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Revisiting preferences for agricultural insurance policies: Insights from cashew crop insurance development in Ghana

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ABSTRACT

The development and uptake of agricultural insurance products by farmers in developing countries has been universally and disappointingly low. This paper investigates farmers' preferences and willingness to pay for a variety of agricultural insurance products, including indemnity insurance, index insurance, benchmark insurance, and hybrid (indemnity-index) insurance in the Bono and Bono East Regions of Ghana. We employed hybrid latent class and multiple indicators, multiple causes (MIMIC) models using discrete choice experimental data from 383 cashew growers. The results show that cashew farmers are heterogeneous in their preferences, with a majority advocating for agricultural insurance against key perils such as wildfires, high wind speed and excess rainfall. Hybrid (indemnity-index) insurance product is highly preferred and valued by cashew farmers advocating for agricultural insurance, followed by index insurance product. Farmers are quite sensitive to premiums, expected payout, type of perils covered by the insurance and loss assessment criteria. Social and behavioural constructs relating to trust in insurance companies, subjective knowledge about agricultural insurance, and perceived agricultural insurance benefits are significant determinants of farmers' preferences for agricultural insurance products. The findings imply that it has become very necessary for agricultural insurance product developers, underwriters, and insurers in developing countries to gain more insight on farmers' social and behavioural constructs related to agricultural risk, insurance knowledge and trust. We suggest that agricultural insurance product developers and policy-makers involved in agricultural insurance development should improve farmers' understanding of basis risk and the concept of agricultural insurance, as well as the potential benefits of farm insurance. In this way, we can improve the uptake of agricultural insurance products by farmers in developing countries.

1. Introduction

Agricultural production in emerging economies, particularly in sub-Saharan Africa, is characterised by a high level of risk (Eze et al., 2020; Velandia et al., 2009). These risks are related to production, marketing, and financing. One key approach to dealing with these risks involves the strategic development of agrarian risk management frameworks and tools (Miranda and Mulangu, 2016; Velandia et al., 2009). To reduce risks, state institutions, non-governmental bodies, policymakers, and stakeholders in the agricultural sector have been progressively engaged in the design and development of sustainable and cost-effective insurance products which are feasible in the local context and preferred by producers.

The search for a sustainable agricultural insurance products and markets is premised on the notion that insurance claims during the worst production seasons can augment mitigation and coping strategies, reduce farmers' vulnerability, and provide a basis for production-enhancing agricultural investments that can improve the livelihood and welfare of many poor farmers, particularly in emerging economies (Peters, 1998; Velandia et al., 2009; World Bank, 2013). For instance, the Chinese government supported the agricultural insurance market with premium subsidies, which helped the agricultural insurance market

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to grow significantly (World Bank, 2013). Similarly, weather-based crop insurance product has been substantially developed to protect investments by Ghanaian, Indian, and Mexican farmers from weather-related perils (GAIP, 2020; World Bank, 2013; Zant, 2008). The World Bank revealed that agricultural insurance exists in over one hundred nations, globally. It is evident that development of agricultural insurance markets has been widely promoted by agricultural economists, governments, non-governmental development organizations and agricultural policymakers as a means of addressing the adverse impacts of agricultural production risk on smallholder farmers of the developing world. However, uptake of agricultural insurance products by farmers in developing countries has been universally and disappointingly low, with farmers rarely willing to purchase insurance unless it is heavily subsidized (Miranda et al., 2014; World Bank, 2013). In addition, market penetration of agricultural insurance products and piloted programs in emerging economies, including sub-Saharan Africa, are low (AIDP, 2013; Miranda et al., 2014; World Bank, 2013). Therefore, there is a need for sustainable insurance designs and relevant policies that could help the acceptance, adoption, and penetration of agricultural insurance products. Existing literature suggests that low acceptance of agricultural insurance in emerging economies are linked a number of social, economic, behavioural and supply factors (Carter et al., 2014: Platteau et al., 2017).

In Ghana, research evidence continues to give credence to the notion that the cocoa sector will be affected by climate change by 2030, while the cashew crop would rather improve. The anticipated improvement in the cashew sector in the era of climate change is due to the fact that cashew crop is more resilient and can survive harsh environmental conditions relative to cocoa (Competitive Cashew initiative, 2020). This implies that cashew production can either substitute or complement cocoa production to generate regular income for farmers, create employment, creates wealth and empower women and youth in rural areas (ClAT, 2011; Competitive Cashew initiative, 2020). The government of Ghana and development partners are developing agricultural policies to help develop the cashew sector. For example, Tree Crop Development Authority (TCDA- Act 1010) was implemented by the Government of Ghana in 2020 to promote and support the development and regulation of cashew and other tree crops such as shea, mango, coconut, rubber, and oil palm, a step in the right direction. The European Union's Ghana National Indicative Program through Competitive Cashew Initiative has also implemented Resilience Against Climate Change (REACH) program to develop climate-smart agricultural policies and plans to create a sustainable agricultural economy and to inform future planning decisions.

Despite these efforts, little attention has been paid to the design and development of agricultural insurance products for cashew farmers. Meanwhile, the plethora of risks and uncertainties that cashew farmers must face, or mitigate through management ex-ante or coping ex-post (Fafchamps, 1999) using traditional methods, can be counterproductive (Chantarat et al., 2017; Roberts, 2005). Without proper risk management instruments, like agricultural insurance, a cashew crop farmer may experience loss of investment from perils such as drought, excess moisture, drought, wildfire, excess rainfall, windstorm, flood, pest, or disease (Abdi et al., 2022). Most Ghanaian farmers, including cashew crop farmers, use traditional indigenous knowledge and experience rather than contemporary risk management tools, such as agricultural insurance, to mitigate idiosyncratic and systemic risk, and covariate or systemic risk, from environmental and climatic factors (Abdi et al., 2022; Kwadzo et al., 2013; Owusu et al., 2021). Consequently, most financial institutions have become reluctant to extend their loan portfolios to foster the development of the cashew subsector and related industry. While research evidence continues to establish the relationship between farmers' willingness to insure and the features of agricultural insurance products (Adjei et al., 2016; Owusu et al., 2021), a knowledge gap persists regarding the relationship between agricultural insurance product choices and farmers' perceptions of and attitudes towards insurance in general, as well as basis risk. In addition, not much is known about cashew farmers' preferences regarding agricultural insurance product types.

Literature synthesis thus displays gaps in knowledge on the heterogeneous preferences for different agricultural insurance products defined by their attributes in the Ghanaian context (Osei Tutu, 2012; Stutley, 2010). We find knowledge gaps regarding agricultural insurance products, farmers' perceptions and attitudes on agricultural insurance, and the key perils they are willing to insure against to enhance the sustainability and development of the cashew sector. An extant empirical investigation of insurance products in the Ghanaian agricultural sector and willingness to pay for them focuses on the maize and cocoa crop sub-sectors (Adjei et al., 2016; Dziwornu et al., 2019; Ellis, 2017; Kwadzo et al., 2013; Nyaaba et al., 2019; Owusu et al., 2021). Stutley (2010) argued that there cannot be any viable insurance product for the Ghanaian cashew sub-sector, Osei Tutu (2012) observed that insurance demand exists in the cashew sub-sector, since risks posed by adverse environmental hazards limit farmers' access to farm financing. Attitudes, trust, and perception are behavioural aspects that have been argued to affect insurance uptake. Guiso (2012) argued that since insurance involves an exchange of money today against a promise of money in the future, the trust that the person purchasing the insurance policy has for the insurer can affect the former's willingness to pay for the policy. Some studies have found perception of people as a significant factor which explains why people are not willing to purchase insurance, particularly in the health sector (Ankrah et al., 2021; Coydon and Molitor, 2011; Jehu-Appiah et al., 2000; Gine et al., 2008).

To date, there is no consensus on smallholder farmers' preferences for agricultural insurance product types, particularly in developing countries including in Ghana, due to varied perception about agricultural insurance and premiums (Ankrah et al., 2021; Carter et al., 2014), scanty knowledge about agricultural insurance (Ankrah et al., 2021; Addey et al., 2021) and absence of agricultural insurance products in production regions where insurance is needed (Ankrah et al., 2021). Moreover, most agricultural insurance studies utilised products based on some index approach (Miranda and Mulangu, 2016; Sibiko et al., 2018). However, Meuwissen and Molnar (2010) argued that hybrid insurance products that combine different insurance product types are suitable for farmers facing both systemic and idiosyncratic risks. For instance, Meuwissen and Molnar (2010) argued that hybrid insurance product which combine both index and indemnity insurance product types are suitable for farmers facing both systemic and idiosyncratic risks. Under such hybrid product type, farmers' idiosyncratic risks are insured by the indemnity portion of the policy, while the systemic or covariate risk is covered by the index portion of the policy. Such hybrid insurance products can be a remedy for eliminating basis risk.

The objective of the present paper was to assesses farmers' preferences and willingness to pay for a variety of agricultural insurance products, including indemnity insurance, index insurance, benchmark insurance, and hybrid (indemnity-index) insurance. The paper further identified relevant attributes that can help in developing appropriate agricultural insurance product that is acceptable by farmer. This paper provides the first evidence of which we allow farmers to choose from a variety of agricultural insurance products in a single experiment, unlike other studies where farmers are presented with only one insurance policy to indicate whether they are willing to pay or not (e.g. Aizaki et al., 2021; Budhathoki et al., 2019; Doherty et al., 2021; Karlan et al., 2011; Miranda et al., 2014; Sibiko et al., 2018). Allowing farmers to choose from a variety of agricultural insurance products mimics the random utility theory of modelling human behaviour and decision-making (Lancaster, 1997). Thus, we allow cashew farmers to make their decision as if they have a utility function for which they were to make choices from different insurance product types (e.g., indemnity insurance, index insurance, benchmark insurance, and hybrid (indemnity-index) insurance) to maximise their utility subject to their budget constraint and specific perils.

In addition, it is the first to consider the effect of farmer's perception and attitudinal constructs such as trust in insurance providers, subjective and indigenous knowledge about basis risk and agricultural insurance in latent choice framework explaining farmer's decision adopt agricultural insurance for their perils. In addition to extending the frontier of knowledge, the results from this study will provide technical guidance for the Ghana Agricultural Insurance Pool (GAIP), World Cover, and any other agricultural insurance companies or policy makers to design products in harmony with cashew crop farmers' risk management preferences, in order to enhance their access to agricultural credit. The study contributes to the search for sustainable crop insurance designs to support the agricultural development in emerging economies.

2. Methodology

2.1. Latent and choice modelling framework

This study adopted an integrated latent-choice modelling framework (See Fig. 1). The first part of the conceptual framework focuses on the latent variable model. As shown in Fig. 1, personal and production characteristics influence behavioural constructs, which are defined by perceptions and attitudes toward agricultural risk and insurance. The second part focuses on the choice model. This part incorporates the personal and production characteristics, social and behavioural constructs, and attribute levels of the agricultural insurance products and how they affect cashew farmers' utility from choice of insurance for their cashew farm.

Behaviour, attitudes, and perceptions affect farmers' choices, and the choices made by the farmers are also influenced by goals and utility (Atkinson and Birch, 1970; Gollwitzer and Bargh, 1996; Lancaster, 1997). Thus, in this study, the motivation to insure a farm depends on the expected utility and the basis risk. We thus recognise farmers' perceptions and attitudes as social and behavioural constructs, and the choice of insurance policy is influenced by agricultural risk and insurance characteristics.

This implies in this study that farmers' perceptions of and attitudes towards agricultural risk and insurance in general determine their agricultural insurance scheme preferences. If farmers' perception and attitudinal variables are included directly in the utility function, it will lead to measurement and endogeneity bias (Daly et al., 2012; Mariel, Meyerhoff and Hess, 2015). Hence, we use the integrated latent-choice method, which avoids inherent bias from direct inclusion of perception and attitudinal variables into the utility function (Hess, 2012).

Recent studies have suggested that generating social and behavioural constructs from the observed perception and attitudinal indicators, and incorporating them in the choice model, can avoid the inherent bias (Mariel et al., 2015; Paulssen et al., 2014). The incorporation of social and behavioural constructs in the choice model helps attain consistent and improved estimates (Daly et al., 2012). The attainment of consistent estimates i two criteria. These include the limited information criteria (two steps, sequentially) and the full information criteria (one step, simultaneously).

In the limited information criteria, a multiple indicators, multiple causes (MIMIC) model is usually used to investigate the relationship between socioeconomic variables and the attitudinal variables in the first stage using structural equations.

The factor scores from the first stage are saved and included in the choice model (Diamantopoulos, 2006). The full information criteria estimate both the MIMIC and choice models simultaneously (Ben-Akiva et al., 1999; Daly et al., 2012; Mariel, Meyerhoff and Hess, 2015). While these criteria are more efficient, they can suffer from convergence problems arising from multiple integrals (Bahamonde-Birke et al., 2017).

In this study, we employed the full information criteria, which simultaneously estimate MIMIC and choice models. Thus, scores of perceptions and attitudes towards agricultural risk and insurance were generated as constructs and included in the choice model to explain the cashew farmers' choice of agricultural insurance products.

2.2. Empirical models

2.2.1. Latent variable model

We adopted the multiple indicators, multiple causes (MIMIC) model to analyse the latent variable part of the conceptual framework in Fig. 1. This model allows us to measure the indicators of farmers' perceptions of and attitudes towards agricultural risk and insurance as well as how the indicators are associated with farmer and farm characteristics (Anderson and Gerbing, 1988). Analytically, two steps are followed when estimating the MIMIC model. The first step involves running a confirmatory factor analysis to check how the perception and attitudinal constructs towards agricultural risk and insurance are related to their measured indicators (measurement component). Scores on perception and attitudinal constructs of agricultural risk and insurance indicators (Y_{ijn}) for latent variables j are modelled to measure the effects of scores on their resulting latent variable, denoted as Υ_{jn}:

$$Y_{ijn} = \hbar_{ij}\cdot\Upsilon_{jn} + \nu_{ijn} \tag{1}$$

where Y_{ijn} is the score for cashew farmer n on the i^{th} indicator of latent variable Υ_j ,$\hbar_{ij}.\Upsilon_{jn}$ represents the deterministic aspect and is assumed to be linear. ν_{ijn} captures the errors in measurement and should not be correlated across indicators and $\hbar_{ij}$ denotes factor loadings capturing the impact of Υ_j on $\hbar_{ij}$. Equation (1) is validated using fitness indicators such as RMSEA, SRMR, CFI[1] and chi-square (Bagozzi and Yi, 2012). The second stage involves the estimation of the structural model, where the perception and attitudinal constructs are modelled to be partly explained by the observed personal and production characteristics (X). The structural equation is specified as:

$$\Upsilon_{jn} = \sum_{w}\gamma_{jw}.X_{wn} + \tau_{jn} \tag{2}$$

where γ_{jw} denotes the estimates that account for the w^{th} cashew farmer or farm characteristic represented by Xw on Υ_j, and τ_{jn} is the independent and identically distributed (*i.i.d)* error term which can correlate across latent variables. The two equations are estimated together as a MIMIC model and the predicted scores (i.e., latent constructs) from this joint estimation are incorporated in the choice model. The next section discuses the choice model.

2.2.1.1. Choice model. In considering cashew farmers' knowledge of existing cashew production risks in their operational environment, alternative risk mitigation strategies, agricultural insurance, and the potential risk management benefits of agricultural insurance, this study follows the random utility theory (Lancaster, 1997; Yu et al., 2021). Random utility theory models decisions of individuals among discrete sets of alternatives with the assumption that a rational individual will select the alternative that offers the highest utility (Lancaster, 1997). In this study, we assume that cashew farmers risk management preferences, particularly for agricultural insurance product types, varies based on the attributes of each product and as such can be gauged in a utility function. Thus, cashew farmers behave as if they have a utility function for which they were to make choices from different insurance product type (e.g., indemnity insurance, index insurance, benchmark insurance, and hybrid (indemnity-index) insurance) to maximise their utility. In line with random utility theory, cashew farmers are expected to choose a risk management tool that yields the highest utility, by choosing among the various insurance product types. When faced with different agricultural insurance product types, P_{ks}, a rational cashew farmer k is

[1] Root Mean Square Error of Approximation (RMSEA); Comparative Fit Index (CFI); Standardized Root Mean Square Residual (SRMR).

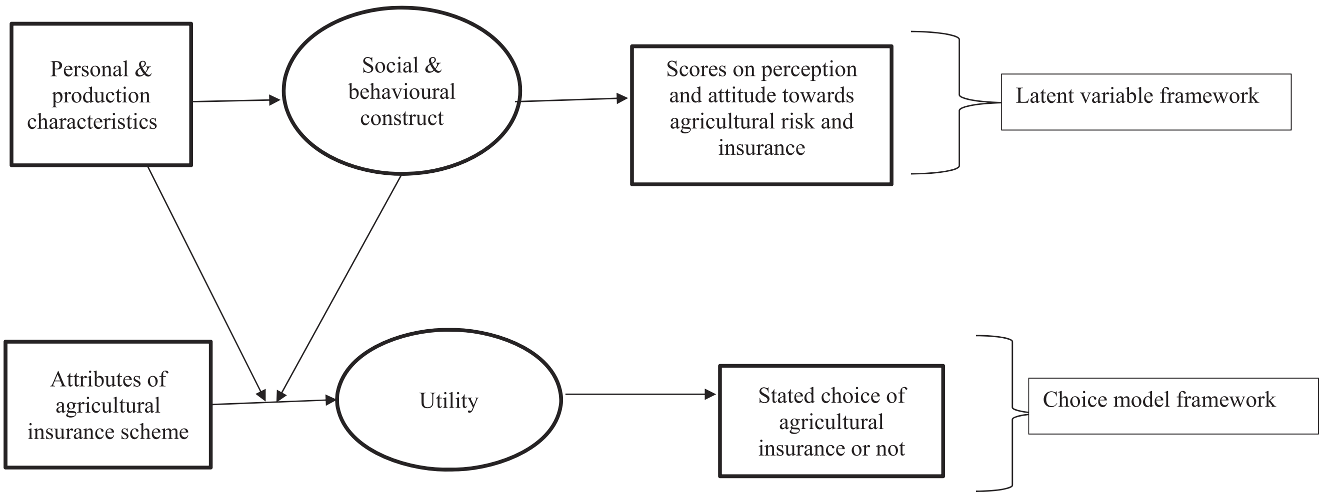

Fig. 1. Latent-choice modelling framework.

assumed to choose insurance product type q in choice scenario s if the utility of his or her choice is greater than the status quo alternative of no insurance, m. Thus $U_{qks} > U_{mks}; \forall r \neq q, m \in P_{ks}$. Where U_{qks} is the utilitly for choosing alternative q and U_{mks} is the utility for the status quo alternative m. We specify U_{qks} as:

$$U_{qks} = \hbar\left(Z_{qks}, X_k, \Upsilon_k, \alpha\right) + \varepsilon_{qks} \tag{3}$$

U_{qks} is defined above; $\hbar(Z_{qks}, X_k, \Upsilon_k, \alpha)$ is the observed systematic element of the utility function; Z_{qks} is a vector of attributes of the insurance product type q; X_k represents observed personal and production characteristics, Υ_k is the latent variables relating to perception and attitudinal constructs of agricultural risk and insurance, α is a vector of parameters to be estimated, and ε_{qks} is the random element of the utility with *i.i.d.* The latent class model places the sampled cashew farmers into distinct classes C and the class allocation depends on distinctive utilities π_C. For a given cashew farmer k fitting in class c, his or her conditional probability (ρ_k) of selecting insurance product type q from the choice set s is specified as:

$$\rho_k = Pr(g_{ks}/C, Z_{qks}) = \prod_{s=1}^{S_k} \frac{\exp^{\left(\pi_C\ Z_{qks}\right)}}{\sum_{l=1}^{L} \exp^{\left(\pi_C\ Z_{qks}\right)}} \tag{4}$$

where g_{ks} captures how cashew farmer k orders his or her choices across the choice sets S_q. Z_{qks} vector of attributes of insurance product type q. Equation (4) takes the form of a multinomial logit probability outcome but we fixed one of the scale parameters for identification purposes. For an individual cashew farmer to be allocated to a given class depends on allocated probability, which has a logistic distribution:

$$\Phi_{k,c} = \frac{\exp^{\left(\theta_{o,c} + \gamma_C X_k\right)}}{\sum_{c=1}^{C} \exp^{\left(\theta_{o,c} + \gamma_C X_k\right)}} \tag{5}$$

$\Phi_{k,c}$ is the probability of being allocated to class c. The utility of a given class is also a function of X $_k$,which captures the observed farm and farmer characteristics. γ_C and θ_o are vectors of parameters to be estimated and a constant for class c, respectively. The unlimited probability over the order of representative choices made by the cashew farmers is computed by finding the expected values for every identified class, C as:

$$\rho r_k = Pr(g_{ks}/Z_{qks}) = \sum_{c=1}^{C} \Phi_{k,c} \prod_{s=1}^{S_k} \frac{\exp^{\left(\pi_C\ Z_{qks}\right)}}{\sum_{l=1}^{L} \exp^{\left(\pi_C\ Z_{qks}\right)}} \tag{6}$$

As evidenced in equation (5), the latent variable (Υ_k) was not included in the function. Only X $_k$ was included because directly including both can potentially cause endogeneity and measurement bias (Ben-Akiva et al. 1999; Daly et al. 2012). We rather incorporated the generated scores derived for the latent variables in the final MIMIC model in the latent class model (Anderson and Gerbing, 1988; Daly et al. 2012). Therefore, for a given perception and attitudinal factor j for cashew farmer k, we specify the i^{th} factor estimate as:

$$t_{ik} = \lambda\left(Y_{ijk}, \xi\right) + \varepsilon_{ijk} \tag{7}$$

where t_{ik} is a function of Y_{ijk} and a vector of parameters (ξ); ε_{ijk} is a random term with logistic distribution,t_k. We employed the ordered logit framework for the perception and attitudinal components $t_1 - t_r$. The probability of a given observed perception and attitudinal factor $t_{ik}(k = 1.....y)$ is specified as:

$$T_{t_{ik}} = t_{(t_{ik}=q_1)}\left[\frac{\exp^{\left(\eta_{i,q1} - \xi_i Y_k\right)}}{1 + \exp^{\left(\eta_{i,q1} - \xi_i Y_k\right)}}\right] + \sum_{f=1}^{F-1} t_{(t_{ik}=q_1)}\left[\frac{\exp^{\left(\eta_{i,f} - \xi_i Y_k\right)}}{1 + \exp^{\left(\eta_{i,f} - \xi_i Y_k\right)}} - \frac{\exp^{\left(\eta_{i,(f-1)} - \xi_i Y_k\right)}}{1 + \exp^{\left(\eta_{i,(f-1)} - \xi_i Y_k\right)}}\right] + t_{(t_{ik}=q_G)}\left[1 - \frac{\exp^{\left(\eta_{i,(Y-1)} - \xi_i Y_k\right)}}{1 + \exp^{\left(\eta_{i,(G-1)} - \xi_i Y_k\right)}}\right] \tag{8}$$

where ξ_i measures the impact of the unobserved variable (Y_k) on the perception and attitudinal factor t_{ik}. The set of computed threshold parameters from equation (8) is signified by $\eta_{i,1}, \eta_{i,2} ... \eta_{i,G-1}$. Each of $\eta_{i,1}, \eta_{i,2} . . . \eta_{i,G-1}$ are computed with ancililary parameters $\sigma_{i,1}, \sigma_{i,2} ... \sigma_{i,(G-1)}$ in that $\eta_{i,2} = \eta_{i,1} + \sigma_{i,1}, \eta_{i,3} = \eta_{i,2} + \sigma_{i,2} .... \eta_{i,G} = \eta_{i,G-1} + \sigma_{i,G-1}$ and $\sigma_{i,G} \geq 0 \forall G$. The ancillary variables are specified such that $\eta_{i,1} < \eta_{i,2} < ... < \eta_{i,(G-1)}$.

Y_k is incorporated in the model via the class-specific allocated probabilities, as in Equation (5). We re-specify equation (5) to include Y_k as:

$$\Phi_{k,c} = \frac{\exp^{\left(\theta_{o,c}+\delta_C X_k+\gamma_C Y_{ijk}\right)}}{\sum_{c=1}^{C}\exp^{\left(\theta_{o,c}+\delta_C X_k+\gamma_C Y_{ijk}\right)}} \tag{9}$$

where, $\theta_{o,}\delta_c$ and γ_c are parameters to be calculated. The impact of perception and attitudinal constructs relating to agricultural risks and insurance Y_k in elucidating the prospect of cashew farmer k fitting in a particular class is shown by the sign of γ_c. The influence of the farmer and production factors on class assignment is captured by δ_c. The impact of perception and attitudinal constructs is captured under the measurement component of the model and the structural aspect contains the impact of the farm and farmer characteristics. The combined log-likelihood equation for our integrated latent class model is stated as:

$$LL(\pi,\theta,\Upsilon,\xi,\eta) = \sum_{n=1}^{N}\ln\int_{\psi}\left(P_k\prod_{i=1}^{3}T_{t_{ik}}\right)f(\psi)d\psi \tag{10}$$

The monetary values offered by each segment of farmers were estimated using the simulation approach by Krinsky and Robb (Jeanty, 2007).

2.3. Attributes selection and choice experimental design

The study considered seven important attributes, including insurance product types, duration, payment mode, methods of loss assessment, key insured perils, premium per acre per year and pay-outs. These attributes were selected from key informant interviews and focus group discussions with relevant stakeholders. Two focus group discussions were held. The first discussion consisted of 17 agricultural insurance experts from Ghana Agricultural Insurance Pool (GAIP), 3 insurance experts from Ghana Reinsurance PLC (Ghana Re), 20 lending managers from financial institutions, 13 climate and weather forecast experts from Ghana Meteorological Agency (G.Met) and Ignitia Ghana Limited, 10 experts from The Statistics Research and Information Directorate (SRID) of the Ministry of Food and Agriculture (MoFA) and 7 members of from different cashew farmer associations. In this group discussion, several relevant agricultural insurance product attributes found in recent literature were discussed. The seven most important attributes for the cashew industry according to the experts are presented in Table 1 with their respective levels. The different attribute levels were also discussed with the panel of experts. After the experimental design, a second focus group discussion was held with experts to ensure that the different combination of insurance product attributes in the choice sets were realistic and based on unique attributes of each insurance product type. Unrealistic combinations were removed before the blocking strategy. We used a random-parameter panel-efficient design to generate two insurance product alternatives (A, B) with a “none” alternative (Choice Metrics, 2021). In the design process using Ngene software, we utilised priors from the pilot survey using multinomial logit model and orthogonal design in the random-parameter panel-efficient design. In addition to the D-error efficiency, we used blocking to reduce the number of choice sets assigned to a respondent. Forty-nine (45) choice sets were created and blocked into five groups. Each block contained nine choice sets. We randomly allocated each respondent to a block.

Table 1
Insurance attributes and attribute levels in choice experiment.

Attributes	Attribute level
Insurance product type	1. Indemnity
	2. Index
	3. Benchmarking
	4. Hybrid (indemnity-index)
Key insured perils	1.Wildfire
	2.Extreme temperature
	3.Excess rainfall
	4.High wind speed
Methods of loss assessment	1.Weather station
	2.Satellite stations
	3.Triggers on selected farms
Duration	1.Annually
	2.Quartely
Payment mode	1.Cash mode
	2. Bank mode
Premiums/acre/year	1. Gh¢ 53
	2. Gh¢100
	3. Gh¢117
	4. Gh¢120[4]
Payouts	1. GH¢455 to GH¢650
	2. GH¢651 to GH¢1200
	3. GH¢1200 to GH¢1750

[4]Exchange rate in December 2018 (GH¢1: US$:0.207).

The insurance product type attribute’s levels consist of indemnity (Stutley, 2010; GAIP, 2012 Mahul and Stutley, 2010), index, hybrid (indemnity-index) (Muewissen and Molnar, 2010) and benchmarking (Swiss-Re, 2016).

Indemnity: The indemnity insurance product type is good for providing cover for idiosyncratic risk that is particular to individual farms. A cashew farmer’s significant sources of risk that are residual and unique to the individual household form the basis of the contract (Wenner, 2005). It involves an on-farm measurement that can establish actual losses and compensate farmers accordingly. Traditional indemnity insurance involving multiperil crop (MPCI) will, however, require an estimate of the potential yield of crops to be insured after emergence. This type of insurance can cover windstorms and other measurable perils such as rainfall, fire, uncontrollable pest, and high temperatures. Therefore, no basis risk can occur in indemnity contracts. However, premium estimates may in some cases be higher than those of index insurance due to loss adjustment cost, which is normally passed on to the farmer in the form of increased premiums.

The indemnity insurance suffers from adverse selection, information asymmetry, moral hazards, and high transaction costs, in addition to the loss adjustment or assessment cost. These render the premiums expensive relative to index insurance and, therefore, less affordable for farmers (Mapfumo, 2007). Hence, we expect indemnity insurance to be preferred by high-income and educated farmers who can appreciate the measurement and calculation of premiums.

Index: Index insurance type is a derivative rather than traditional insurance (Clark et al., 2012). According to Herbold (2012), index insurance are two-fold: the weather index and the area yield index. Indices are based on an agreed threshold of meteorological indices, such as rainfall or precipitation, temperature, humidity, or wind speed measured by weather stations or satellite stations. Pay-outs are based on a pre-determined index or trigger, rather than farm-level losses (World Bank, 2013), which are easy to identify and measure. This approach uses indices such as temperature, wind speed, rainfall, sunshine, and humidity as proxies for actual yields to determine whether a farmer has experienced a loss or not. The basic assumption is a correlation between the chosen index and the expected yield if the right agronomic practices are ensured. This insurance product type solves the moral hazard and adverse selection problems of indemnity insurance but has a basis risk. We expect farmers with small land sizes to prefer index insurance.

Hybrid (indemnity-index): The hybrid (indemnity-index) insurance product combines the index and indemnity insurance product types. Meuwissen and Molnar (2010) identified this type of product under the name “yield shield insurance”. This insurance product is suited for households in farming communities faced with both systemic and idiosyncratic risks. In these circumstances, farmers’ idiosyncratic risks are insured by the conventional indemnity portion of the policy, while the systemic or covariate risk is covered by the index portion of the contract. This product can be a panacea for eliminating basis risk. According to Meuwissen and Molnar (2010), this insurance product addresses the problems of adverse selection, moral hazard, and possible information asymmetry inherent in the indemnity approach. Due to the prevalence of systemic risk in agriculture, we expect hybrid (indemnity-index) insurance to be preferred by cashew farmers. Also, we expect farmers with small size farms to choose hybrid (indemnity-index) insurance.

Benchmarking: In the benchmarking insurance product, the farmers and insurers select specific sites or farms as benchmarks in the midst of many farms with homogeneous characteristics in specific areas in a particular community. These selected benchmark farms are monitored for various triggers agreed for pay-outs by both the insurer and the farmers and whatever happens to these farms is deemed to have happened to the rest of the farms around the benchmark sites for pay-outs to be made. Hence, it is suitable for co-operatives or block farming. It is also best for small-scale agriculture and in situations where loss assessment on individual farms would be a resource-intensive and time-consuming (Swiss-re, 2012). Perils that are systematic and affect a wide area or community are best covered under the benchmarking insurance approach (Swiss-re, 2014). It is not suitable for localised or idiosyncratic risks. Though co-operative or block farming is not popular among Ghanaian cashew growers, most cashew growing communities and farms have similar characteristics akin to block farming. We, therefore, expect smallholder farmers to prefer this type of insurance.

Key perils: The key perils against which farmers were willing to insure based on their residual or transferable risk whose impact on their investment they cannot handle and were willing to insure were wildfires, high temperatures, excess rainfall, and high wind speed.

Duration and Mode of payment: The duration variable has two levels, consisting of annual and quarterly payment periods. The mode of payment can be either cash or bank deposit.

Method of loss assessment: The method of loss assessment variable has four levels. These include the use of weather stations, satellite stations, triggers on selected farms, and detailed farm visits.

Payouts: In line with the random utility theory, the expected payout for the different insurance products forms an important part of farmers' decision to choose the correct crop insurance product. In this study, we generated three payouts based on the key perils, frequency of occurrence of the risk, age of the farm[2] and actual production history (e.g., yield, production cost, revenue), with the help of general insurance and agricultural insurance experts from GAIP, Ghana Reinsurance PLC (Ghana Re), financial institutions, G.Met and Ignitia Ghana Limited as well as members of different cashew farmer associations. Two ranges of expected payouts were computed for the systematic residual risks (i.e., extreme temperature, excess rainfall and high wind speed). These perils were classified as systematic risk that can affect the entire farming areas, particularly in this era of climate change. Based on historical weather data from G.Met and Ignitia Ghana Limited, excess rainfall and high wind speed have similar probabilities of occurrence whereas extreme temperature has a different probability. However, all the three perils are directly affect flowering, fruiting and harvesting stages of cashew crop life. We assumed a coverage level of 50% to 60% of the approved yield. With the help of experts mentioned above, the payout ranges were based on share of the yield or revenue guarantee and production cost. Indemnities were based on the projected value or price for the next cashew production season. A payout of GH¢651 to GH¢1200 was set for excess rainfall and high wind speed and a range of GH¢455 to GH¢650[3] was fixed for extreme temperature. Using the Ngene software, we imposed constraints/restrictions in the design such that any choice situation with the above-mentioned perils will have the corresponding payout values. Ngene software allows for constraints/restrictions to be imposed on attribute levels in the efficiency design. This attribute level count constraints approach utilises the Modified Federov algorithm to generate efficient designs (Choice Metrics, 2021). The Modified Federov algorithm allows for very flexible constraints to be imposed on the design (see Section 8.2 Ngene Manual) (Choice Metrics, 2021). A third payout was estimated for wildfires due to high or extreme risk of wildfire, relative to the other perils. Wildfires can destroy a huge portion of the farm and in many instances, the farmer may have to re-establish the farm. This risk affects all stages of the cashew crop life. Hence, a higher coverage of 75 to 85% was assumed and this translated into higher range of payout. The payout range for this peril was GH¢1200 to GH¢1750. Wildfire was classified as idiosyncratic risk because it is peculiar or unique to farms in some particular communities in the study regions. However, due to climate change and worsening dry periods, wildfires are becoming common in the study area. Similarly, a constraint was imposed in the design such that all choice situations with wildfires as peril takes on a payout of GH¢1200 to GH¢1750.

It is also worth mentioning that we used ranges of payouts to allow us account for the variation in other variables such as method of loss assessment, age of the cashew crop which influences production cost and yield per acre (see Appendix A).

Premiums: The premium per acre variable has four levels. High premiums of Gh¢117 and Gh¢120 were constrained to appear only in choice situation with the high payout range of GH¢1200 to GH¢1750 whereas premiums of Gh¢53 and Gh¢100 were constrained to appear in choice situations with payout ranges of GH¢455 to GH¢650 and GH¢ 651 to GH¢1200 in the choice design using the Modified Federov algorithm in Ngene. The attribute level constraints introduced in the design allowed us to minimize unrealistic combinations.

2.4. The study area and description of data

The study was conducted in the Bono and Bono East regions of Ghana. A multistage sampling technique was used in the sampling process. In the first stage, we purposely selected the Bono and Bono East regions because they are the hub of cashew production in Ghana. Cashew production is predominant in these regions because they have suitable environmental and climatic conditions for cashew growth. From these regions, seven districts were randomly sampled from a prepared list of cashew-growing districts. From these selected districts, 22 communities were randomly sampled from a list of cashew-growing communities. In these communities, we randomly sampled 20 cashew farmers each from each farming community. Overall, 420 cashew farmers were interviewed. However, 383 responses were usable. The remaining responses had missing information due to incomplete responses. Appendix B presents the districts and communities as well as the number of respondents for the study.

The data were collected by means of face-to-face interviews using a structured questionnaire. Prior to main data collection, the questionnaire was pre-tested on 50 cashew farmers in selected districts. In addition to the quantitative data, key informant interviews and focus group discussions were held with leaders of the cashew farmers association, 30 insurance pool members from GAIP, and 50 lending managers from financial institutions to attain qualitative information that would supplement the quantitative data. The questionnaire contained the following parts: socio-economic and institutional data, product characteristics, farmers' attitudes towards and perceptions of the agricultural insurance development system, and the discrete choice experiment. Regarding the socio-economic and institutional variables, we collected data on gender, household, size, farm size, off-farm income, farming experience, the distance of insurance companies, farm vulnerability, tenure, public help in times of disaster, and the cropping systems.

Regarding product characteristics, we collected data on insurance approach, a product option, and product awareness. Data was also collected on the cashew crop farmers' attitudes, knowledge, benefit perceptions, and premium perceptions (See Appendix C). Table 2 presents the descriptive statistics of sampled farmers.

The average age of cashew farmers was 49 years and 75% were male.

[2] The age of the cashew crop has significant implications on the production cost and yield per acre. For instance, yields per acre are low during the early fruiting years of the crop and it keeps increasing as the crop grows (See Appendix A).

[3] Low payout range was assumed for extreme temperate because the crop is resistant to dry conditions and as such there are minimal impacts.

Table 2
Definition of variables and summary statistics.

Variable	Definitions and measurement	Mean	Std. dev
Age	Age of farmer in years	48.73	11.54
Male	1 if farmer is male, 0 if female	0.75	0.24
Education	Years of formal education	10.45	3.25
Agric training	1 if farmer receives agricultural training, 0 otherwise	0.33	0.47
Household head	1 if farmer is the head of household, 0 otherwise	0.76	0.43
Household size	Household size in numbers	4.47	1.38
Farming years	Years of farming	21.94	12.03
Farm size	Farm size in acres	5.69	3.52
Farming age	Age of cashew farm	14.71	4.12
Family land	1 if farmer uses family land, 0 if rented land	0.52	0.50
Family labour	1 if farmer uses family labour, 0 if hired labour	0.49	0.28
Distance	Distance to district capital in kilometers	18.45	60.51
FBO	1 if farmer belongs to farmer based association, 0 otherwise	0.61	0.21
Credit access	1 if the farmer has access to credit, 0 otherwise	0.41	0.21
Off_farm income	1 if farmer has off-farm income, 0 otherwise	0.23	0.30
Gov_support	1 if farmer receives government support in times of disaster, 0 otherwise	0.03	0.01
Insure_cashew	If farmer is willing to pay to insure cashew farm, 0 otherwise	0.90	0.10

Source: Field survey.

This conforms to the general characteristics of farmers in the Ghanaian agricultural sector. The sector is dominated by males and mostly farmers above middle age (Ingram et al., 2015). The average farm size of farmers is 5.7 acres (2.3 ha). Most Ghanaian cashew farmers are smallholders with land size ranging between 0.8 and 3 ha (Wongnaa and Awunyo-Vitor, 2013). Less than half (49%) of our sample of farmers uses family labour, while more than half operate on family lands. This is not surprising, particular in cashew growing, due to the increasing shift towards individual farming and use of hired labour in Ghana (Amanor, 2011). Most of the sampled farmers (61%) belong to farmer-based associations, mostly cashew growers' groups. Only 41% and 3% of surveyed farmers have access to credit or receive government support respectively. Limited access to credit and other forms of production support is not peculiar to cashew production in the study area, but remains a common phenomenon in all the sub-sectors of the Ghanaian agriculture (Owusu, 2017; Twumasi et al., 2020). About 23% of sampled farmers have off-farm incomes. Due to liquidity constraints and declining farm incomes, it is common for farmers to diversify production and have multiple sources of income (Ali et al., 2021). In terms of farm insurance, 90% of farmers are willing to insure their cashew farms.

Empirical results

2.5. Latent MIMIC results for farmers' perceptions of and attitude towards agricultural risk and insurance

Table 3 presents the latent MIMIC results which investigate how farmers' latent perceptions of and attitude towards agricultural risk and insurance constructs relate to farm characteristics, the socioeconomic characteristics of farmers, and observed indicators. As shown in Table 4, three latent constructs were identified. These constructs are labelled (i) lack of trust in insurance companies (LTIC), (ii) subjective knowledge on agricultural insurance (SIKAI), (iii) perceived agricultural insurance benefits (PAIB). We validated these constructs using composite reliability (CR) and average variance extracted (AVE). The CR for the four constructs were 0.85, 0.88 and 0.81, respectively. The AVE values were 0.76, 0.81 and 0.79, respectively. The CR and AVE values show that the

Table 3
MIMIC estimates for farmers' perception and attitude toward agricultural risk and insurance.

Variable	Lack of trust in insurance companies (LTIC)	Subjective and indigenous knowledge on agricultural insurance (SIKAI)	Perceived agricultural insurance benefits (PAIB)
Structural model	Coeff. (R.std. error)	Coeff. (R.std. error)	Coeff. (R. std. error)
Age	−0.0029(0.0047)	−0.0054** (0.0026)	0.0054(0.0036)
Male	−0.0483 (0.0969)	0.0050 (0.0562)	−0.0372(0.0779)
Education	−0.0449***(0.0133)	−0.5131*** (0.0083)	0.0466***(0.0096)
Agric training	−0.0388 (0.0842)	−0.0296 (0.0607)	0.0103 (0.0627)
Household head	−0.0505(0.1098)	−0.1078(0.0673)	0.0344(0.0866)
Household size	−0.1204***(0.0275)	−0.0449** (0.0184)	0.0347(0.0218)
Farming years	−0.0086**(0.0042)	−0.0172***(0.0035)	−0.0026(0.0031)
FBO	0.2883 (0.2333)	0.1084 (0.4546)	−0.1291(0.2654)
Credit access	−0.0707 (0.1058)	−0.1755** (0.0694)	−0.0885(0.0814)
Farm age	0.0244***(0.0091)	0.0654***(0.0061)	−0.0144*(0.0075)
Farm size	0.0442***(0.0103)	1.0168** (0.0077)	−0.0276***(0.0081)
Distance	−0.0004(0.0003)	−0.0002 (0.0003)	0.0001(0.0004)
Family land	−0.0809(0.0727)	−0.0978**(0.0477)	0.1153**(0.0562)
Hired labour	−0.4204***(0.0821	−0.1206*(0.0611)	0.1578**(0.0633)
Loamy soil	−0.4165 (0.8311)	−0.2297***(0.0159)	0.2810(0.2021)
Explained variance (R^2)	**0.65**	**0.69**	**0.25**
Measurement model			
Companies delay	2.3347***(0.2982)		
Companies cheat	1.2996***(0.0796)		
Cannot trust insurance companies	0.9639***(0.0566)		
Nothing happens		−1.9795***(0.1404)	
Helping each other		−0.7855***(0.0878)	
Enhance loan		−0.5653***(0.0790)	
Don't think risk		2.8559***(0.2112)	
For rich people		1.1166***(0.1015)	
Necessary protection		−0.7661***(0.0427)	
Invite wildfire		0.2197***(0.0341)	
Insurance peace			2.9746***(0.2156)
Insurance benefit			2.0167***(0.3097)
Premium reasonable			0.5946***(0.0832)

Note: RMSEA = 0.03, CFI = 0.92, SRMR = 0.02; ***, **, * show significance at 1%, 5% &10% levels respectively.

Table 4
Cashew farmers' utility estimates and preferences for different insurance attributes[5.]

Respondents	383			
Observation	10,341			
Log-likelihood	−2637.29			
AIC	5384.57			
BIC	5601.71			
Classes	Class 1		Class 2	
Class probabilities	0.11		0.89	
Utility function	Coefficient	Z	Coefficient	Z
Insurance products types				
φ Index	0.2342***	2.99	0.5169***	16.54
φ Hybrid (indemnity-index)	−0.1936	−1.19	0.8935***	12.42
φ Benchmarking	− 7.3211	−1.37	0.3211***	4.46
Duration				
φ Annually	−2.4310	1.49	0.8897***	3.14
Loss assessment method				
φ Weather station	−1.1216	−1.59	0.2002**	2.19
φ Satellite stations	−0.1343***	−4.68	− 1.0251	−1.64
φ Detailed farm visits	0.2229	1.63	0.2434**	2.04
Key insured perils				
φ Wildfire	0.4651**	2.34	1.9411***	14.09
φ High wind speed	0.2423**	2.16	1.3502***	2.87
φ excess rainfall	−0.1411	−0.99	0.9195**	1.99
Mode of payment				
Cash mode	0.2349	1.51	0.6427***	5.40
Payouts				
GH¢651 to GH¢1200	1.1160**	2.19	2.7510***	7.55
GH¢1200 to GH¢1750	1.1563***	2.78	3.9596***	9.46
φ None	0.3196***	4.16	− 0.4151***	−4.58
φ Premium	−0.0015***	9.87	−0.0022***	9.81
Class allocation function				
θ_2	0.790***	28.04		

[5]Dependent variable: choice (1 if a cashew farmer chooses any of insurance product options A or B and 0 if the "none option" is chosen).
***, **, * show significance at 1%, 5% &10% levels respectively.

identified latent constructs are validated (Bagozzi and Yi, 2012). The final MIMIC model showed good fitness as indicated by the RMSEA value of 0.03, CFI value of 0.92, and SRMR value of 0.02. The first construct, lack of trust in insurance companies (LTIC), is defined by indicators pertaining to the perception statements: "*When it comes to paying claims, insurance companies delay and make it difficult", "When it comes to making claims, insurance companies will normally try to cheat you"*, and *"I cannot trust insurance companies to be fair to me*". The results from the structural component of the model show that variables such as education, household size, farming years, and hired labour are negatively associated with the LTIC construct. This suggests that farmers with high education, farming experience, large household size, and who rely on hired labour are less likely to strongly distrust insurance companies. Farm age and size variables are positively related to the construct LTIC. This implies that farmers with older and large farms are more likely to strongly distrust insurance companies. The farm and socioeconomic characteristics explained 65% of the variations in the LTIC construct.

The second construct, subjective and indigenous knowledge on agricultural insurance (SIKAI), is defined by indicators relating statements such as "*insurance is not needed until a farm is burnt", "Insurance is about helping each other*", "*agricultural insurance will enhance my access to loans*", *It is better not to think about risks and emergencies in advance*", "*Insurance is something for rich people*", "*Insurance is necessary to protect your farm and family*", and "*buying insurance against wildfire means inviting the fire accident*". The structural results show that this construct is negatively associated with farmers' age, education, household size, and use of both family and hired labour. On the other hand, farmers with older and large farms who have access to credit are more likely to have high subjective knowledge of agricultural insurance, as indicated by the positive coefficient estimates. Sixty nine (69%) of the variation in this construct is explained by farm and socioeconomic characteristics included in the structural aspect of the model.

The third construct, perceived agricultural insurance benefits (PAIB), is defined by statements including "*agricultural insurance will give me peace of mind*", "*I have heard of the benefits of insurance from other farmers"*, and "*the premium attached to my chosen insurance product is reasonable*". Farmers' years of formal education and use of both family and hired labour are positively associated with PAIB. This construct is positively associated with farm age and size. The farm and socioeconomic characteristics explain 25% of the variation in the PAIB construct.

2.6. Latent class utility and parameter estimates for heterogeneous preference for agricultural insurance attributes

Prior to the estimation of the latent class utilities, we used the log-likelihood ratio test (LR-test), Akaike information criteria (AIC), and Bayesian information criteria (BIC) to test whether the sampled cashew farmers are heterogenous or homogenous in their preferences for agricultural insurance product attributes. A comparison of LR-test, AIC, and BIC values from conditional logit, mixed logit, and latent class models revealed that the sampled cashew farmers are not homogenous in their preferences for the insurance product attributes. This implies that the sampled cashew farmers are heterogeneous in their preferences for agricultural insurance products.

Following the evidence of preference heterogeneity, we further estimated random parameter logit, standard latent class, and hybrid latent class models to ascertain which model best fits the data. It was found that the hybrid latent class model fits the data better than the others and as such we estimated the hybrid latent class model. Based on the log-likelihood, and AIC and BIC estimates from the hybrid latent models, we found that the two-class latent model was optimal and hence we present the results for the two-class hybrid latent model in Table 4. The results show that majority of the cashew farmers (89%) belonged to the second and only 11% belonged to the first class. As expected, and in accordance with economic theory, the premium variable was negative in both classes one and two (McFadden, 1974). This implied that the cashew farmers are sensitive to the cost of insuring their farms and that higher insurance cost decreases the likelihood of farmers to insure their farms. Similarly, as expected and in accordance with the random utility theory, the two payout options were significant and positive in both classes both classes.

In class one, members attain significantly positive utility from only index insurance product. In terms of perils, members of class one attain positive and significant utility from insuring against wildfires and high wind speed. The utility estimates for the payout options GH¢651 to GH¢ 1200 and GH¢1200 to GH¢1750 were significant and positive. The same members of this first class attain significantly negative utility using data from satellite stations for loss assessment. The "none" option was positive and significant in class one.

In class two, members attain significantly positive utilities from all the insurance product types. However, the highest utility was attained from hybrid insurance product which combines indemnity and index product features. The second highest utility was attained from index insurance, followed by benchmarking insurance respectively. Regarding, duration of payment of premiums, members of class two obtain positive and significant utility estimates from annual duration and they prefer cash payment mode as shown by the significantly positive utility estimates at 1% level.

In terms of method of loss assessment, members of class two attain significantly positive utilities from the use of weather stations and detailed farm visits. In terms of peril, members of class two attain positive and significant utilities from insuring against wild fires and high wind speed. Regarding payouts, the utility estimates of both payout options were highly significant and positive. Finally, members of class two obtain significant and negative utility from the status quo option. The class allocation function estimate is positive and highly significant at 1% level, suggesting that cashew farmers with higher latent constructs have a greater likelihood of belonging to class two than class one.

Table 5
Effects of farmer and farm characteristics, perception and attitudinal constructs on agricultural insurance choice.

Variable	Coefficient	Z
Structural Equations (Effect of farmer & farm characteristics)		
γ Age	−0.1561***	3.12
γ Male	0.4712**	2.49
γ Education	1.5235***	4.35
γ Agric training	5.2312***	3.50
γ Household head	0.2120**	2.53
γ Household size	0.4306	1.60
γ Farming years	−3.0235	−1.57
γ FBO	0.6411***	4.01
γ Credit access	0.1032***	4.43
γ Farm age	−0.1512***	−3.32
γ Farm size	0.2034***	12.71
γ Family land	0.4102**	2.35
γ Hired labour	−0.1217	−1.61
γ Loamy soil	0.7211***	13.14
Measurement Equation (Effects of perception & attitudinal constructs)		
λ_{t1}*LTIC*	−2.4107***	−4.25
	−0.9241***	−3.53
λ_{t3}*PAIB*	2.8919***	10.60
Measurement Equation (Threshold)		
λ_{t1} 1&2	−0.4527***	−2.81
λ_{t1} 2&3	1.3257***	3.36
λ_{t2} 1&2	−0.2432***	−3.17
λ_{t2} 2&3	3.1118**	2.49
λ_{t3} 1&2	−0.4191**	−3.09
λ_{t3} 2&3	2.3216***	3.87

***, **, * show significance at 1%, 5% &10% levels respectively.

2.7. Effects of cashew farmer and farm characteristics, perceptions, and attitudinal constructs on agricultural insurance choice

In Table 5, we presented the structural results relating to farmer and farm characteristics and measurement results relating to the perception and attitudinal constructs and their effect on cashew farmers' agricultural insurance product choices. The variables included in the structural and measurement components helped in explaining the sources of cashew farmers' heterogeneity (Owusu-Sekyere et al., 2022). Based on the class allocation function, class one is set as the reference category and the results in Table 5 pertain to class two. Relative to class one, the structural results indicate that cashew farmers who are advocates of agricultural insurance for cashew farms are more likely to be male farmers and household heads as shown by the significant and positive estimates for male and household head variables. Among the institutional variables, we found that years of education, agricultural training, membership in farmer-based organisation, and access to credit are positive and significant. This means that advocates of agricultural insurance for cashew farms are positively associated with these variables.

In terms of farm characteristics, variables such as farm size, use of family land, and farming on loamy soils are positive and significant, suggesting that advocates of agricultural insurance for cashew farms are more likely to be farmers with large farms on family land and loamy soils. On the other hand, advocates of agricultural insurance for cashew farms are less likely to be old farmers with old cashew trees.

The measurement results show that all the perception and attitudinal constructs (.

$\lambda_{t1} - \lambda_{t3}$) relating to agricultural risk and insurance are statistically significant. Specifically, the results show that the latent constructs labelled as "*lack of trust in insurance companies* (λ_{t1})", and "*subjective and indigenous knowledge on agricultural insurance* (λ_{t2})" were negative and significant, suggesting that cashew farmers who advocate for agricultural insurance for cashew farms are less likely to be associated with higher values of lack of trust in insurance companies, and subjective and indigenous knowledge on agricultural insurance. On the other hand, the *perceived agricultural insurance benefits* (λ_{t3}) construct was positive and significantly different from zero, implying that cashew farmers who advocate for agricultural insurance for cashew farms are more likely to be associated with higher values of perceived agricultural insurance benefits. Indicating the need to sensitize farmers on the benefits of insuring their farms.

Table 6
Implicit trade-offs and monetary valuation of insurance products and key perils.

Attributes	Class 1(GH¢)	Class 2(GH¢)
Insurance approach		234.95 [175.45, 455.47]
Index	156.13 [100.15, 209.90]	
Hybrid (indemnity-index)	NS	406.15 [380.48, 555.50]
Benchmarking	NS	145.95 [89.95, 280.70]
Loss assessment method		
Weather station	NS	91.00 [45.15, 100.20]
Satellite stations	−26.86 [-35.95, −15.50]	NS
Detailed farm visits	NS	110.64 [90.35, 190.90]
Key insured perils		
Wildfire	310.07 [185.55, 315.70]	882.32 [776.10, 1540.45]
High wind speed	161.53[85.90, 235.57]	613.73 [590.33, 836.19]
Excess rainfall	NS	417.95 [384.81, 674.51]
None	231.06 [150.15, 345.75]	−188.68 [-299.15, −96.74]

NS = Not significant. Estimates in parenthesis are 95% confidence intervals. Exchange rate in December 2018 (1 GH¢: 0.207 US$).

In Table 6, we present the implicit trade-offs and monetary values that cashew farmers attach to agricultural insurance product attributes, consisting of insurance product types, methods of loss assessment, and key perils. A positive estimate shows how much the cashew farmer would be willing to offer for a given agricultural insurance product attribute to be changed from its base category; a negative estimates expresses how much the cashew farmer is ready to offer to prevent the change. It is clear from the results that the two classes differ in terms of how much money they attached to the same insurance product attributes.

The estimates show that among the insurance product types, class one members were willing to offer GH¢156.13 (US$32.32) for index insurance product. The same class one members were ready to offer GH¢ 310.07 (US$64.18) and GH¢161.53 (US$33.44) to insure their cashew farm against wildfires and high wind spend, respectively. In terms of methods of loss assessment, class one members were ready to offer GH ¢-26.86 (US$5.56) to avert using satellite stations instead of triggers on selected farms for assessing losses. In addition, class one members were willing to offer GH¢231.06 (US$47.83) for the status quo alternative.

Members of class two, on the other hand, were willing to offer substantial amounts for hybrid (indemnity-index), index and benchmarking insurance products, respectively. Specifically, the estimates show that members of class two value hybrid (indemnity-index) insurance product (GH¢406.15 (US$84.07)) above all others, followed by the index insurance (GH¢234.95 (US$48.63)) and benchmarking insurance (GH¢ 145.95 (US$30.21)). In terms of perils, the same class two members offered GH¢882.32 (US$182.64) and GH¢613.73 (US$127.04) to insure against wildfires and high wind speed, respectively. In addition, members of class two were ready to offer GH¢91.00 (US$18.84) and GH¢ 110.64 (US$22.90) to move from using triggers on selected farms to the use of weather stations and detailed farm visits, respectively, for assessing losses. Finally, members of class two were willing to offer GH¢ 188.68 (US$39.06) to avoid the status quo alternative. In Table 7, we

Table 7
Cashew farmers' implicit expected payout versus payouts in the survey.

Payouts (in survey)	Class 1(GH¢)	Class 2(GH¢)
GH¢651 to GH¢1200	744.00 [650.15, 1445.71]	1250.45 [950.59, 1395.48]
GH¢1200 to GH¢1750	770.86 [690.80, 1500.65]	1799.82 [1250.35, 2345.55]

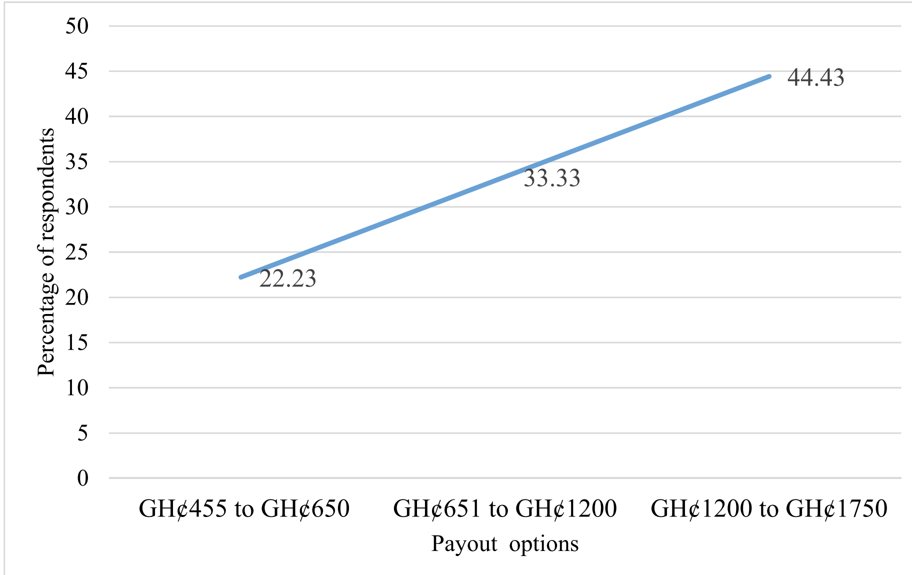

Fig. 2. Distribution of payout choices.

compare farmers' implicit expected payouts to the range of payouts included in the survey design. In class one, the estimates revealed an inferred value of GH¢744.00 (US$154.01) for the payout option tied to excess rainfall and high wind speed (i.e., GH¢651 to GH¢1200). This amount falls within the range of payout specified in the survey design. Similarly, an implicit value of GH¢770.86 (US$159.57) was expected for the payout fixed to wild fires (i.e., GH¢1200 to GH¢1750) and this value also falls within the specified range of values in the survey.

In class two, the inferred payout for the payout option tied to excess rainfall and high wind speed is GH¢1250.45 (US$258.84) and a value of 1799.82 (US$372.56) for the payout fixed to wild fires (i.e., GH¢1200 to GH¢1750). The inferred value for the latter payout option is higher than the specified range in the survey design. Fig. 2 shows that high proportion of the sample (44.43%) selected the payout option with ranges GH¢1200 to GH¢1750. This is followed by GH¢651 to GH¢1200 with 33.33% and GH¢455 to GH¢650 with 22.23%.

3. Discussions

Building on earlier studies that tried to avoid the inherent bias associated with direct inclusion of perception and attitudinal variables into choice models (e.g. Hess, 2012; Mariel et al., 2015; Paulssen et al., 2014), we employed a latent variable framework approach where a factor analysis of farmer's perception and attitudinal variables relating to agricultural risk and insurance were first performed, and their subsequent constructs were jointly estimated with the choice attributes (Daly et al., 2012). By doing so, we dealt with the endogeneity bias and measurement error that could lead to inconsistent results. In addition, the inclusion of perception and attitudinal variables could highlight how cashew farmers' preferences for agricultural insurance schemes can be reliant not only on traditional socioeconomic factors but also on perception and attitudinal factors. Consequently, the novelty of the present study lies in the incorporation of the social and behavioural constructs into the choice model, through which we could explain how the construct impacts choices of agricultural insurance product attributes, and thus choices (Weber and Milliman, 1997). In addition, this paper is among the first to evaluate cashew farmers' preferences for different insurance product types in a single experimental setting, unlike other studies that only focus on farmers' willingness to pay for single insurance products (e.g. Aizaki et al., 2021; Budhathoki et al., 2019; Doherty et al., 2021; Karlan et al., 2011; Miranda et al., 2014; Sibiko et al., 2018).

An important finding worth discussing is that of heterogeneous preferences for agricultural insurance product attributes. This finding concurs with a recent study by Owusu et al. (2021), who found that Ghanaian cocoa farmers are heterogeneous in their preferences for agricultural insurance products, which can be associated with cashew farmers since both are tree crop farmers facing similar perils and risks. Two distinct segments of cashew farmers were identified based on their preferences for different agricultural insurance product attributes. Cashew farmers in segment two are classified as 'advocates' of agricultural insurance schemes against key perils, since their utilities relating to insurance product types, key perils, and methods of loss assessments, as well as duration and mode of payments, were all positive. Additionally, the negative preference for the status quo option also supports the labelling of class two as advocates of agricultural insurance schemes. Advocates of the agricultural insurance scheme constitute 89% of the sampled cashew farmers. Based on the positive direction and significance of the utility estimates for index insurance, wildfires and high wind speed, payout options as well as the status quo, we classify members of segment one as 'transitioning' towards agricultural insurance schemes.

Another important finding worth discussing has to do with the three social and behavioural constructs identified and their effects on the choices made by cashew farmers. The four social and behavioural construct relates to: (i) lack of trust in insurance companies, (ii) subjective and indigenous knowledge on agricultural insurance, and (iii) perceived agricultural insurance benefits. Specifically, our empirical findings indicate that all the constructs have significant impacts on cashew farmers' preferences for agricultural insurance products. Specifically, we found that cashew farmers who advocate for agricultural insurance for cashew farms are less likely to be those who lack trust in insurance companies. This finding is supported by Hill (2010) and King and Singh (2020), who argued that building trust in insurance and insurance companies is highly relevant to enhancing demand for agricultural insurance.

The findings also indicate that cashew farmers' subjective and indigenous knowledge of agricultural insurance have a negative impact on their decisions to insure their cashew farms (Liu et al., 2016). This finding is supported by Hill et al. (2013), who argued that farmers are less likely to pay for insurance if they lack an understanding of basis risk and components insurance schemes or product packages. In addition, Giné et al. (2008) argued that lack of understanding of basis risk by farmers could lead to a reduction in willingness to purchase insurance over time. These subjective ideas and knowledge about agricultural insurance products deviate from objective knowledge about agricultural insurance (Ali et al., 2021) and thus, have a negative impact on farmers' preferences. A notable perception among farmers, which confirms a misunderstanding about agricultural insurance, is their expectation of a pay-out for every risk that occurs on the farm regardless of their coverage by insurance. This perception confirms what Mahual (1999) described as a challenge insurance companies face. He noted that people expect a claim to happen once insurance coverage is bought, and the expectation leads to moral hazard in insurance schemes. As expected, the perceived agricultural insurance benefits have positive impacts on advocates of agricultural insurance for cashew farms. This is in line with Garrido and Zilberman (2008). However, from the demand viewpoint, farmers are least able to ascertain the benefits of agricultural insurance in areas where traditional methods are employed to mitigate risks and where farmers have not experienced extreme climatic perils that could not be managed by traditional methods. This thus conforms to Habituated Action Theory, which argues that engaging in risky behaviour often without negative outcomes decreases the perceived risk perception associated with such behaviour.

The effects of socioeconomic and farm characteristics on agricultural insurance product choices are worth considering. In terms of farmer characteristics, we found that older farmers are less likely to advocate for agricultural insurance and this is supported by Sherrick et al. (2004), who found that older people are less likely to enrol in an index insurance scheme in the US. Male farmers are more likely to advocate for agricultural insurance, relative to females, which may be attributed to the fact that most of the cashew farmers are males. Education and agricultural training positively correlate with preference for agricultural insurance for cashew farms. This is not surprising given that highly educated and trained farmers can understand the complicated loss assessment processes associated with making agricultural insurance claims. This finding is supported by Sherrick et al. (2004), who argued that insurance users are expected to be more experienced and better educated. In addition, a study in the Ghanaian health sector found education to be a key determinant of insurance enrolment (Brugiavani and Pace, 2011; Chankova et al., 2008).

Farmers who are members of farmer-based organisations are more likely to have higher preferences for agricultural insurance for their cashew farms, compared with non-members. This may be attributed to the fact that farmer organisations or cooperatives share knowledge and information about production technologies, innovation, and risk mitigation strategies. This finding is in agreement with Coydon and Molitor (2011), who observed that belonging to community-based organisations positively influences adoption of micro insurance schemes. Access to credit positively influences preferences for agricultural insurance and this is not surprising, since the propensity of farmers to purchase insurance depends largely on their credit status (McIntosh et al., 2013). Thus, credit-constrained cashew farmers are less likely to insure their farms, since their propensity to purchase agricultural insurance is significantly dependent on their financial status, which is usually related to credit in many emerging economies. This finding is in line with what Owusu et al. (2021) found in Ghana for cocoa farmers.

In terms of farm characteristics, cashew farmers are less likely to have higher preferences for agricultural insurance for old farms, relative to young farms. This might result from the low yields obtained from very old farms or cashew trees. Yield and revenue from old farms might not be able to offset the cost of insuring the farm. Farmers who have large cashew farms are more likely to have higher preferences for agricultural insurance. This was expected because the larger the farms, the higher the losses incurred in times of disaster or peril, and as such farmers are more willing to purchase insurance. This finding is supported by Enjolras et al. (2011) and Black and Dorfman (2000), who found a positive relationship between farm size and willingness to pay for insurance. Farmers operating on family lands are more likely to have higher preferences for agricultural insurance, relative to those farming on rented lands. Farmers operating on family lands are free to insure their farms without seeking approval from landlords.

Findings relating to preferences and valuation of the insurance product types are very important in this paper and worth discussing. We found that the hybrid insurance product which combines indemnity and index insurance features is the most preferred insurance product and farmers attach a higher value to this insurance product. This is in line with our expectation because the hybrid insurance product because cashew farmers are faced with both systemic and idiosyncratic risks. In addition, the prevalence of systemic risk in cashew farming as well as ownership of small cashew farms (small farm sizes) of support the high valuation of hybrid insurance product. Furthermore, this products includes aspects of two insurance products and allows farmers to decide which of the two suits their specific situation. The high preference and valuation for hybrid insurance partly explains why insurance products such as index and benchmarking, have not been scaled up to a sustainable level in sub-Saharan Africa (AIDP, 2013). Most of the piloted insurance products in developing countries have been indexed-based crop insurance (AIDP, 2013; Miranda and Mulangu, 2016). This important finding indicates the need to restructure or reconsider the existing insurance products from the viewpoint of insurance users and understand their preferences in terms of which attributes of different insurance products can be combined in such a manner that will attract farmers.

The preferences and valuations of index and the benchmarking insurance products are the second and third most preferred insurance products for cashew farmers who advocate for agricultural insurance. Contextually, the attributes of these insurance products conform relatively closely to the characteristics of smallholder farmers, who are a majority in the Ghanaian cashew sub-sector. Index insurance eliminates moral hazard for the insurer, since loss assessment is carried out by an independent weather or satellite station or is based on yield data from an independent institution (Leblois et al., 2014). Though index insurance may be more suitable for smallholder Ghanaian farmers, determination of losses does not involve any effort from the farmer and as such it is not surprising that this product was not considered as the first insurance product preferred by the farmers. Furthermore, farmers may not find index insurance attractive due to the presence of basis risk, where a farmer may not qualify for pay-out because the area average figures do not fall within a loss threshold. Benchmarking is successfully implemented under block farming. However, cashew production is scarcely done in blocks in Ghana, which may explain why benchmarking was the third preferred insurance approach.

In terms of perils, our findings indicate the cashew farmers advocating for agricultural insurance exhibited high preferences for multiple perils policy, and this is in concordance with the findings of Owusu et al. (2021), who found that cocoa farmers in Ghana prefer multiple peril insurance policy for their cocoa farms. Specifically, cashew farmers in both segments place higher value on wildfire as the key peril to insure against. This peril, which occurs mainly in the dry season, coincides with the flowering and fruiting of the cashew crop and has a significant direct impact on yield and revenue. In addition, advocates of cashew insurance place higher preference and value on high wind speed. Thus, the most important risks facing cashew farmers in the study areas are wildfires and high wind speed. High wind speed in the dry season are triggers for wildfires and hence this finding is not surprising. Furthermore, advocates of agricultural insurance for cashew farms prefer annual cash payment of insurance premiums. Crop farming in Ghana is seasonal and so is farmers' income. Cashew is an annual crop, therefore, farmers' preference for annual payment is reasonable since that is when they can have money to pay the premium. This means that insurance companies must plan premium payments to coincide with the cashew harvesting season. Also, most farmers in cashew growing communities in Ghana do not have bank accounts. This explains their preference for cash payment for insurance premiums.

In terms of method of loss assessment, advocates for agricultural insurance have strong preferences for detailed farm visits and use of weather stations. This finding is contrary to Gosh et al. (2021) who found Indian farmers to have weak preferences for method of loss assessment.

Furthermore, the findings reveal that the expected payout is a key variable in farmers' decision to choose agricultural insurance for their cashew farm, irrespective of the segment they belong to. This findings is in accordance with the random utility theory, which posits that rational farmers will select alternative insurance product that offers them the highest utility (Lancaster, 1997). Our study demonstrates that the expected payout by advocates for agricultural insurance for wildfires is higher than what was specified in the design. Thus, there are disparities in proposed payout offered by insurance developers and what is expected by farmers.

4. Policy implications

Our findings have some relevant policy implications. Agricultural insurance product developers and policymakers in developing countries have over the years tried to find an improved insurance contract designs that would be commercially viable and sustainable. Our findings relating to the effect of farmers' social and behavioural constructs relating to trust in insurance companies, subjective and indigenous knowledge on agricultural risk and insurance, as well as perceived benefits of agricultural insurance imply that the uptake of agricultural insurance products does not solely depend on the type of product design, rather it also depends significantly on farmers underlying social and behaviour towards agricultural risk, insurance and insurance providers. Proper education on agricultural risk and insurance is needed because agricultural insurance is complex, and as such will require constant education and awareness-raising to increase farmer's knowledge of insurance products, particularly among smallholder farmers in sub-Saharan Africa. This can be achieved by organizing educational campaigns and sensitization programs on basis risk, agricultural insurance and benefits of farm insurance. In addition, educational programs and campaigns aimed at promoting agricultural insurance uptake in developing countries should focus on changing farmers' negative perception and attitude towards agricultural insurance and insurance providers. In these ways, we can improve the farmers' knowledge on agricultural insurance and change the negative perception and beliefs about agricultural insurance. The findings also imply that farmers have some distrust in insurance companies and as such there is an urgent need to rebuild farmers' trust in insurance providers.

Finding relating to high preferences and valuation for hybrid insurance product implies that future agricultural insurance product designs should try to incorporate attributes from different insurance products to form a hybrid product that can cover a variety of farmers' risk portfolio. This can potentially address the prevalence of systemic risk in agriculture. Another interesting implication from this study relates to heterogeneity among farmers on key perils and the amount attached to wildfire and high temperatures. We recommend that a product development policy and underwriting approach that incorporates the prices of key perils to estimate the insurance premium for cashew farmers would stimulate demand for such products in the study area.

To encourage acceptance and adoption of agricultural insurance, agricultural insurance product developers, underwriters, and insurers in sub-Saharan Africa including Ghana, should be cognisant of the need to consult farmers and find out what perils and insurance products they prefer, prior to the development of insurance products. This can be done through piloting and feasibility studies to ascertain farmers' preferences regarding different insurance product attributes. In addition, variations in preferences must form a basis for market segmentation, positioning, and targeting, and must be incorporated into product development for the sector to enhance the cashew crop farmers' demand for agricultural insurance products.

The findings further imply that if crop-specific agricultural insurance products are developed, majority of smallholder farmers will take up agricultural insurance to developing countries. This is supported by the high proportion of cashew farmers that advocate for agricultural insurance that covers their prevailing risk. The development of these crop-specific insurance products should take into consideration the policy relevant factors identified in this study as influencing choice of agricultural insurance. For instance, preference for agricultural insurance is linked to credit access, as it offers farmers high purchasing power to buy agricultural insurance. When insurance is linked to credit, it in turn insures the loan and keeps the credit market working (by motivating banks to give credit) thereby ensuring that farmers don't remain indebted in the event of disaster.

Another relevant implication of our findings relates to the formation of farmer-based associations and their positive impact on preferences for agricultural insurance. We suggest that that existing the cashew farmers association should be strengthened and linked to the cashew development board. The formation of the Tree Crop Development Authority, 29 September 2020, was a giant initiative and put Ghana's cashew sector on the path of becoming a leader in cashew processing in West Africa. However, we suggest that cashew farmers' associations should form a part of this development authority. This creates an imperative for the development of the cashew sector, and will require the Ghana Agricultural Insurance Pool (GAIP) and World cover to implement a successful insurance scheme for the sector to enhance their access to credit and foster the development of cashew as alternate crop to compliment cocoas production in Ghana. In this vein, insurers need to understand what motivates farmers to insure as well as their heterogeneous preferences based on the various insurance product types and their attributes.

The findings relating to disparities in what insurance companies or developers propose and what farmers expect implies that there is a need for insurance products to be structured in such a way that party receives reasonable premium or payout. Government can also subsidize insurance to some extent in order to ensure that both parties receive reasonable indemnities in case of insured loss.

Findings from this studies have some important implication for future research on farmer's preferences for agricultural insurance products. Our findings point to the need to include social and behavioural constructs relating to farmers' perceptions and attitudes towards basis risk and agricultural insurance. This is particularly important because previous studies tend to focus only on traditional socio-economic characteristics and how they impact farmers' willingness to pay for agricultural insurance. This also implies that future research on preferences and determinants of farmers choices of agricultural insurance products should employ analytical methods that allows for the incorporation of behavioural constructs.

5. Conclusion

We examined cashew farmers' heterogeneous preferences and willingness to pay for agricultural insurance in the Bono and Bono East regions of Ghana. The study further explored how farmer's perceptions of and attitude towards agricultural risk and insurance affects their choice of agricultural insurance attributes. The following key conclusions are drawn from this paper. From the viewpoint of insurance policies, we conclude that a hybrid agricultural insurance product is most preferred and highly valued by farmers that are already advocating for agricultural insurance as well as those transitioning towards agricultural insurance. Secondly, we conclude that social and behavioural factors are significant determinants of smallholder farmers' demand for crop insurance in developing countries including Ghana. Thirdly, the widely held view that smallholders, particularly in sub-Saharan African, are not willing to pay for agricultural insurance should be re-visited. It is important for agricultural insurance developers and providers, particularly in developing countries, to understand what perils concern smallholder farmers and to take into account their preferred mode of payment, duration, payouts and preferred products when designing agricultural insurance schemes and premiums. Another key conclusion is that cashew farmers are willing to offer substantial amounts to insure their farms against wildfires and high wind speed. Generally, findings from this study suggest that with the development of crop-specific hybrid insurance products coupled with proper education on basis risk, agricultural insurance and benefits of farm insurance, we can improve the uptake of agricultural insurance products in developing economies. With a drive to increase uptake of crop insurance schemes in Ghana, an important requirement is to assess local farmers' own preferences for various attributes of agricultural insurance product including their preferred perils to insure, method of loss assessment, mode of payment, premiums and expected payouts.

CRediT authorship contribution statement

Nicholas Oppong Mensah: Conceptualization, Data curation, Investigation, Project administration, Resources, Writing – original draft, Writing – review & editing. **Enoch Owusu-Sekyere:** Methodology, Software, Formal analysis, Conceptualization, Data curation, Validation, Writing – original draft, Writing – review & editing. **Cosmos Adjei:** Data curation, Investigation, Project administration, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Actual Production History (APH) according to year of harvesting.

Harvesting year	Yield (number of 80 kg bag)	Average production cost per acre in GH¢	Average revenue per acre in GH¢
Year 1	1.5	1200	1700
Year 2	2.5	878	3740
Year 3	4	798	6168
Year 4	4	726	6780
Year 5	6	660	7458
Year 6	6	450	8202
Year 7	7	450	9500
Year 8	7	410	9500
Year 9	6.5	410	9020
Year 10	6.5	410	9020

Source: Cashew producers' association.

Appendix B. study areas and sampling.

District	Communities	Number of respondents sampled	Responses used	Total responses used in each district
Techiman South	Tanoso	20	20	60
	Techiman	20	20	
	Twemia-Nkwanta	20	20	
Techiman North	Tuobodom	20	20	60
	Tanoboase	20	20	
	Buoyem	20	20	
Kintampo North	Kintampo	20	20	60
	Kunso	20	20	
	Ntankro	20	20	
Kintampo South	Chirehin	20	20	57
	Jema Nkwanta	20	19	
	Kokuma	20	18	
Jaman North	Duadaso No.1	20	17	52
	Duadaso No.2	20	18	
	Sampa	20	17	
Nkoranza North	Dwenewoho	20	18	53
	Kranka	20	18	
	Manso	20	17	
Wenchi	Akrobi	20	15	41
	Koase	20	14	
	Nkonsia	20	12	
Total	21 communities	420	383	383

Appendix C

Farmers' perception and attitude towards agricultural risk and insurance.

Constructs	Strongly Agree (5)	Agree (4)	Undecided (3)	Disagree (2)	Strongly Disagree (1)
1. *Lack of trust in insurance companies (LTIC)*					
When it comes to paying claims, insurance companies do not delay and make it difficult	97(25.3)	97(25.3)	181(47.3)	–	8(2.1)
When it comes to making claims, Insurance companies will normally try to cheat you	–	107 (27.9)	167(43.6)	34(8.9)	75(19.6)
I cannot trust insurance companies to be fair to me	252(65.8)	6(1.6)	59(15.4)	1(0.3)	65(17.0)
2. *Subjective knowledge on agricultural insurance (SKAI)*					
Nothing happens in case of a disaster, I don't get any pay-out in one year.	28(7.3)	72 (18.8)	74 (19.3)	208 (54.3)	1(0.3)
Insurance is about helping each other	–	17(4.4)	36(9.4)	327 (85.4)	3(0.8)
Agricultural insurance will enhance my access to loans	–	69(18.0)	290(75.7)	24(6.3)	–
3. *Perceived agricultural insurance benefits (PAIB)*					
Agricultural insurance will give me peace of mind	–	141 (36.8)	43(11.2)	195 (50.9)	4(1.0)
The premium attached to my chosen insurance product is reasonable	–	68(17.8)	148(38.6)	157 (41.0)	10(2.6)
I have heard of benefit of insurance from other farmers	–	135 (35.2)	29(7.6)	98(25.6)	121(31.6)
4. *Indigenous beliefs about agricultural insurance (IBAI)*					
It is better not to think about risks and emergencies in advance	–	341 (89.0)	4(1.0)	37(9.7)	1(0.3)
Insurance is something for rich people	6(1.6)	258 (67.4)	8(2.1)	110 (28.7)	1(0.3)
Insurance is not necessary when no farm is burnt	–	15(3.9)	30(7.8)	326 (85.1)	12(3.1)
Buying insurance against wildfire mean inviting the fire accident	365(95.3)	–	8(2.1)	2(0.5)	8(2.1)

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