surface where they were visually visible to the respondent. Respondents were asked to rank the insurance policy profiles in ascending order, starting with the most preferred to the least preferred policy combination. One of the main assumptions is that, for each choice made, a chosen combination is assumed to yield a higher level of satisfaction than the one rejected, allowing the probability of the chosen alternative to be modeled in terms of attribute levels (Kamara *et al*., 2018). The enumerator recorded the preferences or ranking on a questionnaire prepared for data collection and re-confirmed the ranking with the keeper. Conducting the interviews helps to confirm appropriate attributes, thereby reducing the likelihood of model misspecification (Pu and Grossklags, 2015). The use of pictorial designs has been widely used in CA (Irungu, 2011; Tetaz, 2014) for stimulating respondents to make informed choices because they are easily understood (Tano *et al*., 2003). Fischer *et al*. (2008) and Geppert *et al*. (2005) indicated that use of pictorial stimuli in CA increases homogeneity of perceptions, reduces information overload and problems of misunderstanding by improving communication as they are more realistic.

[4]Utility is the overall preference or total worth of a product which is the sum of what the product parts are worth (part-worths).

[5]Part-worth utilities predict rankings assuming correct additive utility specification (Louviere, 1988)

TabIe 1. Insurance policy attributes and their levels solicited from Focused Group Discussions (FGD) in central district of Botswana

Product attribute	Attribute level
Type of compensation	-Per herd
	-Proportion of the herd
Monthly Premium	-$0.70
	-$1.40
	-$2.10
Type of insurance	-Weather index-based insurance (WIBI)
	-Normal insurance (NI)
Payment Plan	-Monthly
	-Annually
Coverage	-Replace the dead cow
	-Give cash in hand
Time to Compensation	-After one month
	-After three months
	-After six months

Date analysis. lt is assumed that keepers derive utility from the attributes of the insurance policy, therefore a random utility function is applied to estimate derived utility (Kairu-Wanyoike *et al*., 2014). The utility of the ith livestock keeper selecting the jth insurance attribute profile can be presented in the following from:

$$U_{ij} = V_{ij}(x_{ij}) + \omega_{ij} \qquad (2)$$

Where U is a stochastic utility function, V is the deterministic component of utility (standard regression function), x_{ij} represents the insurance profile attributes, and ω_i, is a stochastic error term. It was assumed that cattle keepers will rate profile j higher than profiIe i based on the under- lying utility, if $U_{ij} < U_{il}$. Conceptually, the term V_j was this presented as:

$$V_{ij} = \beta_0 + \beta_1 \text{ COM P} + \beta_2 \text{ TY PE} + \beta_3 \text{ PAY} + \beta_4 \text{ COV} + \beta_5 \text{ TIME} + \beta_6 \text{ PRICE} \qquad (3)$$

V, represents the insurance profile rank responses provided respondents from the survey (1= highly preferred, 16 = less preferred), the β are marginal utility values arising from a change in levels of attributes. An OPM estimated the marginal utility attributes which were used in estimation of the WTP. The OPM accounts for the ordered/ ordinal nature response of the dependent variable (Mackenzie, 1993). All other attributes were made dummies because of their categorical nature while price data was used as a continuous variable in order to get only one price coefficient.

Equation 4 was operationalized as an additive conjoint equation to estimate the part-worth of each attribute based on respondent's preference rankings (Irungti, 2011):

$$R_i = \sum_{k=1}^{n} \beta_k X_K \qquad (4)$$

Where R , is the rank by the ith respondent of the Ith insurance product (or profile), which is a combination of X_k attributes (k = 1 ,. . . , n attributes) while β_k is the estimated part-worth or utility of

[6] The orthogonal array is a subset of all of the possible combinations that allows estimation of the part-worths

the kth attribute. Because the profile ranks reflect ordered choices, equation 3 was operationalized as an ordered probit model (Daykin and Moffat, 2002)

$$Rank_i = \alpha + \beta_1 \text{ COVER} + \beta_2 \text{ TIME} + \beta_3 \text{ P RICE} + \beta_4 \text{ COV} + \beta_5 \text{ COMP} + \beta_6 \text{ PAY} + e \quad (5)$$

Where $Rank_{li}$ (Dependent variable) is the preferred profile rank order by the ith smallholder cattle keeper, α is the general mean, β_1 to β_6 are coefficients of estimated coefficient (part-worth) of the ith attribute, e is the Random error term.
The independent variables include: type of an insurance policy cover (COVER), the waiting duration before compensation is dispatched to the keeper after the loss of a cow (TIME), the month ly premium of insurance policy offered (PRICE), the type of insurance policy (COV), the type of insurance compensation keepers (COM P), and the instalment plan (PAY).

Relative importance is calculated by getting the difference between highest and lowest path-worth v8lues, providing an indication of attributes highly valued by respondents or smallholder cattle keepers:

$$RI_i = \left[\frac{\text{Utility range}_i}{\sum \text{Utilityrangeforallattributes}}\right] * 100 \quad (5)$$

Where RI_i is relative importance value of the ith attribute, Ulility range is the difference of the high And low marginal value and Utility range for all attributes is the sum of the ranges [Max (β_j) - Min (β_i)] across all the attribute.

The WTP for an attribute is given by the ratio of the attribute coefficient to the price coefficient (Hole *et al*., 2012). Therefore, after running the utility function, 3 values are used to calculate the WTP for each attribute:

$$WTP_i = -\beta_{\text{attribute}} \Big/ \beta_{\text{price}} \quad (7)$$

Where WTP is the estimated willingness-to-pay amount for each attribute level, $\beta_{attribute}$ is the marginal coefficient of a non-price attribute and β_{price} is the price coefficient.

The collected data were captured and analyzed with SPSS (version 16) and Stata (version 14) analysis software. To characterize the socio-economic characteristics of respondents, descriptive statistics (means, frequencies and percentages) were computed with Stata. Smallholder cattle keepers' preferences for relative important attributes and attribute levels of cattle insurance policy were characterized by running a conjoint analysis using SPSS.

Results and discussion

Socio-economic characteristic of cattle keepers. Of the 182 cattle keepers surveyed in the central district, 75% were male, 25% were females, indicating that cattle keeping is dominated by males rather than females. The mean age of respondents was 53 years old and age was not significant across the three villages of the study area. Number of years of formal schooling was statistically significant ($p = 0.00$) across all villages, keepers in Palapye and Serowe had attained primary level while those in Mahalapye attained Secondary level. Distance travelled from the farm to the nearest tared road was significant ($p = 0.035$) in Mahalapye and Palapye only, with a mean distance of 24

and 8 kilometres, respectively. The average annual income from sales of other livestock (p=0. 1) and off-farm investment (p>0.0 1) was statistically significant. Mahalapye village had more income of livestock sales and off-farm investments as compared to other villages.

Awareness of livestock insurance policy. Only 11 % of respondents were aware about the existing livestock insurance policy while 89% were clueless about it. This lack of knowledge possibly indicates that the insurance company did not disseminate the policy information effectively across the country. During FGDs, keepers disclosed that insurance policies were for commercial farmers. In all three villages, most smallholder cattle keepers aware of the insurance policy were found in Palapye, while Serowe and Mahalapye had the same number of respondents aware of the insurance policy. Generally, there was little variation of a wariness of the insurance policy across the three locations. Principally keepers learnt about the policy from different sources, 50% from the radio, 5% from the television, farmer association group and an AON insurance agent respectively. Both the veterinary officers and farmers' association groups were uninformed or had limited information about the insurance policy. The media outreach through radio (50%) seemed to be the most effective medium of disseminating information to keepers in rural areas as most respondents heard about the policy through it. Nyareza and Dick (2012) conducted a study in Zimbabwe to investigate benefits or using radio to communicate agricultural information to peasant farmers. It was found out that 88% of the respondents listen to Radio Zimbabwe because its farming programmes were presented in their local languages and they received useful information. In Nigeria, farmers admitted that they gained some knowledge about various improved agricultural practices which impacted and improved their production by listening to agricultural programmes aired by Radio Benue (Okwu *et al*., 2007). Moreover, Fisher *et al*. (2009) established that 48% of respondents who knew about insurance were informed through television set, in contract to the current study where majority of keepers were informed via radio stations.

Table 2. Awareness level about the livestock insurance policy

Awareness	Serowe	Palapye	Mahalapye	Percent
Aware	6	8	6	11
Not aware	68	40	54	89
Total	74	48	60	

Source: Survey Data, (2018)

Reasons for not uptaking livestock insurance policy. Keepers who were aware of the policy but did not uptake it gave several reasons for their actions or lack of interest in the policy. Six constraints were elicited by farmers, 26% of them indicated that they were not interested and did not know the importance of this scheme for their production system. Some had little knowledge of the scheme (15.8%) so they could not make informed decision while 10.5% of the keepers lacked money to pay month ly premiums, did not trust insurance companies and preferred to engage in non- agricultural enterprises. Keepers thought it was better to engage in other non-agricultural activities as a diversification tool. Generally, agriculture is a risky enterprise hence natural risks cannot be avoided. This reason was also indicated by farmers in Central India where 28% of farmers preferred to shift from agriculture into less risky non-agricultural Small and Medium enterprises (Khan *et al*., 2013). Ng'ang'a *et al*. (2013) also observed that households with low reliance on non-market benefits (insurance) of cattle have high off-farm income which provides an alternative for offsetting unexpected expenditures. A high percentage of keepers did not know the benefits of the insurance policy hence lacked interest in uptaking it. Most of the smallholder keepers have a myth that insurance policies of this nature are meant for commercial farmers.

Table 3. Constraints impeding uptake of the insurance policy

Reason for not taking up insurance policy	Percent of farmers
Lack of money	10.5
Limited knowledge of the policy	15.8
Not interested	26.3
I do not know the importance of the policy	26.3
Best to diversify in non-agricultural business	10.5
Don't trust insurance companies	10.5

Source: Survey Data, (20 18)

Relative importance and utilities for attributes. Relationship between columns of ranked data was measured with the Kendall's Tau correlation coefficient, normally ranging from 0 (no relationship) to I (perfect relationship) (Kendall and Smith, 1939). The Kendall's Wan coefficient in the current study was found to be 0.717, suggesting a strong relationship between the rankings. Both the Pearson's and Kendall's tan coefficients are positive and relatively high thereby indicating a perfect degree of association between variables and data fitting well in the model.

In conjoint analysis, the relative importance of attributes is vital as it signifies which attribute is perceived more important than the other when making a purchase choice. It measures the extent to which utility is increased by fluctuating from most preferred to least preferred level of each attribute. Relative importance scores are computed by taking the ratio of the path-worth for an attribute (difference between the highest and lowest utility value) and the sum of all the partworth ranges. The relative importance of attributes in descending order are: type of insurance cover (25%), time of compensation (21%), monthly premium (17%), insurance coverage (14%), type of compensation (12%) and payment plan (11%). The "type of insurance cover" attribute was deemed the most important attribute. Ideally, a cattle keeper considering to purchase an insurance policy, would select a normal insurance cover paying a monthly premium of $0.70 with compensation payout dispatched within one month after the loss of an animal. The attribute considered least important was "payment plan" hence having with a reduction effect on the utility of the insurance policy.

The utilities results are in accord with the relative importance of attributes results. The Normal insurance level continued to yield the highest utility (0.907), implying that normal insurance cover is highly appreciated by smallholder keepers. The "time of compensations" attribute yielded negative utilities, farmers are not willing to wait for a longer duration for compensation payout. The most preferred attribute level was compensation after 1 month (-0.66 1), indicating that keepers want immediate payment after the veterinary doctor certifies cause of death for the animal. As waiting duration (months) increase, utility increases proportionally but in a decreasing manner.

Smallholder cattle keepers do not prefer to pay any of the suggested monthly premiums for insuring their cattle, as depicted by the negative utilities, attached to the monthly premiums (Table 4). The best preferred premium is $0.70, while $2.10 is the least preferred premium amount. An increase in monthly premium decreases the interest to pay for an insurance policy, postulating the law of demand that quantity of a good purchased, varies inversely with price of a good (Nicholson, 2014). The results tally with Hill (2013)'s study conducted in the United States to measure consumer preferences for goat meat and live goals utilizing choice-based conjoint analysis method. The study revealed that price was negatively statistically significant, indicating that consumer's utility decreased as price increased.

The respondents preferred to be compensated with cash rather than the insurance company replacing their dead cow(s). This statement is emphasized by the fact that keeper's time of compensation display negative coefficients. Since farmers are not willing to wait longer period after their loss, compensating them in cash is a bit quicker than replacing the dead animal. On the other hand, most farmers prefer to insure a proportion of their cattle herd as compared to insuring the whole cattle herd. This could be due to the ir production orientation and income status. Majority of the small holder cattle keepers are unemployed and rely heavily on cattle as their source of income, which limits their level of investment. They may not afford to pay insurance premium for the entire herd owned. Smallholder keepers were more comfortable with paying premiums on an annual instalment basis. This seems sensible as they could sell an animal in order to secure funds to be able to insure other animals. Majority of smallholder cattle keepers only sell when a need for cash arises, cattle can easily be liquidated (Mahabile *et al*., 20l4).

Table 4. Preferred attributes levels a nd their utilities

Attribute	Level	Relative Importance	utility Estimate	t-val ue
Insurance Coverage	Proportion of a herd	14	0.275	1.589
Type of Insurance	Normal Insurance	25	0.907	5.242
Payrnent plan	Annually	11	0.189	1.092
Type ot Compensation	Give cash in hand	12	0.159	0.919
Monthly premium($)	0.70	17	-0.086	-0.'I I3
	1 .40		-0. 173	-0.1 I s
	2.10		-0.259	-0.414
Time of compensation	1 month	21	-0.661	-3.178
	3 months		-1 .322	-3.170
	6 months		-1.983	-3.173

Constant 9,808
Pearson's R = 0.908 Kendall's Tau=0.7 17

Source: SPSS Conjoint Analysis. Survey Data. (2018)
At the time or survey I USD=P9.97

Profile ranking according to WTP. Table 5 displays results of Willingness to pay (WTP) and ranks for the 1.6 insurance profi les generated through SPSS orthogonal design. The attributes WTPs were calculated using individual attribute coefficients, the profiles were ranked according to their WTP in descending order, the highest WTP being the most preferred and the lowest WTP being the least preferred profile. The results show that profile 8 ($39.81) has the highest WTP, followed by card 15 ($29.38) and 7 ($23.4 1) while the least preferred card was profile 13 with a negative WTP of $29.38. From the 16 profiles, eight profiles yielded positive WTP, while the other eight yielded a negative WTP. A negative WTP means that respondents are not WTP for the insurance combination.

The willingness to pay (WTP) for each attribute level preferred was calculated and aggregated to estimate the overall mean WTP for an insurance profi le (Table 5). Thus W IB I cover is significant (p= 0.00) and positively increases the utility of an insurance policy hence, keepers are willing to uptake an insurance policy that covers their animals against losses caused by weather elements only. This results contradicts the previous findings where NI was relatively important to farmers than WI BI. Receiving compensation after 3 months was found to have a negative significant (p=0.092) on the WTP for livestock insurance at the 0.1 significant level (Table 6). Keepers were not willing to uptake an insurance policy that pays compensation money after such a long time, they preferred immediate

payment. The attribute with the highest influence on the respondents' WTP for the insurance policy is the WIB I type of insurance cover contributing the highest WTP am ount of $ 17.77 (P177. 70) to the mean WTP for the insurance profile. The "pay monthly premium" and ' Compensate within 3 and 6 months" attributes negatively affect the overall WTP for the insurance policy, respondents are not WTP for an insurance policy where premiums are paid on monthly installments but prefer to pay once off per year. Likewise, respondents are against a long waiting period before being compensated for their loss, long waiting time for compensation decreases the overall mean WTP amount. In conclusion WTP according to the preferred livestock insurance attributes is $11.45 per month, amounting to P114.50 as national currency of the study area (Botswana).

Table 5. Willingness to pay (WTP) for insurance profile

Insurance profile	Type of compensation	Monthly premium	Type of Insurance	Payment plan	Coverage	Time of compensation	W T P ($)	WTP rank
1	0. 159	-0.173	-0.907	0.189	-0.275	-1.983	12.99	7
2	Q. 139	-0.086	0.907	0.189	0.275	-1.9d3	-8.39	11
3	0. 1.59	-0.086	0.907	-0.189	0.275	-1.322	-25.66	14
4	0. 159	-0.086	0.907	-0.189	-0.275	-0.661	-20.30	13
5	-0.159	-0.173	0.907	0.189	0.275	-0.661	4.28	8
6	-0.159	-0.173	0.907	0.189	0.275	-0.661	-3.90	9
7	0.159	-0.086	-0.907	0.189	-0.275	-0.661	23.4 1	3
8	-0.159	-0.239	-0.907	0.189	0.275	-0.661	3.9.81	1
9	-0.159	-0.259	0.907	-0.189	-0.275	-1.983	-28.48	15
10	0.159	-0.086	-0.907	-0.189	0.275	-1.983	18.96	5
11	-0.159	-0.086	0.907	0.189	-0.275	-0.661	-9.07	12
12	-0.159	-0.086	-0.907	0.109	0.275	-1.322	20.30	4
13	-0.159	-0.259	0.907	-0.189	-0.275	-1.322	-29.38	16
14	-0.159	-0.086	-0.907	-0.189	-0.275	-0.661	17.48	6
15	0.159	-0.259	-0.907	-0.189	0.275	-0.661	29.38	2
16	0.159	-0.173	-0.907	-0.189	-0.275	-1.322	-4.28	10

n=l6
TQ =0463*, p=0.16

Source: Author, Survey Dara. (2018)

Attributes and their levels: Type of compensation (Per herd. Proportion of the herd): Monthly Premium ($0.70. $1.40. $2.10); Type of insurance (Weather index-based insurance. Normal insurance); Payment Plan (Monthly. Annually); Coverage (Replace the dead cow. Give cash in hand): Time to Compensation (After 1,3, 6 months).
* 0.05 percent siatisi ical significance level percent. 1 USD=P9

Conclusion

The study was motivated by lack of livestock insurance policy suitable for smallholder keepers in Botswana. Also there was no empirical reference on the existing commercial agricultural insurance scheme. According to the results, smallholder cattle fanners were not aware of livestock insurance. The most important attribute to be included in the intended livestock insurance policy is type of insurance cover since it has the highest relative importance score. Time of compensation and monthly premium yielded negative coefficients they should be modified to the preference of respondents. Smallholder cattle keepers preferred nonnal insurance covering a portion of their cattle herd, paying

a monthly premium of $1 .40 on annual basis, where compensation will be paid in the form of a live cow. Doubtless long waiting periods for compensation payout and insuring the whole herd were unsatisfactory. Insuring whole herd which might be very expensive for smallholder keepers with large herd of cows. The estimated WTP premium amount is $11.45 per rnonth. The low level of awareness regarding various components of livestock insurance clearly implies that all the stakeholders alongside service provider should be actively engaged in public awareness and capacity building campaign to disseminate insurance policy information.

TabIe 6. Coefficients of the OPM regression model preferred insurance attributes

Attribute	Coefficient	t-value	WTP ($)
Compensate by replacing dead cow	0.009	0.81	1. 12
WIBI cover	0. I4I	0.00***	17.77
Pay premiums monthly	-0.032	-0.386	-4.09
Cover proportion of the herd	0.056	0. 134	7.07
Compensate After 3 months	-0.077	-0.092*	-9. 76
Compensate After 6 months	-0.005	-0.909	-0.66
Premium	0.008	0.806	
TOTAL WTP			1145

N—2912
Log likeI ihood — -8063.636 Pseudo R2= 0.0013
Prob > chi2- 0.0050
LR chi2(7) = 20.29

Statical significance levels: ** *0.0 1, * 0.05. and *0. 1 percent respectively. The coefficient for the altenate attribute (e.g. compensate by cash or pay premiums annually) was the opposite sign of that presented In this table, W IP= $-\beta_{attribute}/\beta_{attrubute}$
Premium is used as the price. 1 USD= P9.9 7, N- number of observations (182 respondents* 16 insurance profiles)

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References

Bahta, S.T., Baker, D. and Marobela, O. 2013. Competitive smallholder livestock in Botswana: Results of a livestock value chain stir vey in the Central district of Botswana. Nairobi, Kenya: International Livestock Research Institute.

Bahta, S., Wanyoike, F., Katjiuongua, H. and Marumo, D. 2017. Characterisation of food security and consumption patterns among smallholder livestock farmers in Botswana. *Agriculture & food security* 6 (1): 1-11.

Bridges, J.F., Hauber, A.B., Marshall, D., Lloyd, A., Prosser, L.A., Regier, D.A., Johnson, F.R. and Mauskopf, J. 2011. Conjoint analysis applications in health—a checklist: a report of the ISPOR Good Research Practices for Conjoint Analysis Task Force. *Value in health* 14 (4): 403-413.

Daykin, A. R. and Moffatt, P. G. 2002. Analyzing ordered responses: A review of the ordered probit

model. Understanding Statistics: *Statistical Issues in Psychology, Education, and the Social Sciences* l (3): l57- 1.66.

Dofonsou, S.G. and Lowenberg-De Boer, J. 2008. Ex ante non-market valtiation for novel product: literature review (No. 1240-20 16- 10 1659). Working Paper No 08-02.

Fischer, I. and Buchenrieder, G. 2009. Insurance preferences of small holders: resuIts from an adaptive conjoint analysis in Northern Vietnam. Discussion Paper No. 05/2008.

Geppert, M. and Dufhues, T.B. 2005. Visualizing rural financial market research in Northern Vietnam through pictures. Beuren, Germany

Hill, J. I. 20.13. Consumers' preferences for goat meat in the United States: an application of choice-based conjoint analysis PhD Dissertation, Louisiana State University.

Hole, A.R. and Kolstad, J.R. 20.12. Mixed logit estimation of willingness to pay distributions: a coiriparison of models in preference and WTP space rising data from a health-related choice experiment. *Empirical Economics* 42 (2): 445-469.

Iningu, P. 20.11. An Economic Analysis of Adoption Potential of a New Tsetse Fly Repellent Technology in Kaj iado and Narok Districts of Kenya. PhD Dissertation, University of Nairobi.

Kairu-Wanyoike, S.W., Kaitibie, S., Heffeman, C., Taylor, N. M., G itau, G.K., Kiara, H. and McKeever, D. 20.14. Willingness to pay for contagious bovine pleuropneumonia vaccination in Narok South District of Kenya. *Preventive Veterinary Medicine* 115 (3-4): 130- 142.

Kamara, J., Jofre-Bonet, M. and Mesnard, A. 20.18. A discrete choice experiment to elicit the w illingness to pay for health insurance by the informal sector workers in Sierra Leone. *International Journal of Heulth Economics and Policy* 3 (1): 1- 12.

Kendall, M.G. and Smith, B.B. 1939. The problem of in rankings. Annals of Mathematical Statistics.

Kgosikoma, K. and Malope, P. 20.16. Determinants of market participation and the instikitional constraints: Case study of Kweneng West, Botswana. *Journal of Agricultural Extension and Rural Development* 8 (9): 178- 186.

Kgosikoma, O.E. and Batisani, N. 20.14. Livestock population dynamics and pastoral comm unities adaptation to rainfall variability in communal lands of Kgalagadi South, Botswana. *Pastoralism* 4 (19): 1 -9.

Khan, M.A., Chander, M. and Bardhan, D. 20.13. Willingness to pay for cattle and buffalo insurance: an analysis of dairy farmers in Central India. *Tropical Animal Health Production* 45: 46.1 468.

Kimalu, P.K. and Mariin ba, K. 20.14. Research Methods, Monitoring and Evaluation. Kairilnni Enterprises Limited, Na irobi, Kenya.

Krystallis, A. and Ness, M. 2005. Consumer preferences for quality foods from a South European perspective: A conjoint analysis implementation on Greek olive oil. *International Food and Agribusiness Management Review* 8 (2): 62-91.

Lancaster, K.J. 1966. A new approach to consumer theory. *Journal of Political Economy* 74 (2): 132-157.

Louviere, J.J. 1988. Conjoint analysis in odell ing of stated preferences. *Journal of Transponrt Economics and Policy* 22 (1): 93-119.

Mackenzie, J. 1993. A comparison of contingent preference models. *American Journal of Agricultural Economics* 75 (3): 593-603.

Mahabile, M. 20.14. Measuring transaction costs in marketing cattle in Southern Botswana. *Botswana Journal ofA gricultural and Applied Science* 9 (2): 75-81.

Mahboob, M. H., Rehman, Q. M., Hamid, K. and Saeed, M. Y. 2009. Insured and non- insured livestock farmers' perception toward livestock insurance-a case study of Faisalabad-Pakistan. *Journal of Livesiock Science* 10: 48-52.

Mahboob, M. H., Rehman, Q.M., Hamid, K. and Saeed, M.Y. 2019 Insured and non-insured livestock fanners' perception toward livestock insurance-a case study of Faisalabad- Pakistan. *Journal of Livestock Science* 10: 48-52.

Masike, S. and Urich, P. 2008. Vulnerability of traditions 1 beef sector to drought and the challenges of climate change: The case of Kgatleng District, Botswana. *Journal of Geography and Regional*

Planning 1 (1): 0 I 2-0 18.
Masole, C. 20.1.8. Economic losses and ex-post response to foot and mouth disease outbreak among smallholder beef producers in Northeast District, Botswana. Masters dissertation, Egerton University.
Mitchell Robert, C. and Carson, R.T. 1989. Using surveys to value public goods: The contingent valuation method. Washington: Resources for the Future.
Mogotsi, K., Kgosikoma, O.E. and Lubinda, K.F. 20.16. Wild life-livestock interface, veterinary cordon fence damage, lack of protection zones, livestock thefi and owner apathy: Complex socio-ecological dynamics in Foot and Month disease control in southern Africa. *Pastoralism* 6 (21): 1 - 12.
Mogotsi, K., Nyangito, M. M. and Nyariki, D. M. 20.11. The perfect drought? Constraints limiting Kalahari agro-pastoral communities from coping and adapting. *African Journal of Environmental Science and Technology* 5 (3): 168- 177.
Ng'ang'a, S.K., Ritho, C., Nzuma, J., Moyo, S. and Herrero, M. 20.13. An assessment of the factors infi uencing household willingness to pay for non-marketed benefit of cattle in the agro-pastoral systems of Mozambique. *African Journal of Agricultural Research* 8 (18): 194 9- 1957.
Orlowski, D. and Sigwele, H. 20.14. Agriculture public expenditure review 2000-20 13 Botswana.
Orme, B. K., A I pert, M.I. and Christensen, E. 1997. Assessing the validity of conjoint analysis-continued. In Sawtooth Software Conference Proceedings University of Texas. pp. 209-226.
Otieno, D.J. 20.11. Economic analysis of beef cattle farmers' technical efhciency and willingness to comply with disease free zones in Kenya, Doctoral dissertalion, Newcastle University, U K. Oinna, E. A., Obare, G. A. and Staal, S. 3. 2003. Cattle as assets: Assessment of non-market benefits front cattle in smallholder Kenyan crop-1 ivestock systems. Proceedings of the 25th International Conference of Agricultural Economists (IAAE), 16-23 August 2003, Durban, South Africa.
Pu, Y. and Grossklags, J. 20.15. Using conjoint analysis to investigate the value of interdependent privacy in social app adoption scenarios. 36th International Conference on Information Systems, Fort Worth, USA.
Shepherd, D.A. and Zacharakis, A. 1999. C onjoint ana lysis: A new methodological approach for researching the decision policies of venture capitalists. Venture Capital. *An lnternational Journal of Entrepreneurial Finance* 1 (3): 197-217.
SPSS, I. 1997. SPSS Conjoint 8.0. Chicago: SPSS. United States of America.
Statistics, Botswana. 20.15. Annual agricultural stir vey report 20.13. Gaborone, Botswana. Statistics, Botswana. 20.18. Ann ual agricultural survey report 20.15. Gaborone, Botswana.
Tano, K., Kamuanga, M., Faminow, M.D. and Swallow, B. 2003. Using conjoint analysis to estimate farmer's preferences for cattle traits in West Africa. *Ecological Economics* 45 (3): 393-407.
Temoso, 0., Villano, R. and Hadley, D. 20.15. Agricultural productivity, efficiency and growth in a semi-arid untry: A case study of Botswana. *African Journal of Agricultural and Resource Economics* 10: 192-206.
Tetaz, M. 20.14. An alternative to Even Swaps for modeling decision in a multi attribute problem; The case of Labor Formaily. *Ciencias Administrativas* 2: 1- 17.
Vaca Moran, F.F. 2014. Application of Choice-Based Conjoint Analysis to Detent ine Consumers Preferences and Willingness to Pay for Grass Fed Beef in the United States. Doctoral Dissertations, Louisiana State University.
van Engelen, A., Malope, P., Keyser, J. and Seven, D. 20.13. Botswana agri-food value chain project: beef val die chain study. FAO: Rome, Italy.
Wang, M. H., Thomas, K.R., Chan, F. and Cheing, G. 2003. A conjoint analysis of factors influencing American and Taiwanese college students' preferences for people with disab ilities. *Rehabilitation Psychology* 48 (3): 195-201.
Yamane, T. 1967. Elementary Sampling Theory. New Jersey: Prentice Hall.