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Cashew growers' preferences for market information system design in Benin: a choice experiment approach

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In Benin, cashew value chain is a promising sector in terms of its export earnings potential and its contribution to the diversification of the country agricultural sources of income. However, its efficiency is hindered, among others, by information asymmetry issue. Market information system (MIS) has been used as an alternative for addressing such issue. Unfortunately, as in most african countries, most MIS still depend on donor for their financing, hence raising the issue of MIS sustainability once the funding ran out. Stakeholders renewed interest in setting up payment-based MIS. To analyze MIS design through estimating users (i.e. cashew growers) willingness to pay for its characteristics, the study grounds its assumption on consumer utility theory. Therefore, the study assumes that a respondent is willing to pay for MIS services if the service provided matches his preferences. Accordingly analyzing cashew growers' preferences for MIS characteristics will inform about the appropriate design increasing respondent's willingness to paying for it. Data were collected from 344 cashew growers. Respondents' preferences were analyzed using choice experiment approach. The results showed that most growers still doubt about MIS effectiveness. However, analyzing their preferences reveal that respondents are willing to pay to receive information in the evening, once in a week, from their farmer's association, through their mobile phone and in local language.
Keywords: Market information system, choice experiment, cashew value chain, logit model.

INTRODUCTION

In Benin, in the last decade, agricultural value chains diversification has become a priority in national development strategies. In fact, the country has learnt lessons from the consequences of relying on cotton as single cash crop on which the national economy was based.

Since, the recent management and organizational issues that adversely affect cotton production and marketing, public policy choices were oriented to promoting potential cash crops other than cotton. This will permit to improve agriculture sector contribution to the Gross Domestic Product (GDP) and avoid the risks related to the high dependence of the economy on cotton (Adégbola et al., 2010). Among the other cash crop to be promoted, cashew nut is one of the promising because of its importance on international market. Benin cashew industry contributes to almost 3% to the Gross National Product (GNP) and 7% to GDP (INSAE, 2009). In central and northern regions of the country, cashew plantations cover over 190,000 hectares. In 2016, the total domestic production of cashew is estimated at 100,000 tons and stand for almost 25% of the total exported agricultural products. The cashew sector employs more than 200,000 farmers and several artisanal and semi-industrial processing units are engaged in (MAEP, 2017). It thus generates income for growers as well as for other actors of the value chain (i.e. traders, processors, exporters, etc.).

However, as most agricultural value chains, information asymmetries if of central concern hindering cashew value chain efficiency. This results in inequitable access to market information for producers (Mikami, 2007; CTA, 2008; Gillet *et al.*, 2013, El Bouazizi, 2018). The cashew sector remains characterized by a lack of coordination among its economic agents. Indeed, information on prices and quality of cashew nuts easily circulated among traders (i.e., buyers, intermediaries and exporters) while producers do not or have a very limited access to it (Mikami *et al*., 2008). The cashew market is characterized by highly variable prices, changing rapidly, especially at growers' level. Growers' access to market information is therefore essential to make informed marketing decisions.

To address this issue, market information systems (MIS) are

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used. MIS are systems supporting agricultural market information's collection and dissemination (Subervie et *al.*, 2014; Mikami 2007, Mittal *et a*l, 2012). Several MIS models have been used, such as: reviews, local radio, public speaker, etc.

Since a decade and taking advantage of the increasing access to mobile phones and internet in the developing world, phone-based MIS offer new opportunities for communication and information-sharing across all types of value chains. This significantly reduces transaction costs and thereby increases agricultural value chain efficiency (Aker, 2011a; Kpenavoun *et al*, 2013). However, as in most West-African countries, Benin' market information system operations are mainly funded by donors (e.g., Belgium, Germany, etc.), which does not confer sustainability to the MIS (Shepherd, 1997; CTA, 2008; Kizito, 2011; Subervie et *al.* 2014). Indeed, the recent experiences in setting up phone-based MIS in Benin have failed for two main reasons: i) they were financed by donors, ii) target groups do not perceive it usefulness and are not used to pay for such services. To ensure the sustainability of development-partners funded pilot initiatives and general ICT for agriculture projects, the payment of market information system services by beneficiaries is advocated (CTA, 2008; Subervie et *al.*, 2014).

Most studies on market information systems revealed that access and use of information provided by market information systems improve production and marketing decisions (Kizito 2011; Mittal et *al.*, 2012; Kpenavoun et *al.*, 2013). Despite that, funding such system remains the bottleneck hindering its long-term and sustainable operation.

As paid services seemed to be the most relevant option, it become relevant to ensure that the suggested services meet and account for both farmers' socioeconomic characteristics and expectations when paying for them. Therefore, it is essential to analyze cashew growers' preferences for MIS characteristics (i.e. phone or television, time of reception, language, etc.) in order to inform the conception of future interventions which will be capable of putting in place effective and sustainable information systems. The overall objective of this study was to determine cashew growers preferences for different MIS characteristics. Specifically, the study seeks to identify the preferred MIS key attributes and their associated levels by growers and to determine the relative values attached to these attributes by the cashew growers. It contributes to the ongoing debate about the design of payment-based MIS by analyzing cashew growers' preferences for market information system attributes using choice experiment approach.

MATERIALS AND METHODS

***Study area*:** The study was carried out in the cashew production region of Benin (West-Africa), especially the provinces of Collines, Donga, Borgou and Alibori. The Agro-ecological zones are categorized according to the cashew nut production potential and comprise in four (04) zones. The zone 1 (or the highly favorable area) which is the most appropriate zone for cashew productions; the zone 2 (or the favorable area) with medium favorable conditions for potential production; the zone 3 (or less favorable area) which correspond to area with limited conditions for plantation and the zone 4, which is the marginal area for cashew nut production. Zones 1 and 2 account for approximately 87% and 11% of the total cashew plantations respectively, whereas the less favorable and marginal zones stand for just 2% of the total plantation.

***Sampling and data collection*:** The multistage sampling approach was adopted in this study. A first stage consisted in purposively selecting four (04) provinces distributed in two major cashew agroecological zones (zones 1 and 2). In these selected provinces, thirty (30) municipalities were identified as major producing area of cashew nut (MAEP, 2003). In that regard, four (04) departments were selected in a second phase before selecting the respondents. The random selection was performed using a list of farmers which was compiled from the database of the Agricultural Diversification Project implemented by the Ministry of Agriculture. Base on this sampling frame, we were guided by the formula of Yamane (1967) to determine the minimum sample size, through the following equation:

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

With n = sample size, N = size of total population of interest and e = margin of error set at 5%. A final sample of 344 cashew growers were selected to participate to the experiment.

Depending on the size per municipality, Table 2 presents the sample spatial distribution across selected municipality.

Table 2. Distribution of the sampled cashew growers across the selected regions and municipalities.

Departments	Municipalities	No. of producers
	Savè	20
	Ouessè	24
Collines	Savalou	20
	Bantè	24
	Tchaourou	21
	Parakou	24
Borgou	N'Dali	24
	Nikki	23
	Bassila	16
Donga	Djougou	24
	Ouaké	23
	Copargo	22
	Natitingou	23
	Kouandé	24
Atacora	Péhunco	16
	Kérou	16
Total		344

Source: Field Survey Data

Analytical framework

***Definition of attributes and levels*:** Several literature sources were used to document the potential attributes of market information system (Aker, 2011a; Kpenavoun *et al.*, 2013; Subervie *et al*., 2014). Literature findings (Hensher et *al.*, 2005; Tapsoba, 2007; Johnson, 2013; Martin *et al*., 2014) were used to prepare and implement a qualitative approach to identify the most relevant attributes for this case study. The final key services attributes of market information system considered were: time of broadcast, channel, frequency, language and source of information (Aker *et al*., 2010; Aker, 2011b; Pierskalla *et al*., 2013; Aker et Fafchamps, 2015; Nakasone *et al*., 2014; Kikulwe *et al*., 2014; Singh *et al*., 2015; Islam et Grönlund, 2010). The choice of these attributes as the most important ones and the selection of their respective levels were performed through focus group discussions, conducted during the exploratory field survey. Focus group sessions were conducted to account for growers' preferences with regards to the aforementioned attributes. With respect to the monetary attribute is concerned, it was defined on the basis of CFA 20 which is the unit cost of an inter-network message using mobile phone. Further, based on CFA 20, an increase of 25%, 75%, 125% and 150% give the monetary attribute's levels. Table 1 summarizes the finalized list of attributes and their respective levels. The table also highlights the reference level considered for each attribute. The reference levels were selected base on their easiness of understanding by cashew growers. They are defined as follow:

- Mid-day: most of farmers are not free at this time
- Television: few farmers own a television
- French: most farmers do not speak French
- Daily: given the length of cashew production cycle, the information cannot be broadcasted on a daily basis
- Cost 20 FCFA: is the price of an inter-network message
- Private sector: few farmers know or are in contact with private organizations.
- ***Experimental design*:** In choice experiment (CE), orthogonal design is commonly used for combining attributes levels and generating relevant alternatives (Choice Metrics, 2018). Orthogonality is satisfied when the levels of each attribute vary independently of each other (Huber *et al.*, 1996). This allows minimizing data correlation issues.

Table 1. Attributes and levels of attributes.

Attributes	Attributes' levels
Time of broadcast	Morning
	Active moment of the day
	Mid-day*
	Evening
Broadcast channel	Phone
	Newsletter
	Radio
	Television*
Language	Local
	French*
Source of information	Farmer's organization
	Public sector
	Private sector*
Frequency	Daily*
	Weekly
	Twice a month
	Monthly
Cost of information (in CFA per mobile phone message)	20*
	25
	35
	45
	50

NB: *****: reference levels.

The six attributes and their respective levels give (4x4x2x3x4x5) x (4x4x2x3x4x5) = 3.686.400 alternatives options. This results in a set of 16 choices to present to respondents. To avoid biased responses due to fatigue from long questionnaire, two blocks of eight choices were generated. Accordingly, producer were asked to choose within at most eight choice tasks. Each choice is made up of two alternatives and a "none of two alternatives" option, which refers to respondents' current situation (i.e., status-quo option). Figure 1 shows the choice alternatives presented to respondents and Table 3 presents the choice cards. Adamowicz *et al.* (1998) recommend including status quo option in CE to allow respondents to opt-out if none of the proposed alternatives match their preferences. This implies opting-out, also, provides a positive level of utility.

Choice experiment approach: Choice experiment (CE) is based on Lancasterian theory of consumer choice. This theory also known as new consumer demand theory asserts that

Table 3. Example of choice card.

Characteristics	Alternative 1	Alternative 2	None of two alternatives
Time of broadcast	Active moment of the day	Morning	
Broadcast channel	Newsletter	Radio	
Frequency of broadcast	Twice a month	Weekly	
Language	Local	French	
Source of information	Public sector	Private sector	
Cost of information (CFA per message)	25	20	
I like			

Table 4. **Description of explanatory variables insert in the logit models.**

Variables	Coded	Modalities
Dependent variable		
The respondent's choice in the set of alternatives	Y_n	1= If the producer has made every choice in the sand of alternatives and 0 if otherwise
Attributes of MIS		
Coefficient for the Alternative Specific	ASC	-
Morning	MOR	1= Morning and 0= if not
Evening	EVEN	1= Evening and 0= If not
Active moment of the day	AMDA	1= Active moment of the day and 0= If not
Phone	PHON	1= Phone and 0= If not
Newsletter	NELE	1= Newsletter and 0= If not
Radio	RAD	1= Radio and 0= If not
Weekly	WEE	1= Weekly and 0= If not
Twice a month	TWM	1= Twice a month and 0= If not
Monthly	MON	1= Monthly and 0= If not
Local language	LOLA	1= Local language and 0= If not
Membership to association	MEMA	1= Yes and 0= No
Public sector	PUBSE	1= Public sector and 0= If not
Cost of information	COSIN	Continuous

individuals derive utility from the characteristics of the good consumed rather than the good itself (Lancaster, 1966). Translating this approach into econometric language calls for the random utility theory, which justifies an econometric approach based on the analysis of choice probabilities.

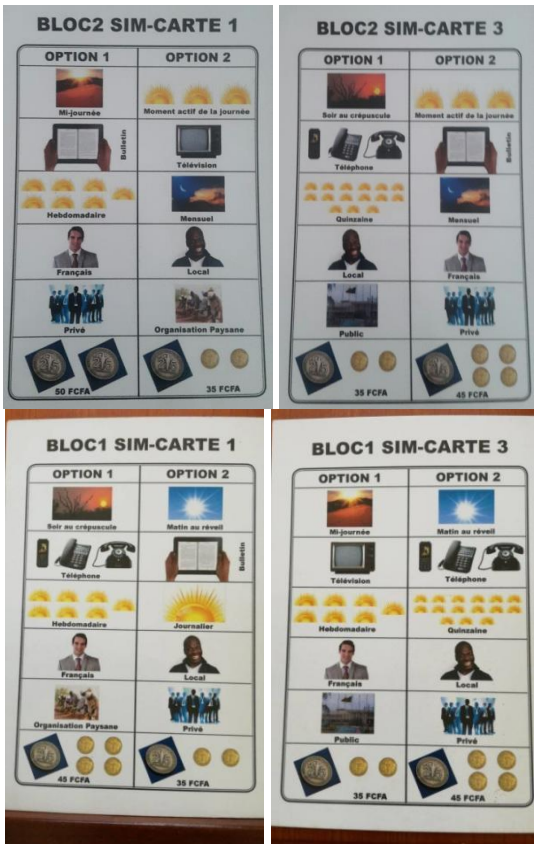

Figure 1. **Sample of choice cards**.

Accordingly, it is assumed that when growers are asked to rate alternative approaches to access information to either increase cashew yields and quality at farm-level or to sell the harvested nuts at competitive price, their choices are made based the expected utility derived from each specific characteristic of the information system.

The conditional logit (CL) is the most common model used to analyze data from choice experiments (McFadden, 1974). This model assumes independent and identically distributed error terms with a type I extreme value distribution. Random utility theory states that it is not possible to identify all the factors that influence the utility of an individual (McFadden, 1974; Baltas et *al.*, 2001).

Since utility is not known with certainty, it is treated as a random variable and the utility from a good is decomposed into two parts: (i) a deterministic part V^{1} which depends on preferences and the level of alternatives (i.e., observable factors); and (ii) a stochastic part (error term) accounting for unobservable factors (McFadden, 1974). Then, its general form is:

$$Ui = Vi + \varepsilon i \qquad (1)$$

Suppose that utility depends on choices made from a certain set of alternatives *C*, the utility function of an individual is of the form:

$$U_{in} = U(X_{in}, Z_n) \qquad (2)$$

Where for a *n* grower, a given level of utility *U* is associated with an alternative *i*, $i \in C$, (the set of alternatives). The alternative *i* is chosen with respect to another *j* as if the utility of *i* is greater than that of the alternative *j*, X_{in} are the attributes of i and Z_n represents the socio-economic characteristics. Further, the agents' socio-economic characteristics X_{in} are very likely to influence attributes preference as well as agents expected utility (Hanley et *al.*, 1998).

Since it is assumed that individuals select alternatives with the highest utility, the probability that a decision maker selects the alternative *i* implies that its utility is greater than that of other alternatives. So, the probability that a *n* grower choose the alternative *i* over a set of given alternatives ***c*** is:

$$Prob\,(y_n = i|C) = Prob(V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}), \forall j \in Cn, j \neq i \quad (3)$$

With y_n the respondent's choice in the set of choices *C.* We have y_n =1 for every choice made in *C* and 0 if otherwise. To estimate equation (3), the error term is assumed to follow a Gumbel distribution and to be identically and independently distributed (McFadden, 1974).

Further, the independence of irrelevant alternatives (IIA) states that the likelihood ratio of choosing any of the two alternatives is not affected by the introduction or suppression of other alternatives (Ben-Akiva et *al.*, 1985; Hanley et *al.*, 1998). This implies that the conditional probability of choosing a given alternative is:

$$\text{Prob}\left(U_{in} > U_{jn}\right) = \frac{\exp\left(V_{in}\right)}{\sum_{jeC}\exp\left(V_{jn}\right)} = \frac{\exp\left(\beta_n X_{in}\right)}{\sum_{jeC}\exp\left(\beta_n X_{jn}\right)} \quad (4)$$

Where β_n stands for growers' preferences.

Discrete choice models are usually estimated using the conditional logit model of McFadden (1974). It imposes homogeneity of preferences among respondents and verifies IIA assumption of independence (Hausman *et al.*, 1984; Hensher *et al*., 2005). However, preferences are very likely to be heterogeneous across respondents (Green, 2008). To address homogeneity bias, mixt logit and latent class models are usually used. In fact, mixt logit model relaxes the assumption of independence of irrelevant alternatives that results from the independent and identically distributed property underlying the conditional logit model. This, therefore, allows for the parameters to be randomly distributed across the population in order to capture preference heterogeneity. Further, in mixt logit only β_n density $f(\beta_n|\theta)$ is observed (Ruto *et al.*, 2009). Therefore, the unconditional probability of choosing a given alternative *i* is the integral of equation (5) with respect to the possible values of weighted β_n by the density of the population of β_n:

$$\text{Prob}_{(yn\,=\,i)} = \int \frac{\exp(\beta n Xin)}{\Sigma jeC\,\exp(\beta n Xjn)} f(\beta n|\Theta d)\beta_n \quad (5)$$

$f(\beta_n|\theta)$ is the density function and represents the distribution of β_n, In equation (5), β_n follows a continuous distribution (McFadden, 1974; Fiebig et *al*., 2010).

The empirical model looks like this:

$$\begin{aligned}\text{Prob}_{(yn\,=\,i)} = {} & \text{ASC} + \beta_1\text{MOR} + \beta_2\text{EVEN} + \beta_3\text{AMD} \\ & + \beta_4\text{PHON} + \beta_5\text{NELE} + \beta_6\text{RAD} \\ & + \beta_7\text{WEE} + \beta_8\text{TWM} + \beta_9\text{MON} \\ & + \beta_{10}\text{LOLA} + \beta_{11}\text{MEME} + \beta_{12}\text{PUBSE} \\ & + \beta_{13}\text{COSIN}\end{aligned}$$

With :

Note that conditional logit and mixt logit are used complimentarily to analyze cashew growers' preferences for the characteristics (i.e. attributes) of a hypothetical market information system.

***Choice of mixed and conditional logit models for data analysis*:** To analyze the data according to the choice of alternatives in many in the "orthogonal experimental design", several econometric models are used. Mathematically, these models are generally based on the assumption that the choice probabilities related to the utility function can be estimated by the multinomial logit model (MLM). However, this model has limits linked to the hypothesis (Gumbel's law) of Identically Distributed Independence (IDI) of the error terms between the alternatives and the observations, and therefore presume a homogeneity of preferences (Espinosa *et al*., 2009; Martin *et al*., 2014). Another limitation of the MLM is related to the hypothesis of independence of irrelevant alternatives (IIA). This is the capital limit of multinomial logit model (Ben akkiva & Bierlaire, 1999). To overcome these limitations, several other alternative models are proposed. These are nested logit, crossed nested logit, latent class model (LCM), polytomous probit model, mixed logit, conditional logit, generalized multinomial logit, etc. (Tapsoba, 2007, Martin *et al*., 2014). The nested logit first proposed by Ben akkiva & Bierlaire (1999), also belonging to the same family of generalized extreme values as the multinomial logit does not allow to completely escape from the IDI and IIA hypotheses. More flexible than the previous models, the polytomous probit is not at all constrained by the three (03) limits previously developed. However, the estimation of this model generates too heavy econometric calculations. The latent class logit model (LCL) also does not violate the IIA hypothesis. It is a model which admits that the distribution of the coefficients is discrete rather than continuous. The small constraint for the latent class logit model is that it uses a statistical methodology based on the concept of likelihood to identify sources of heterogeneity at the segment level rather than at the individual level. The mixed and conditional logit models are not constrained by any of the aforementioned limits and make it possible to detect a possible unobserved heterogeneity in the preferences at the level of the individual and not at the level of the segments like the latent class logit model (Faustin *et al*., 2010; Birol *et al*., 2011). Mixed and conditional logit models perform better in terms of estimation (Shen, 2009) than other estimation models such as the latent class logit model. Other authors such as Scarpa et al. (2004), explain that mixed and conditional logit models have the advantage of being based on a joint estimate and that they allow a more intuitive interpretation and facilitate communication to decision makers. Mixed and conditional logit models allow the heterogeneity of preferences of the actors surveyed to be taken into account (Cembalo *et al*. 2009; Birol *et al*., 2011). For these reasons, mixed and conditional logit models were applied in this study for data analysis.

***Willingness to pay (WTP) estimate*:** Relying on the demand theory, willingness to pay estimate measures cashew growers' welfare with regard to market information system attributes. It is derived for each attribute following formula where V^0 is

the initial utility and $V^1$is the utility corresponding to a given alternative of the market information system. It is therefore the marginal rate of substitution between the market information system characteristics and the monetary attribute (Hanemann, 1984).

$$WTP = b_y^{-1} \ln \left\{ \frac{\sum_i \exp(V_i^1)}{\sum_i \exp(V_i^0)} \right\} \quad (6)$$

Where b_y stands for the marginal utility of income. From conditional logit model, WTP estimates are derived as follow:

$$WTP_i = \frac{dx_i}{dx_c} = \frac{-\beta_i}{\delta_c} \quad (7)$$

With β_i the marginal utility of an attribute *i* and δ_c the cost parameter associated.

RESULTS

Preferences analysis *Conditional Logit (LC)*: Table 5 presents the results of the conditional logit model. The estimated coefficient for the alternative specific constant parameter (i.e., ASC parameter) is found to be negative and significantly different from zero. ASC measures whether or not respondents have interest in using information system services and hence, a negative coefficient implies that producers prefer their current situation. This little or lack interest could be explained by the low knowledge level of the usefulness and effectiveness of market information system services.

However, the preferences analysis shows that coefficients associated with the time of broadcast levels (evening and active moment of the day), are negative and statistically significant at 5% and 1% level respectively. We can say that the farmers have negative preference (disutility) or do not have preference to these periods compared to the reference period which is the mid-day. On the other side, the coefficients of phone, newsletter and radio were positive and statistically significant at 1% level and hence, these broadcast channels are revealed to be the most preferred by the interviewed cashew growers. Furthermore, the magnitude of each estimate shows that phone is the most preferred channel, followed by radio and newsletters. Phone also represents the most preferred attribute with regard to the entire MIS model. The explanation behind this result is that producers (in urban as well as rural area) are already very accustomed to the use of phones and radio in their daily life. About the frequency of information dissemination, all cashew farmers preferred a weekly dissemination. This result could be explained by the fact that information reception is subject to payment. Finally, the use of local language for information dissemination is strongly preferred by all growers as its estimated coefficient was positive and statistically significant at 1% level.

***Mixed logit model (ML)*:** The mixt logit model was used to assess the issue of heterogeneity, and hence to verify homogeneity assumption in cashew growers' preferences for the market information system attributes (Table 5). In this model, the cost attribute and ASC parameter are fixed while the remaining variables are random parameters, assuming a normal distribution (Train, 2002). Therefore, beside the attribute cost and ASC parameter fixed coefficients, estimates of mixt logit model are significant and positive at 1% for evening, phone, newsletter, radio, weekly, local; and 5% for farmer's association.

Table 5. Conditional Logit and mixt Logit models' estimates

Attributes	Conditional Logit Coefficients	Mixt Logit Coefficient
ASC	-2.01*** (0.19)	-2.54*** (0.20)
Morning	-0.18 (0 .98)	-0.30 (0.10)
Evening	-0.27** (0.97)	0.37*** (0.10)
Active moment of the day	-0.31*** (0.09)	-0.40*** (0.10)
Phone	1.57*** (0.10)	1.78*** (0.10)
Newsletter	0.86*** (0.10)	0.98*** (0.11)
Radio	1.43*** (0.11)	1.61*** (0.11)
Weekly	0.34*** (0.09)	0.42*** (0.10)
Twice a month	1.12 (0.10)	0.12 (0.1)
Monthly	0.24 (0 .94)	0.31 (0.10)
Local language	0.81*** (0.06)	1.08*** (0.12)
Membership to association	0.06 (0.08)	1.18** (0.08)
Public sector	-0.02 (0.08)	0.07 (0.09)
Cost of information	-0.01 (0 .00)	-0.01*** (0.00)
Number of observations	344	344
F (13, 344)	30.15***	43.27***
R^2	0.5178	0.5312

( ) Standard –Error : *** signification at 1%, **signification at 5% et * signification at 10%

Source: Authors' estimations

***Willingness to pay for the market information system service attributes*:** The willingness to pay estimates measures growers' welfare with regard to their desire to have a preferred item or attribute and their reluctance to accommodate a non-preferred attribute. Table 6 presents the conditional logit model estimates of cashew growers' WTP for market information system attributes. The positive values in the table represent increase in payments that growers would be willing to make to obtain a more desirable attribute of the market information system, while negative values indicate the compensation that cashew growers would ask in return for accepting a less desirable attribute of the market information system. Results show that cashew farmers are willing to pay for 9 out of 12 total attributes (i.e., phone, newsletter, radio, weekly, monthly, local language, membership to farmers 'association and public sector office). However, given the level of utility that these characteristics provide to them, some

are more preferred than others. Thus, for preferred attributes, producers are willing to pay more. They therefore agree to pay up to CFA 375.17 for using their phone as information system support to receive a message in local language (CFA 102.98), on a monthly basis (CFA 148.05). This service should be provided by their associations (CFA 49.21) and public sector offices (CFA 12.35).

Table 6. Willingness to pay estimates by Conditional logit.

Attributes	Conditional logit WTP estimates (N= 8250)
Morning	-52.69
Evening	-106.12
Active moment of the day	-106.12
Phone	375.17
Newsletter	193.90
Radio	284.94
Weekly	141.55
Twice a month	138.55
Monthly	148.05
Local	102.98
Farmer's association	49.21
Public sector	12.35

Source: Authors' estimations

With respect to the appropriate time to broadcast information, growers are not willing to pay and would rather ask for compensation. The lowest compensation request was found to be the "morning" time of broadcast, suggesting it is the most convenient for respondents among the levels of time to broadcast characteristic.

DISCUSSIONS

Access to production and market information is key for competitiveness and sustainability of farming. However, little is known on farmers, in general, and cashew growers' preferences for market information system attributes and in return about its adoption. Choice experiment approach was used to elicit cashew growers' preferences for market information system characteristics. It was found that growers have significant preferences for various levels of the considered attributes. Regarding broadcast channel attribute, growers first preference was towards mobile phone, then follows radio and newspapers. With respect to the language attribute, respondents preferred local language. As for broadcast frequency, growers are more interested in receiving information on a weekly basis and concerning the source of information, growers prefer information be sourced from their local farmer's association. Therefore, a MIS including all these attributes or characteristics is very likely to be adopted by cashew growers.

Significantly higher preference was placed on phone using in MIS. Indeed, studies provide evidences on the usefulness of the device in communication system. Investigations demonstrated that mobile phone is an effective, useful, bidirectional, fast, interactive, inexpensive tool that can improve productivity and rural incomes when used as support for disseminating agricultural and market information (CTA, 2008, Aker, 2011a). In addition, it has been largely proven that phone is a basic communication device for many farmers (Mittal *et al.*, 2012). Preference of radio is also consistent with the results of Svensson *et al.*, (2009) and Kisito (2011). They concluded that radio is the most popular media in rural areas because it has the advantage of reaching many producers and thereby positively impact marketing decisions. Some growers prefer to access market information through newsletter. The preference for this attribute could be explained by the fact that up to 44% of respondents have attended formal school. Therefore, a relatively large audience is reached through newsletter; which has the advantage of preserving information through printings; but it does not allow interaction with the service provider (CTA, 2008).

Access to Information system services also depends on information broadcast frequency. This parameter seems very useful to respondents, since it informs about the costs related to receiving information. This frequency can be weekly, twice a month or monthly. Results suggest a strong preference for information dissemination on a weekly basis. The progressive harvest for cashew nuts could explain this preference. However, Lam *et al.* (2016) concluded that market information can be daily and/or weekly broadcasted.

Concerning broadcast language, cashew farmers prefer the local language. This preference is due to the low level of education in rural areas. In addition, any broadcasting system needs a source of knowledge, and here, respondents prefer that their association be used as core of competences to provide experience-based information to be broadcasted. This shows the extent to which farmers trust their associations. This confirms as well, the important institutional and economic role played in supporting farmers. Furthermore, it informs on cashew growers needs to have very accurate and specific information, which from their perspective can only be provided by their association. This kind of institutional arrangement has been observed among Sahelian cereals value chain actors. Indeed, they got their own source of information and set a model of information network in response to markets characteristics (Mittal et *al.*, 2012). In addition, it should be noted that some farmers' associations have already taken over the role of public rural extension.

***Conclusions*:** Cashew production is one of the most promising agricultural value chains in Republic of Benin. But, as most agricultural value chain, its efficiency is undermined by information asymmetry issues with regard to prices, quantities and qualities standards. Thus, market information systems appear as a mean to ensure a fair access to information to all value chain actors. This study analyzed

cashew growers' preferences for market information system characteristics. The results showed that most cashew growers were not interested to adopt the MIS due to doubt about its effectiveness. However, analyzing their preferences revealed that growers are more interested in receiving information sourced from their association, on a weekly basis, in the morning, through their phones and in local language. These preferences reflect respondents expected utility derived from subscribing to such information system.

However, any increase in the cost associated with accessing to market information induces a disutility leading to grower's disinterest in the service to be provided. The study outcomes are expected to guide policy-makers and experts aiming at setting up payment-based information systems in agriculture. The studied attributes and their associated levels might be useful in the configuration of a new system that would maximize benefit for users and uptake in the cashew nut farming areas.

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