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Factors influencing agricultural entrepreneurship engagement in rural mining areas of Kasai Oriental, DR Congo

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Abstract: This study examines the factors influencing rural household engagement in agricultural entrepreneurship in Kasai Oriental. Despite the coexistence of farming activities with a thriving artisanal diamond mining sector, the region continues to experience persistently high unemployment, poverty, and food insecurity. In front of such challenges, agricultural entrepreneurship may hold the alleviating keystone. To investigate determinants of agricultural entrepreneurship engagement, the study lies on fixed-effects logit model to control unobserved heterogeneity at the village level. Key findings indicate that self-efficacy significantly increase the likelihood to engage in agricultural entrepreneurship, while fear of failure substantially reduces it. Access to land and participation in informal credit groups also exert positive influences on decision to engage in entrepreneurial activity. Conversely, demographic factors reveal lower engagement among younger, more educated individuals, and big households, likely due to attraction of get-quick-rich artisanal mining perceived as offering high income. Additionally, land conflicts and proximity to mining sites further diminish the probability of engaging in agricultural ventures. Based on these results, policy interventions must focus on vocational training, psychological support, improved access to credit and land. Such efforts should specifically target youth and educated rural residents to enhance the attractiveness and sustainability of the agricultural sector. Thus, this study contributes to a nuanced understanding of the multifaceted drivers of rural agricultural entrepreneurship in the context of mining region and provides actionable insights for targeted strategies to foster sustainable rural economic development.

Keywords: cognitive factors; entrepreneurial; fixed-effects logit; Kasai Oriental; mining areas

1. Introduction

1.1. Telling facts: Broader Sub-Saharan context

Sub-Saharan Africa continues to face persistent and interrelated development challenges. In some countries, poverty rates reach up to 91%, with 67% of the population living in extreme poverty. The region also suffers from a 7.2% unemployment rate, and widespread food insecurity levels that often exceed emergency thresholds [1,2]. While the region's projected economic growth rate is 3.5%, and per capita income by 1.1% by 2025, such progress remains insufficient to meet basic needs and reduce significantly extreme poverty [2,3].

Amid these challenges, entrepreneurship emerges as a critical engine for economic transformation. Since Schumpeter's pioneering work, entrepreneurship has been widely acknowledged as a driver of innovation, structural change, and inclusive growth. It enables individuals to create economic value by identifying opportunities,

mobilizing resources, and assuming risk in exchange for both financial and non-financial rewards [4–6].

In the agricultural sector, entrepreneurship is understood as a dynamic process through which individuals create or expand enterprises within the farming sector. This process merges entrepreneurial intent with agricultural practices, encompassing the identification and evaluation of opportunities in the sector, the strategic exploitation of these opportunities, and the initiation and development of new businesses or products. Through innovation at every stage, entrepreneurship permits to generate wealth, sustain business operations, and create economic value needed for both individual and community growth and well-being [7–11]. Entrepreneurship in agriculture thus acts as a catalyst for the formation and launch of small businesses [12]. Given that a significant portion of the population in many developing countries resides in rural areas, promoting entrepreneurship and fostering a supportive entrepreneurial ecosystem is crucial for improving livelihoods and addressing persistent issues such as food insecurity and poverty in these communities.

To this regard, many empirical studies support the positive relationship between early-stage entrepreneurship, reductions in unemployment, and economic growth [13–17].

In Sub-Saharan Africa, where 82% of the population lives in rural areas and agriculture remains the dominant source of livelihood employing around 50% of the rural workforce entrepreneurship in the agricultural sector offers significant potential for poverty alleviation and rural development [18–20]. Agricultural entrepreneurship can contribute to improved productivity, job creation, enhanced food security, and income diversification It also fosters market integration, innovation, and the adoption of new technologies, thereby turning subsistence farming into market-oriented ventures[15,21–24].

Nevertheless, despite its central role in rural areas, agricultural sector remains underdeveloped, constrained by smallholder dominance, limited access to credit and technology, and low productivity across Africa [7,18,20,22,23,25,26]. Poor infrastructure, underinvestment in public goods such as road, storage facilities, networks, and market organisation characterize by isolated and fragmented markets, raise transaction and distribution costs [27]. Moreover, increased competition from non-agricultural sectors particularly mining further compound the problem. These pressures often lead to insecure land tenure and conflicts over land and labor [3,18,28,29]. Limited training opportunities, weak institutional support, shortages of skilled labor, and inadequate access to social capital and networks to the other side compound the problem of agricultural sector in Africa [7,20,25,30–32].

Altogether, this array of challenges significantly hinders the launching, development, and sustainable establishment of entrepreneurial ventures within the sector; eventually limiting the sector's capacity to foster innovation, attract investment, and promote economic diversification through entrepreneurial activities in rural areas. Understanding how rural population makes decision to pursue agricultural entrepreneurship given these challenges is an urgent imperative.

1.2. Agricultural entrepreneurship literature insights

Notable literature highlights several key drivers of agricultural entrepreneurship: unemployment, poverty, food insecurity, the pursuit of self-sufficiency, and a desire for improved well-being. Advances in agricultural technology and innovation also present new opportunities to improve productivity and profitability, making agriculture a more attractive livelihood option [32].

Nevertheless, many empirical studies have investigated how entrepreneurship contributes to addressing economic challenges, primarily focusing on developed regions [6,13,15–17,33,34]. These studies have solely focused on the critical role of entrepreneurship in poverty reduction and economic growth at macro, mezzo or micro.

However, despite the bourgeoning body of research in recent years, there remains a need for more contextualized empirical studies that explore the drivers of entrepreneurship, especially in rural areas of developing countries. Such studies should integrate not only cognitive factors but also social and contextual realities through a mixed-methods approach, with a particular focus on specific sectors like agriculture.

A notable recent multi-country study addresses this gap by employing panel data from 69 countries worldwide. This research adopts an integrated approach combining entrepreneurial cognition and social networking, rather than focusing solely on cognitive factors. The authors demonstrate that positive perception of entrepreneurial opportunities, confidence in personal skills and abilities, social networks with existing entrepreneurs, and investment in others' businesses as business angels are key drivers motivating individuals globally to pursue agricultural entrepreneurship [35].

While comprehensive, this multi-country study does not differentiate between urban and rural contexts, which is crucial given the unique constraints rural entrepreneurs face. Moreover, rural settings themselves are heterogeneous across developing countries. In light of these considerations, our study intends to contribute to the entrepreneurship literature by contextualizing the entrepreneurial process within rural mining areas of Kasai Oriental. It offers valuable insights for policymakers aiming to enhance farmers' entrepreneurial skills and promote agricultural entrepreneurial orientation in these specific environments. Therefore, this study aims to investigate how contextual factors, beyond cognitive factors influences, determine entry into agricultural ventures in the rural mining areas of Kasai Oriental, and to analyze how these factors may serve either as opportunities or obstacles to emergence of agricultural entrepreneurship in this environment.

1.3. Agricultural entrepreneurship facts in Kasai Oriental

Kasai Oriental region is predominantly agricultural. Rural households in this province largely rely on agriculture as their primary source of livelihood. Approximately 90% of 70% of the rural population, engage in farming activities [36,37]. Despite the region's favorable tropical humid climate, abundant arable land, and fertile soil-conditions that could support up to three agricultural seasons per year, the agricultural ventures remain embedded in a traditional, family-based system primarily oriented towards households' subsistence [38]; to the extent that agricultural market-oriented ventures are few and still in their infancy [36]. As a result, agricultural

production is insufficient to meet the year-round food needs of rural households which may explain the prevalence of high rate of food insecurity in Kasai Oriental reaching up 90% in some territories of the region [29,39].

For instance, statistics from Kasai Oriental indicate that only 8% of small and medium-sized enterprises (SMEs) operating in the province are engaged in the agricultural sector. **Table 1** below presents the distribution of these statistics by crop in rural areas of Kasai oriental.

Table 1. SME in agricultural sector in Kasai Oriental.

N⁰	Crop	Percentage (%)
1	Maize	3
2	Cassava	2
3	Peanut	1
4	Coffee	0.5
5	Rice	0.5
6	Market gardening	0.5
7	Oil palm	0.5

The analysis of **Table 1** indicates that maize cultivation constitutes the largest proportion of agricultural SMEs, accounting for 3%, followed by cassava at 2%, and peanuts at 1%. Other crops, including coffee, rice, horticultural products, and oil palm, each represent approximately 0.5% of SMEs. This distribution highlights a concentration of agricultural entrepreneurship in a limited range of crop types, with maize and cassava being the most prominent. This pattern singles out the sector's orientation towards subsistence, as maize and cassava are the primary crops for food consumed by approximately 70% of the rural population in Kasai Oriental [36]. Moreover, the relatively low percentages observed across all crop categories-despite 90% of the regional population being engaged in farming activities-suggest that agricultural SMEs remain underdeveloped.

This figures also reveal limited diversification within the agricultural sector and suggests that agriculture may be less attractive to SMEs in the region. This is due to array of restrictions, including cultural factors, limited entrepreneurial resources, and the scale of enterprises. Additionally, the agricultural sector faces a relatively complex market control mechanism, stemming from the unique characteristics of crops and related services. As a result, the rate of new agricultural ventures is low.

The remainder of the paper is organized as follows: Section 2 replaces this study with theoretical foundation based on the literature. Section 3 outlines the methodology, including the study area, sampling techniques, dataset description, and empirical strategy. Section 4 delves into descriptive, diagnostic analyses, and empirical results. Finally, Section 5 encapsulates the conclusion, policy implications, study limitations, and prospects for future studies.

2. Theoretical framework

This research is embedded in Social Cognitive Theory, which has gained much attention in recent years for examining factors influencing entrepreneurial activity. The

theory provides a coherent psychological framework to investigate how cognitive and social capital factors can predict individuals' decisions to engage in entrepreneurial activities.

Social Cognitive Theory explains the dynamic interaction between cognitive, behavioral, and environmental influences through the concept of reciprocal causation, where individuals are simultaneously influenced by personal and environmental factors [40,41]. Entrepreneurial decisions are made within the context of both internal dispositions and external surroundings. Consequently, each decision to engage in entrepreneurial activity is unique, shaped by distinct opportunities, challenges, and barriers that require contextualized and specific investigation. In this context, Social Cognitive Theory offers valuable insights into how individuals process information, develop attitudes, and make decisions regarding entrepreneurial engagement. It broadens our understanding of motivation by incorporating the influence of past behaviors and social environments, extending beyond internal personal factors alone.

Given the socio-economic landscape of Kasai Oriental where individuals have livelihood choices between non-farm activities such as artisanal mining and agricultural entrepreneurship, this study aims to explore how personal, social, institutional, and environmental factors drive both the initiation and entry into agricultural entrepreneurship, especially considering the constraints faced by the agricultural sector in rural areas of this region.

3. Methods and materials study setting and period

3.1. Study area and period

The study was carried out in Kasai Oriental, in the centre-south of the DRC, from 12 August to 25 September 2024. This region is characterized by its landlocked position and limited connectivity due to underdeveloped communication networks, which exacerbates its economic vulnerability [37]. As showed in **Figure 1** below, Kasai Oriental is divided into five territories: Kabeya Kamuanga, Katanda, Lupatapata, Miabi, and Tshilengi, comprising 146 extended villages locally known as "groupement". It spans 9545 km^2 and has an estimated population of 3.1 million people, with residential densities ranging from 190 to 484 inhabitants/km^2 in rural areas [42–44]. Kasai Oriental economy is primarily based on agriculture and diamond mining, with agriculture being the backbone of the economy, involving about 90% of households [37].
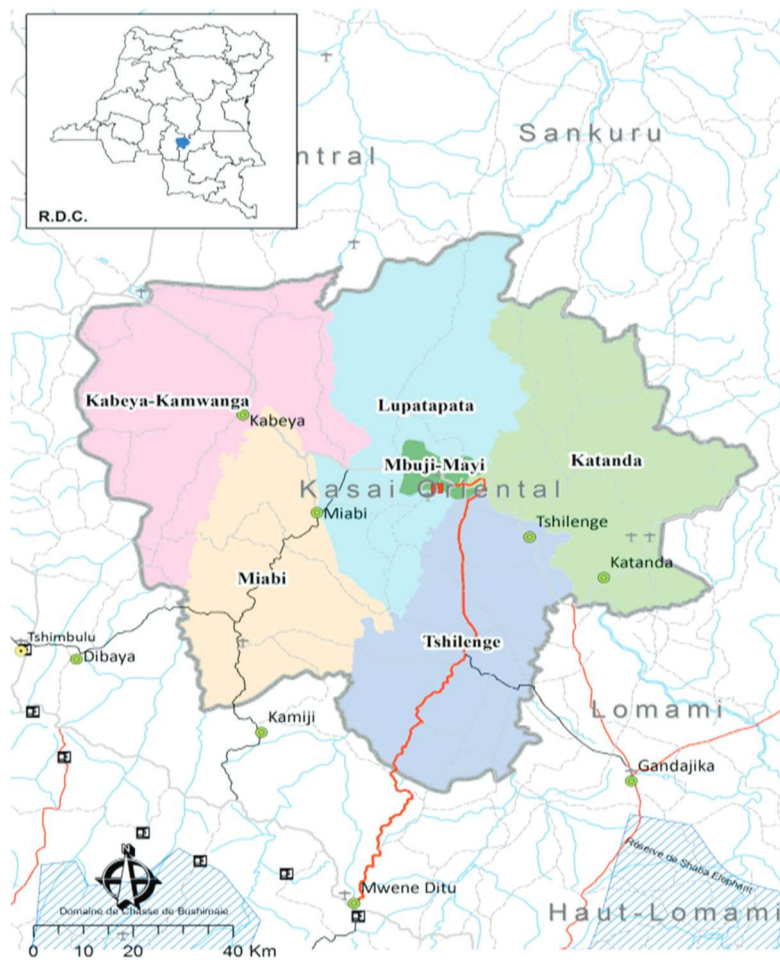
Figure 1. Study area map based on the 2015 administrative redistribution.
Source: Congo Profond, 2018.

3.2. Study design, sample size determination, collection tools and procedures

This study employed cross-sectional data from rural households to investigate the drivers of agricultural entrepreneurship in Kasai Oriental. The sample size was determined using a combination of purposive and multistage sampling techniques. Initially, 15 villages were selected based on their high agricultural activity, accessibility, and demographic significance, aiming to represent 10% of 146 extended villages across the region. To ensure geographical diversity, only 24 households were chosen from each extended village. These households were randomly selected from lists provided by village leaders, resulting in a total sample of 360 entrepreneurs. The sample size calculation was based on standard clustering precision methods. Assuming an average agriculture rate of 70% in Kasai Oriental, a critical value of 1.96 for a two-tailed test at a 95% confidence level, and a margin of error of 0.5, the initial sample size was calculated to be 323. Adjusting for a 90% expected response rate, the total sample size was rounded up to 360. This stratified sampling approach included both densely and sparsely populated areas. Simple random sampling using Excel-generated random numbers was employed to select households from lists provided by local authorities, minimizing selection bias. If a selected household was absent, it was replaced by the next household on the list to maintain unbiased selection. Thus, a semi-

structured questionnaire was developed based on a review of agricultural entrepreneurship literature. The questionnaire includes sections on cognitive factors and socio-demographic characteristics along with, institutional factors like diamond mining site proximity, access to land, and informal mechanism of credit, and land conflicts experience were included due to their critical roles in shaping agricultural entrepreneurship and sustainability, particularly in the context of Kasai Oriental. To ensure data quality, standardized data collection tools were initially developed in French and then translated into Tshiluba, the vernacular language of Kasai Oriental. The data were subsequently translated back into French to maintain consistency, using the Kobo Collect application-based phone. Before data collection, data collectors underwent a four-day training session that covered the selection procedure for study participant households, the study's purpose, and the steps for gathering necessary information from household participants. Throughout the data collection process, the principal investigator supervised and reviewed the data daily to ensure completeness and quality. Additionally, questionnaires were checked for completeness by the principal investigators, and feedback was provided to data collectors each morning to address any issues promptly.

3.3. Data processing and empirical model construction

The collected data was coded, entered, and cleaned using Excel 16 and then exported to STATA version 15 for analysis. After cleaning,10 households were excluded for missing data. So, final sample include 350 households for analysis. Descriptive statistics were computed. To address potential multicollinearity and heteroskedasticity issues among core explanatory variables, diagnostic and multicollinearity assessment were performed alongside heteroskedasticity test. The Mean of variance inflation factors (VIFs) for all variables was 1.44, with all variables having values below the heuristic upper limit of 5.0, confirming no multicollinearity problem. Correlation matrix was used to further examine the multicollinearity problem and crude relationship between independent variables and the outcome variable, agricultural entrepreneurship, which further confirms the absence of problematic linear dependencies among the explanatory variables. Meanwhile, heteroskedasticity test revealed a chi-square (χ^2) value of 348.25 significant at (< 0.01) *p*-value. For empirical analysis, a fixed effects logistic model was employed to assess the impact of independent variables on the binary dependent variable while accounting for unobserved heterogeneity at the village level. Additionally, linear fixed effects and ordinary least squares (OLS) models were used to verify consistency across models. The logistic model helped establish the best-fitting relationship between dependent and independent variables by accommodating the data distribution. The logistic regression coefficients forecast a logit transformation of the probability of relationship characteristics, as described by Greene [45–49].

In this study, the dependent variable is binary, taking values of 0 and 1, which makes logistic regression an appropriate model. The probability of the outcome ($Y_i = 1$) (representing Agricultural Entrepreneurship) given the vector of independent variables X_i which includes variables of interest and other covariates, can be expressed as:

$$P(Y_i = 1) = \frac{\exp(X_i\beta)}{1 - \exp(X_i\beta)} \tag{1}$$

Conversely, the probability of the other outcome ($Y_i = 0$) is given by:

$$\text{P}(Y_i = 0) = 1 - P(Y_i = 1) = \frac{\exp(X_i\beta)}{1 - \text{ex}\ (X_i\beta)}.$$

For comparison and consistency checks, a linear model can be represented as:

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \tag{2}$$

Here, X_i is a comprehensive vector encompassing cognitive factors, household size, household head characteristics (gender, level of education, marital status, and age), proximity to market and mining sites, access to advanced technologies and inputs, and household income. The logistic model (Equation (1)) is used to predict the probability of Agricultural Entrepreneurship, while the linear model (Equation (2)) serves as a reference to ensure consistency with the logistic model's assumptions. By employing a logistic fixed-effects model, the study examines the relationship between Agricultural Entrepreneurship and socioeconomic and demographic factors, thereby investigating to what extent the variables determine rural household agricultural entrepreneurship.

3.4. Variable selection

3.4.1. Dependent variable

To capture the drivers of agricultural entrepreneurship in Kasai Oriental, in this study, the dependent variable is Agricultural Entrepreneurship (early stage), which is a binary variable coded as 1 for individuals actively starting a business within the "Agriculture, forestry, and fishing" sector, according to the International Standard Industrial Classification of All Economic Activities (ISIC)—Revision 4 [50] and 0 otherwise.

3.4.2. Cognitive and other explanatory variables

On the one hand, entrepreneurial cognitive factors are understood as knowledge structures that serve as mental frameworks through which individuals assess, judge, and make decisions regarding opportunity evaluation, venture creation, and growth [51,52]. Given the significant influence of cognitive factors on entrepreneurial intentions and decision-making as evidenced by a range of empirical studies [11,35,40,53],this paper considers it appropriate to focus on three of them relevant to agricultural entrepreneurship: self-efficacy, fear of failure, and opportunity perception. Accordingly, we argue that self-efficacy and opportunity perception positively influence an individual's propensity to engage in agricultural entrepreneurial ventures, whereas fear of failure exerts a negative effect.

On the other hand, access to land, informal local credit, land conflict experience as institutional factors have been included to examine the path mechanism of the effect of these variables on rural households' motivation to engage in and sustain agricultural entrepreneurship. It also considers sociodemographic characteristics such as gender, education, age, household income, proximity to mining sites, farmland size, as crucial control variables. These factors are known literature to influence entrepreneurial

intentions and practices in agriculture[53–55]. Moreover, the paper also included personal (marital status), agricultural (farmland size), and economic (household income) variables as controls in our analysis, drawing on extensive literature from similar developing country contexts that underscores their importance for farm-scale production, household decision-making, labor allocation, food security, and poverty [15,29,56]. These variables are also likely to mediate the relationship between engagement in agricultural entrepreneurship and cognitive factors. To account for potential differences in agricultural entrepreneurship across villages due to economic, social, and cultural variations, the model controls for village fixed effects to minimize estimation bias from unobserved variables. Thus, we propose that demographic factors like age, education, household size, access to land and informal financial mechanism modes, and proximity to mining sites are significant determinants of agricultural entrepreneurship.

4. Results and discussion

This section presents descriptive statistics, model diagnostics, and empirical findings. It also provides a detailed discussion of the results, from which relevant policy implications will be drawn.

4.1. Descriptive results

Table 2. Variable definitions and descriptive statistics.

Variables	Descriptions	Means	SD	[95% Conf. Interval]
Dependent variable				
Agricultural Entrepreneurship	1 if agriculture entrepreneur (Agriculture, livestock, and fishing) and 0 otherwise	0.71	0.02	0.66–0.76
Cognitive variables				
Self-Efficacy	1 if the household head considers having knowledge, and skills to start up a business and 0 otherwise	0.67	0.47	0.63–0.72
Fear of Failure	1 if household head indicates that fear of failure would prevent them from setting up a business and 0 otherwise	0.39	0.49	0.34–0.44
Opportunity Perception	1 if household head see good opportunities to start an agricultural business in the area where they live and 0 otherwise	0.58	0.49	0.53–0.63
Demographic Control Variables				
Gender of HH Head	1 if household head is Male	0.91	0.28	0.89–0.94
Marital status of HH Head	1 if married, 0 otherwise	0.87	0.34	0.83–0.90
Age of Head	Age of household head in years (continuous)	52.58	15.75	50.9–54.2
18-30		0.07	0.26	0.05–0.10
30-45		0.30	0.46	0.25–0.35
45-60		0.31	0.46	0.26–0.36
≥ 60		0.32	0.47	0.27–0.37
Household size	Number of people in household (continuous)	6.61	2.50	6.35–6.87
HH Head education level				
Illiterate	1 if Illiterate, 0 otherwise	0.47	0.50	0.42–0.52
Primary	1 if primary, 0 otherwise	0.33	0.47	0.28–0.38
Secondary	1 if secondary, 0 otherwise	0.14	0.35	0.11–0.18
Tertiary	1 if university level, 0 otherwise	0.06	0.24	0.04–0.09
Socioeconomic variables				
Farmland size	Size of household main plot for business (continuous)	1.57	8	2.21.49–1.66
Land Access mode	1 if inherited, 0 otherwise	0.70	0.46	0.65–0.75
Land conflict experience	1 if household has experienced land conflicts around, 0 otherwise	0.43	0.50	0.38–0.48
Household Income	Monthly farm household income (continuous) in thousands of CDF: 1US$ = 2800 CDF	39.87	51.93	4.4–45.3
Proximity to mining site	1 if mining sites in $\leq$ 5 km in household area, 0 otherwise	0.27	0.45	0.23–0.32
Access to tontines	1 if household has access to informal financial mechanism of credit, 0 otherwise	0.63	0.48	0.58–0.68

Table 2 presents a descriptive overview and basic statistics of the key variables used in this study on agribusiness in rural settings in Kasai Oriental. The variables range from the dependent variable to demographic controls and socioeconomic factors, including behavioural (explanatory) variables.

Table 2 reports mean, standard deviations (SD), and 95% confidence intervals (Cis), which together describe the main characteristics and variability of the sample. Indeed, 71% of the sampled rural households reported engagement in agricultural entrepreneurship. The low standard deviation (0.02) indicates minimal variability around the mean, suggesting a relatively homogeneous sample with respect to agricultural business. This high prevalence suggests that most of household heads participate in agribusiness activities-such as crop farming, livestock rearing, or fishing-highlighting the predominance of the agricultural ventures among rural households in Kasai Oriental. These findings align with previous studies conducted in the region [29,36,37,57].

On the other hand, 67% and 58% of rural household heads in Kasai Oriental self-assessed as possessing the necessary skills and knowledge to engage in agri-business ventures, and perceived the rural environment as favorable for establishing agricultural enterprises. While entrepreneurial self-efficacy is widely recognized in the literature as a crucial driver of entrepreneurial action, opportunity perception may be equally important in explaining singularities of entrepreneurship that extend beyond individual capabilities. In contrast, 39% of rural households reported a fear of failure in agricultural business. This relatively high prevalence of failure anxiety represents a significant psychological barrier to entrepreneurship. The relatively high standard deviation (0.49) suggests considerable variation in risk perception among rural households in Kasai Oriental. Despite the notable psychological rate of fear of failure among rural households in Kasai Oriental, the combined influence of self-efficacy and opportunity perception provides a fertile ground for promoting agricultural entrepreneurship in this region. Other variables exhibit different patterns. In Kasai Oriental, 91% of rural households are headed by men, indicating a significant male predominance in household leadership. Among these male heads, 87% reported being married. These demographic trends align with existing empirical studies that highlight the prevalence of patriarchal family structures and the widespread occurrence of early marriages, particularly in rural areas of Kasai Oriental [29,36,37,57]. The average age of rural household heads is 52.6 years, suggesting that agricultural entrepreneurs are predominantly middle-aged or older. The age distribution is relatively balanced across the 30–45, 45–60, and 60 years and above categories. However, young household heads aged 18–30 are markedly underrepresented, constituting only 7% of the sample. This underrepresentation may indicate challenges related to youth engagement in agricultural entrepreneurship within the region. Rural households in Kasai Oriental have an average size of approximately 6.61 members. Educational attainment among household heads is low: only 6% have completed tertiary education, while nearly half (47%) are illiterate. This high illiteracy rate among household heads likely poses a significant barrier to the adoption of innovative agricultural practices and business models, thereby undermining the transformative process from traditional subsistence farming to market-oriented agricultural enterprises and entrepreneurial ventures in rural areas. Low literacy could limit access to information, constrain the capacity to

manage farm finances effectively, and hinder engagement with extension services for fostering successful agricultural entrepreneurship. These findings are consistent with rural norms in Kasai Oriental, where larger household sizes may be associated with the availability of labor for agricultural activities, and limited access to formal education has been documented in prior studies [29,37].

On average, rural households in Kasai Oriental possess 1.57 hectares of farmland. However, the high standard deviation of 82.18 hectares indicates significant inequality in land distribution across the region. Approximately 70% of these households acquire land through inheritance, underscoring the continued importance of traditional land tenure systems in Kasai Oriental. These findings align with recent studies conducted in the region [29,36,37]. To other side, despite the predominance of traditional land access, 43% of rural households report having experienced land conflicts. This high incidence highlights latent insecurity in land tenure, which may discourage investment in agricultural activities. The average monthly farm income is 39,870 Congolese Francs (approximately 14 USD), reflecting the relatively low profitability of agricultural entrepreneurship. This low income is likely influenced by technical and financial constraints, such as limited access to credit and advanced agricultural technologies. Furthermore, about 27% of rural households live within 5 km of mining sites, which potentially provide alternative or competing sources of income. This proximity may affect labour allocation within households and influence agricultural productivity. Lastly, 63% of rural households rely on informal financial mechanisms, such as tontines. The widespread use of these informal risk sharing systems appears to play a crucial role in supporting agricultural entrepreneurship in rural Kasai Oriental, where formal financial institutions are quasi absent.

4.2. Diagnostic tests and multicollinearity assessment

For diagnostic and checking of multicollinearity of our regression estimates, we, prior to empirical analysis itself, carried out different diagnostic statistics, including multicollinearity analysis using the Variance Inflation Factor (VIF) and a correlation matrix, classification accuracy, and receiver operating characteristic (ROC) analysis for reliability and robustness of the logistic regression model to predict agricultural entrepreneurship in rural context of Kasai Oriental. **Table 3** below presents the results of these diagnostic tests.

Table 3. Diagnostic and multicollinearity checking statistics.

VARIABLES	Variance Inflator Factor		Correlation Matrix																		
	VIF	1/VIF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1) Agricultural Entrepreneurship			1.00																		
2) Self-Efficacy	1.72	0.5815	0.72	1.00																	

Table 3. (*Continued*).

	Variance Inflator Factor		Correlation Matrix																		
3) Fear of Failure	1.40	0.7128	−0.45	−0.40	1.00																
4) Opportunity Perception	1.58	0.6327	0.30	0.37	−0.36	1.00															
5) Gender of HH Head	1.09	0.9164	−0.08	−0.10	0.05	−0.12	1.00														
6) Marital status of HH	1.20	0.8338	0.14	0.11	−0.07	0.23	0.00	1.00													
7) 18–30	1.40	0.7127	−0.30	−0.22	0.13	−0.07	−0.03	−0.02	1.00												
8) 30–45	1.65	0.6051	−0.07	−0.10	0.04	0.08	0.09	−0.08	−0.18	1.00											
9) 45–60	1.58	0.6331	0.08	0.08	0.00	0.05	−0.04	0.26	−0.19	−0.43	1.00										
10) Household size	1.41	0.7073	0.15	0.19	−0.18	0.15	−0.10	0.10	−0.27	−0.29	0.23	1.00									
11) Primary	1.28	0.7819	0.03	0.09	−0.10	0.03	−0.05	0.04	−0.01	0.00	0.02	0.01	1.00								
12) Secondary	1.25	0.7989	−0.01	−0.03	−0.06	0.02	−0.11	0.06	−0.05	−0.05	0.12	0.07	−0.28	1.00							
13) Tertiary	1.19	0.8404	0.04	0.03	−0.06	0.03	−0.05	0.03	0.11	−0.07	0.03	0.07	−0.18	−0.10	1.00						
14) Farmland size	1.89	0.5288	0.29	0.26	−0.25	0.32	−0.12	0.08	−0.11	−0.01	−0.03	0.19	0.04	0.00	0.06	1.00					
15) Land Access mode	1.28	0.7800	0.51	0.35	−0.19	0.12	−0.09	0.15	−0.10	−0.02	−0.00	0.04	−0.02	0.04	−0.01	0.20	1.00				
16) Land conflict experience	1.52	0.6568	−0.30	−0.27	0.35	−0.43	0.04	−0.10	0.04	−0.16	0.10	−0.10	−0.16	−0.09	−0.18	−0.19	−0.12	1.00			
17) Household Income	1.60	0.6253	0.14	0.11	−0.22	0.23	−0.01	0.13	−0.12	0.00	0.06	0.23	0.04	0.10	0.04	0.54	−0.04	−0.18	1.00		
18) Mining site around	1.48	0.6762	0.02	0.05	−0.04	0.22	−0.11	0.14	−0.05	0.01	−0.00	0.27	0.02	0.01	0.03	0.43	−0.06	−0.12	0.30	1.00	
19) Access to tontines	1.47	0.6791	0.47	0.43	−0.22	0.27	−0.01	0.15	−0.23	0.03	0.18	0.18	0.10	0.03	0.03	0.24	0.13	−0.21	0.09	0.27	1.00
Mean VIF	1.44																				

From **Table 3**, we observed that the mean VIF across all variables in our model is 1.44, with the highest individual VIF being 1.89 for the variable Farmland Size. These values fall below the heuristic threshold of 10 [47,48,58], indicating that multicollinearity is not a concern in our model. The correlation matrix further confirms the absence of problematic linear dependencies among the explanatory variables. Furthermore, it reveals some strong correlations between some covariates and the dependent variable. For example, self-efficacy exhibits a strong positive correlation with agricultural entrepreneurship ($r = 0.72$), supporting the notion that entrepreneurial confidence enhances engagement in agricultural enterprises. In contrast, fear of failure is negatively correlated with both self-efficacy ($r = −0.40$) and agricultural entrepreneurship ($r = −0.45$), suggesting that psychological barriers may inhibit the decision to engage in agricultural business. Opportunity perception shows moderate positive correlations with self-efficacy ($r = 0.37$) and agricultural entrepreneurship ($r = 0.30$), indicating that recognizing local opportunities facilitates entrepreneurial activity. Agricultural and socioeconomic factors such as land access mode ($r = 0.51$) and access to informal financial mechanisms ($r = 0.47$) also demonstrate notable positive correlations with agricultural entrepreneurship, underscoring the importance of resource security and informal finance in determining the decision to engage in agricultural entrepreneurship. Conversely, experience of land conflict is negatively correlated with entrepreneurship ($r = −0.30$), highlighting the disincentivizing effects of insecure land tenure. In all, these results confirm the appropriateness and proper specification of the variables included in the model. They also demonstrate that multicollinearity is unlikely to bias the regression outcomes. Moreover, the findings reveal theoretically consistent associations between entrepreneurial behaviour and both psychological and socioeconomic determinants in rural agricultural contexts of Kasai Oriental.

Table 4. Test for heteroskedasticity of the residual of factors influencing engagement in agricultural venture in Kasai Oriental.

Source	Chi-square (χ^2)	Degrees of Freedom (DF)	*p*-value
Heteroskedasticity	257.49	167	0.0000
Skewness	73.76	18	0.0000
Kurtosis	17.01	1	0.0000
Total	348.25	186	0.0000

Null hypothesis (H_0): Homoskedasticity.
Alternative hypothesis (H_a): Unrestricted heteroskedasticity.

As shown in **Table 4** above, the test results strongly reject the null hypothesis of homoskedasticity, normality, and absence of skewness, given the very low *p*-values (< 0.01) across all tests. This indicates significant evidence of heteroskedasticity in the residuals, as well as deviations from normality reflected in skewness and kurtosis. To address these violations and ensure valid statistical inference, we employ robust standard errors clustered at the village level in our logistic regression model assuming nonlinear distribution. This approach corrects for heteroskedasticity and intra-cluster correlation, thereby providing more reliable estimates [45,46].

Tables A1 and **A2** in the Appendix presents the classification accuracy of the logistic regression model. The model demonstrates strong predictive performance, with a sensitivity (true positive rate) of 96.77% and a specificity (true negative rate) of 87.25%. Additionally, the positive predictive value is 94.86%, and the negative predictive value is 91.75%, confirming the model's accuracy in correctly identifying both agricultural entrepreneurs and non-entrepreneurs. The overall classification accuracy is 94%, indicating effective prediction of the dependent variable based on the explanatory variables. Furthermore, the ROC curve shown in **Figure A1** (annex) visually supports the model's discriminative ability. The area under the curve (AUC) is 0.9799, which is close to 1.0, signifying excellent performance in distinguishing agricultural entrepreneurs from non-entrepreneurs in rural Kasai Oriental.

4.3. Empirical results

This section presents the empirical findings on the determinants of rural household agricultural entrepreneurship in Kasai Oriental. To ensure robustness and facilitate comparison, three estimation methods were employed: Ordinary Least Squares (OLS), Linear Fixed Effects (FE), and Logit Fixed Effects (Logit-FE). Given that the dependent variable is binary, taking the value 1 if the household is engaged in agricultural entrepreneurship and 0 otherwise. The marginal effects derived from the Logit-FE model provide the most meaningful interpretation in terms of changes in the predicted probability of engagement. So, interpretation and discussion will be based primarily on these marginal effects, which capture how changes in each independent variable affect the likelihood of a household participating in agricultural entrepreneurship, holding all other factors constant. **Table 5** below presents these empirical findings for all models.

Table 5. Determinants of rural household agricultural entrepreneurship in Kasai Oriental.

	(1)		(2)		(3)		Logit-FE Marginal Effects (dy/dx)	
VARIABLES	OLS	SE	Linear-FE	SE	Logit-FE	SE	Margins	SE
Self-Efficacy	0.42***	(0.04)	0.42***	(0.07)	3.69***	(0.74)	0.22***	(0.04)
Fear of Failure	−0.13***	(0.03)	−0.13***	(0.03)	−2.06***	(0.67)	−0.12***	(0.04)
Opportunity Perception	−0.03	(0.04)	−0.02	(0.03)	−0.04	(0.75)	−0.00	(0.04)
Gender of HH Head	−0.04	(0.05)	−0.05	(0.04)	−1.76	(1.35)	−0.10	(0.08)
Marital status of HH Head	0.03	(0.05)	0.03	(0.05)	0.87	(0.99)	0.05	(0.06)
Age group (Ref: ≥ 60)								
18–30	−0.25***	(0.06)	−0.26***	(0.07)	−5.74***	(1.75)	−0.34***	(0.11)
30–45	−0.09**	(0.04)	−0.10**	(0.04)	−1.63**	(0.79)	−0.10**	(0.05)
45–60	−0.04	(0.04)	−0.06	(0.05)	−0.82	(0.83)	−0.05	(0.05)
Household size	−0.01*	(0.01)	−0.01**	(0.01)	−0.29**	(0.14)	−0.02*	(0.01)
Head Education level attained (Ref: Illiterate)								
Primary	−0.07**	(0.03)	−0.07*	(0.04)	−1.80**	(0.84)	−0.11**	(0.05)

Table 5. (*Continued*).

	(1)		(2)		(3)		Logit-FE Marginal Effects (dy/dx)	
Head Education level attained (Ref: Illiterate)								
Secondary	−0.08*	(0.04)	−0.07*	(0.04)	−1.56*	(0.83)	−0.09**	(0.05)
Tertiary	−0.02	(0.06)	−0.02	(0.04)	−1.11	(1.45)	−0.07	(0.09)
Farmland size	0.01	(0.02)	0.01	(0.02)	0.68	(0.56)	0.04	(0.03)
Land Access mode	0.27***	(0.03)	0.24***	(0.06)	3.25***	(0.76)	0.19***	(0.04)
Land conflict experience	−0.08**	(0.04)	−0.10***	(0.03)	−1.93**	(0.80)	−0.11**	(0.05)
Household Income	0.00	(0.00)	0.00**	(0.00)	−0.01	(0.01)	−0.00	(0.00)
Proximity to mining site	−0.07*	(0.04)	−0.09*	(0.04)	−1.52*	(0.83)	−0.09*	(0.05)
Access to tontines	0.21***	(0.04)	0.21***	(0.04)	3.19***	(0.80)	0.19***	(0.04)
Constant	0.39***	(0.10)	0.42***	(0.09)	–	–	–	–
Observations	350		350		350		350	
R-squared	0.683		0.692		–			
Villages FE	No		Yes		Yes			
F	39.58***		–					
LR chi2(18)	–		–		293.52***			

Standard errors Clustered at village level in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The analysis of **Table 5** above reveals some valuable associations between the dependent variable and key explanatory variables. For instance, Self-Efficacy exhibits a statistically significant positive effect on agricultural entrepreneurship at the 1% level. Specifically, a one-unit increase in self-efficacy is associated with a 22-percentage point increase in the probability of engaging in agricultural entrepreneurship in rural Kasai Oriental. Fear of Failure in contrast shows a statistically significant negative effect at the 1% level. A one-unit increase in fear of failure reduces the likelihood of engagement by 12 percentage points.

Demographic Variables such as age and education also show significant negative associations. Taking the oldest age group (≥ 60 years) as the reference category, both the youngest group (18–30 years) and the young adult group (30–45 years) are significantly less inclined to participate in agricultural entrepreneurship, with significance levels at 1% and 5%, respectively. **Figure 2** further illustrates a distinct age gradient in agricultural entrepreneurial engagement. Household heads aged 18–30 show the lowest predicted probabilities of engaging in agricultural entrepreneurship. Although the 30–45 age group also demonstrates a negative association, the effect is less pronounced, suggesting that individuals in this group may have comparatively better access to resources or a higher tolerance for risk.
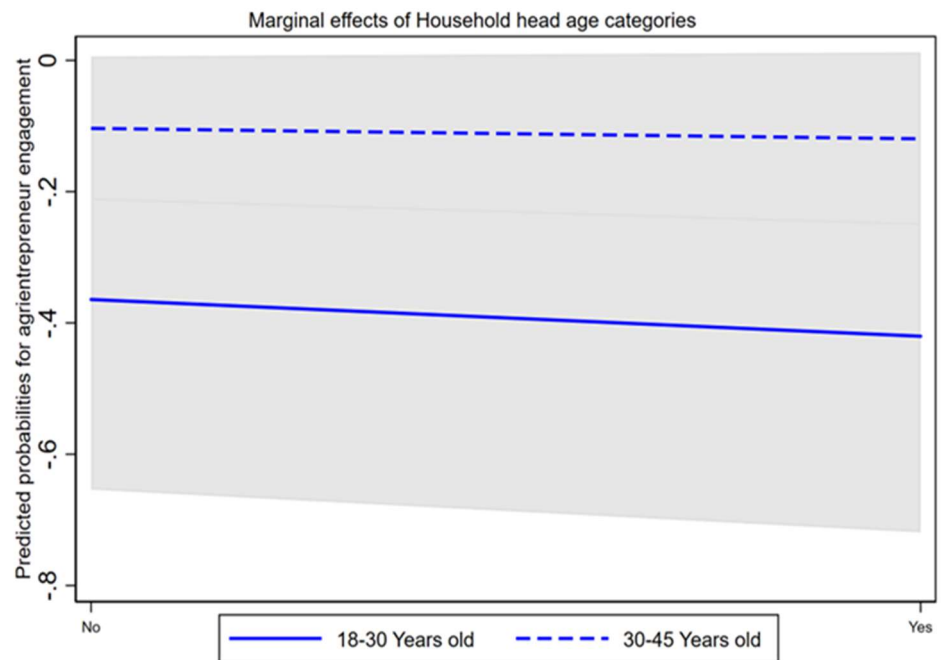
Figure 2. Marginal effects of household head age categories on Agri-entrepreneurial engagement.

Similarly, education levels (primary and secondary) are negatively and significantly associated with engagement in agricultural entrepreneurship at the 5% level. This may suggest that higher education levels among rural populations correspond to a lower probability to pursue agricultural entrepreneurship. **Figure 3** clearly shows that household heads with primary or secondary education ("Yes") have a lower predicted probability of engaging in agricultural entrepreneurship compared to those who are illiterate ("No").
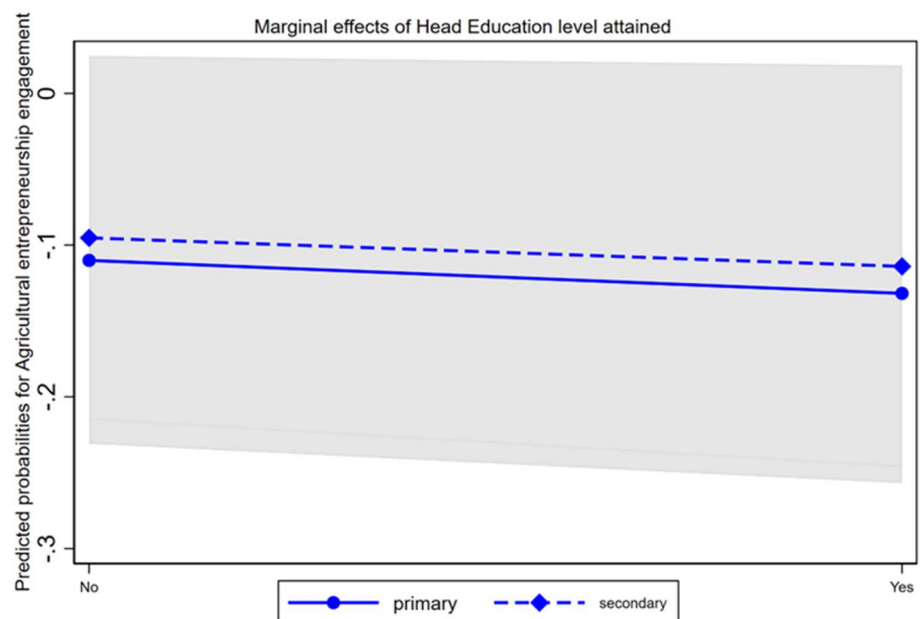
Figure 3. Marginal effects of household head education level achieved on agricultural entrepreneurship engagement.

Conversely, experience of land conflicts and the presence of mining sites near household residences are negatively and significantly associated with agricultural entrepreneurship, suggesting these factors hinder engagement in agricultural business. The **Figure 4** below revealed the household heads who reported a fear of failure ("Yes") show a significantly lower predicted probability of engaging in agricultural entrepreneurship compared to those who did not report such fear ("No"). Similarly, in Panel (B), households located closer to mining sites ("Yes") are less likely to engage in agricultural entrepreneurship than those residing far away. Also, households that have experienced land conflicts ("Yes") show a reduced likelihood of participating in agricultural entrepreneurship.
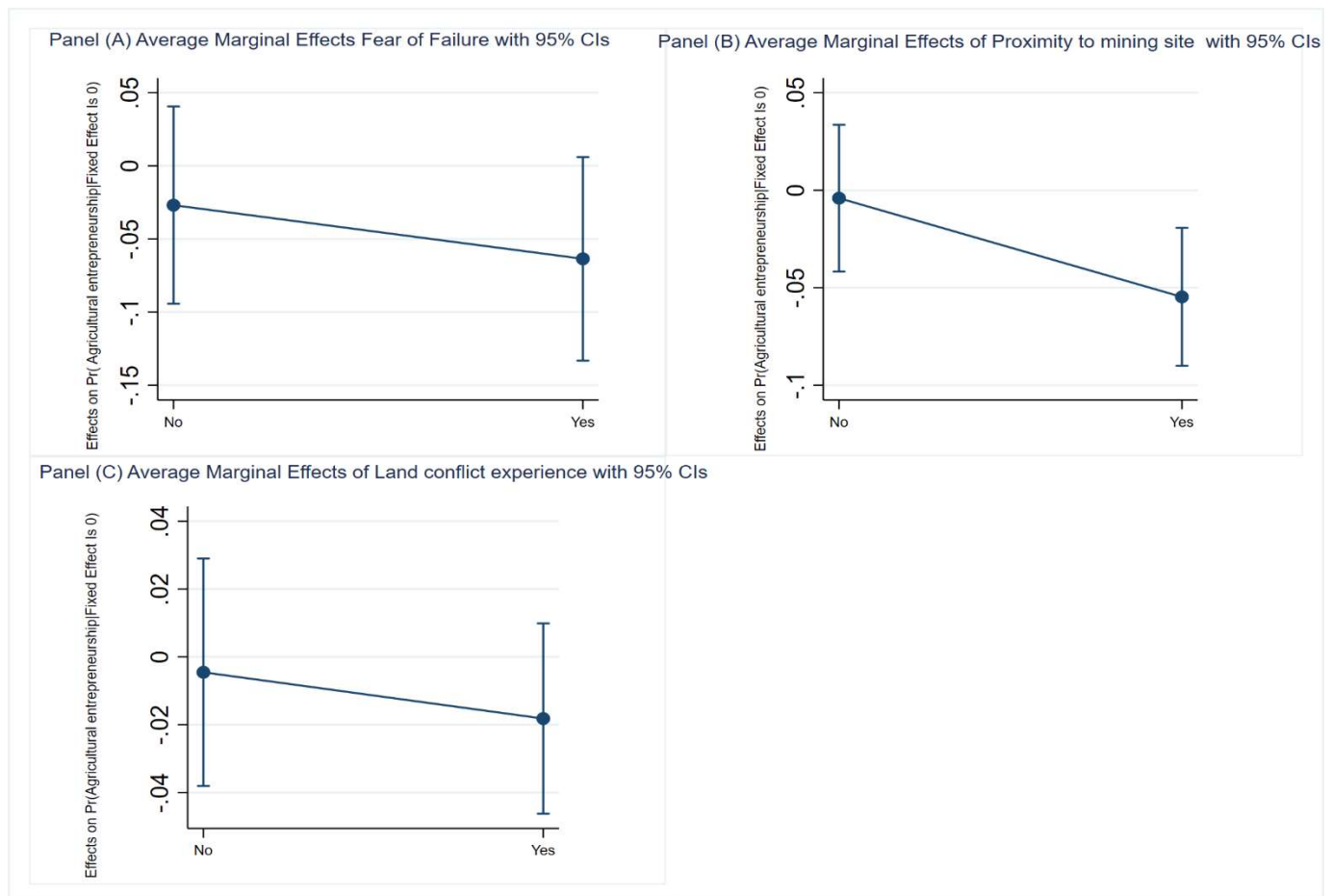
Figure 4. Average marginal effects of predicted probability of fear of failure, proximity to mining sites and land conflicts experience on agricultural entrepreneurship.

Agricultural and institutional factors such as Access to land through inheritance and access to informal local financial mechanisms are positively and significantly linked to agricultural entrepreneurship at the 1% level. These factors increase the probability of participation, highlighting the importance of accessing land and social credit networks as catalyst mediator's agricultural entrepreneurship in Kasai Oriental. Counterintuitively, household size is negatively associated with agricultural entrepreneurship at the 10% significance level, indicating that larger households are less likely to engage in agricultural business activities. **Figure 5** further confirms that the marginal effect is slightly negative, indicating that larger households are

marginally less likely to engage in agricultural entrepreneurship. However, this decline is gradual and small in magnitude.
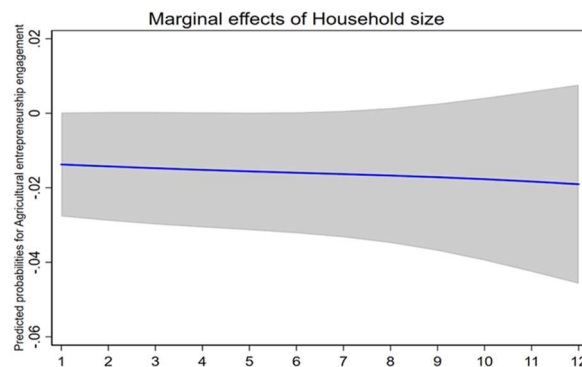
Figure 5. Marginal effects of household size on agricultural entrepreneurship engagement.

Other variables, including opportunity perception, gender of the household head, marital status, farmland size, and income, do not show statistically significant relationships with agricultural entre5reneurship in Kasai's context. The analysis presented in **Figure 6** lies on bar plots of average marginal effects (AMEs) with 95% confidence intervals (CIs), derived from the fixed effects logistic regression model described above. This visualization makes the magnitude and direction of each explanatory variable's impact on the predicted probability of a household engaging in agricultural entrepreneurship crystal clear. Positive AMEs correspond to an increased likelihood, whereas negative AMEs indicate a decreased likelihood.
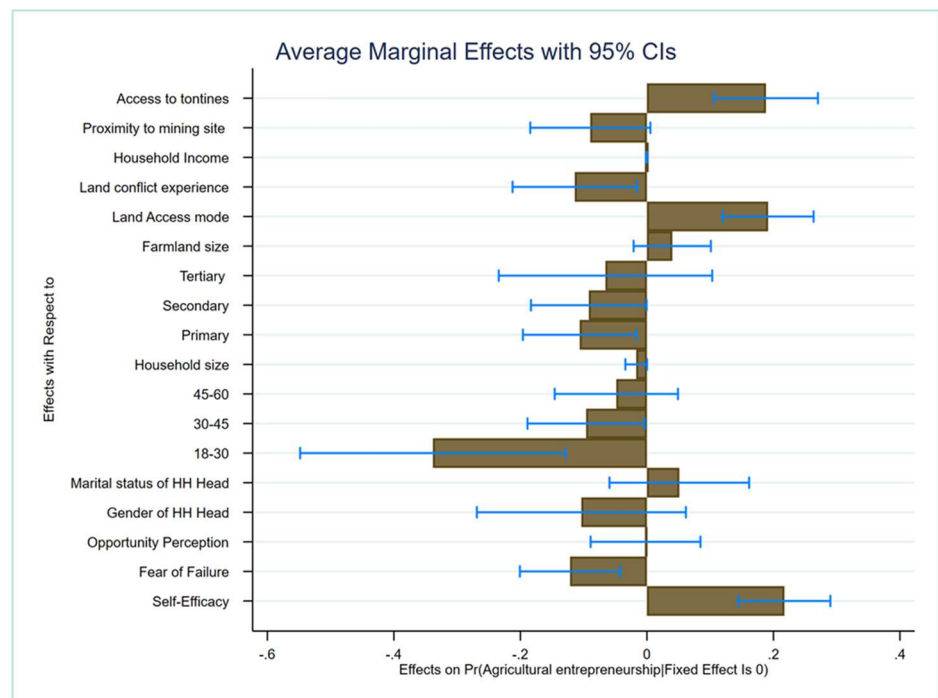
Figure 6. Explanatory variables predicted probability on agricultural entrepreneurship in Kasai Oriental.

Overall, these effects quantify how a one-unit change in each variable influences the probability of agricultural entrepreneurship, while holding all other factors constant.

4.4. Findings discussion

Rural household heads' confidence in their entrepreneurial abilities is strongly and positively associated with engagement in agricultural entrepreneurship in Kasai Oriental. This suggests that self-assuredness in one's entrepreneurial skills is a significant factor determining participation in agricultural entrepreneurship. This finding aligns with findings of empirical review and previous studies in Telangana, India, that found that rural people with higher self-confidence are more likely to engage in entrepreneurial activities in agriculture. This factor plays a catalytic role for engagement and fostering agricultural entrepreneurship [59,60]. Similarly, recent research in China highlights that self-confidence not only increases the likelihood of participating in agricultural entrepreneurship but also enhances the positive impact of motivation on entrepreneurial performance. Entrepreneurial ability acts as a full mediator between motivation and performance, indicating that confidence in one's skills facilitates entrepreneurial engagement and success [33,61,62].

In contrast, fear of failure is negatively associated with agricultural entrepreneurship among rural households in Kasai Oriental, reducing the likelihood of entrepreneurial entry by 12 percentage points. This factor possibly acts as a psychological gravity and a risk-taking deterrent, significantly hindering entrepreneurial behavior and motivation enterprise formation. This finding aligns with previous research indicating that fear of failure can prevent individuals from entering entrepreneurial ventures, as it is perceived as a threat to the success of the enterprise [63–66]. This phenomenon is particularly relevant in rural areas, where non-farm activities often offer higher profitability, yet access to credit and other financial resources are highly constrained. These limitations exacerbate fear of failure and risk aversion [64–66]. For example, notable previous study demonstrated that when the threshold for entrepreneurial success equals the value of the foregone outside option, fear of failure consistently demotivates potential entrepreneurs [67]. Moreover, if fear of failure is conceptualized as risk aversion, it becomes a critical deterrent to entrepreneurial entry, as individuals prioritize avoiding potential losses over pursuing possible gains [68].

Demographic factors, particularly younger adult age groups, show a negative association with engagement in agricultural ventures. This suggests that the younger an individual is, the less likely they are to participate in agricultural entrepreneurship. A plausible explanation for this trend is the availability of more attractive opportunities in non-farm sectors, especially in the mining industry, which tends to draw young people away from farming activities. Demographic factors, particularly younger adult age groups, show a negative association with engagement in agricultural ventures. This suggests that the younger an individual is, the less likely they are to participate in agricultural entrepreneurship. A plausible explanation for this trend is the availability of more attractive opportunities in non-farm sectors, especially in the mining industry, which tends to draw young people away from farming activities. This

finding aligns with previous studies conducted in Kasai Oriental, which reported that many young people in rural areas prefer mining activities due to the higher income potential and the perceived possibility of rapid financial gains compared to farming [36,57]. Additionally, this trend may be influenced by labor migration patterns, such as movement toward mining jobs or urban areas in search of better opportunities [29]. However, this trend may pose significant challenges to the emergence of the agricultural sector and food security in the region, where over 54.4% of the population is estimated to be under 20 years old [36].

Similarly, household size is negatively correlated with agricultural entrepreneurship. While fully counterintuitive, this finding aligns with the social context of Kasai Oriental, where the average household is around seven members, even though it prompts questions about agricultural ventures and non-farm activities trade-offs upon labour allocation within rural households. This large household size may create a dependency burden, as a limited number of active individuals support many dependents. This dynamic may also indicate fragmented labor allocation within households, where younger members pursue non-farm activities, leaving agricultural responsibilities primarily to older members.

This result mirrors findings from previous research conducted in the former Zaire (Democratic Republic of Congo), which demonstrated that larger household sizes correlate with a decline in cultivated area per worker, suggesting increased dependency burdens and fragmented labor allocation [69]. Similarly, recent empirical studies in Nigeria have found that larger household sizes in rural households drive members to engage more in non-farm sectors, implying that a greater labor endowment leads to non-farm enterprise engagement [8].

Another important insight that emerges from our study concerns the mode of land access. Having secure or favorable land access increases the likelihood of engaging in entrepreneurship by 19 percentage points. This finding suggests that tenure security is substantive for encouraging investment and risk-taking in agriculture. It underscores the importance of secure land tenure in fostering entrepreneurship, as greater access to inherited land likely stabilizes and enhances agricultural production. Inheritance remains a prevalent method of land acquisition in Kasai Oriental, allowing the autochthonous rural population to obtain substantial land at minimal cost. This facilitates the expansion of farming enterprises [36]. Since farming is the primary source of food, income, and employment for rural residents in Kasai Oriental, any constraints on land access can severely hinder their entrepreneurial participation. In this regard, existing research has demonstrated that limitations on land access negatively affect rural households' agricultural enterprises by reducing agricultural income [70,71]. Therefore, insufficient access to land-including landlessness, unequal land distribution, and lack of resources to acquire land-poses a significant barrier to rural households' entry into agricultural ventures. Conversely, experiencing land conflict reduces the likelihood of engaging in agricultural ventures by 11 percentage points. Land conflicts discourage productive use of land, particularly by inhibiting entrepreneurial activities. Empirical evidence indicates that such conflicts have a significant negative impact on agricultural ventures by deterring investment and risk-taking. Studies conducted in various developing countries corroborate these findings, showing that the persistence of land conflicts generates uncertainty and risk, lowers

the probability of participation in agricultural entrepreneurship, and constrains the optimization behaviour of smallholder farmers. Consequently, these conflicts discourage both productive land use and long-term investments in agricultural businesses [72–75].

Access to informal credit mechanisms increases the probability of entrepreneurial activity by 19 percentage points. Local social finance systems significantly enhance entrepreneurial potential, likely by alleviating liquidity constraints. This finding aligns with a previous study conducted in Brazil, which reported that a liquidity shock resulting from a welfare program increased small-scale entrepreneurship by 10 percent. This effect was primarily driven by indirect impacts associated with private transfers among low-income households. These results suggest that informal financial assistance plays a crucial role in fostering entrepreneurship by mitigating liquidity constraints [76]. Similarly, a recent multi-country study observed that informal credit substantially supports innovation in small and medium-sized enterprises (SMEs) in developing countries [77]. Proximity to mining sites is statistically and negatively associated with engagement in agri-business. Access to mining reduces incentives for agricultural entrepreneurship because mining activities compete with farming ventures for available labor within rural households, particularly among young members. This finding aligns with the United Nations Development Program in Kasai Oriental, which reports that young people tend to prefer mining activities to the detriment of farming [36,57] . Similarly, a study in Côte d'Ivoire revealed that the development of mining sites attracts household labor away from agricultural businesses [78].

5. Conclusion and policy implications

This study investigated the influence of cognitive, demographic, socioeconomic, and institutional factors on rural household engagement in agricultural ventures in Kasai Oriental. To analyze these relationships, we employed a fixed-effects logit model, from which we derived marginal effects. For robustness and comparative purposes, we also utilized Ordinary Least Squares (OLS) and linear fixed-effects models. The fixed-effects logit approach is particularly robust as it controls for time-invariant unobserved heterogeneity. Fixed effects were incorporated at the village level, with the dependent variable being binary-taking the value 1 if a household is engaged in agricultural entrepreneurship and 0 otherwise.

Our findings reveal that psychological factors play a significant role. Specifically, self-efficacy positively influences rural entrepreneurship, increasing the probability of engagement by 22 percentage points. This suggests that confidence in one's ability to initiate agricultural ventures acts as a strong catalyst for entrepreneurship in Kasai Oriental's rural areas. Conversely, fear of failure has a substantial negative impact, reducing the likelihood of engagement by 12 percentage points. This highlights the critical need to address psychological gravities to agricultural entrepreneurship.

Access-related factors also significantly affect engagement. Households with favourable land access arrangements and those participating in informal local credit groups are 19 percentage points more likely to engage in agricultural entrepreneurship. This underscores the importance of institutional support and social network capital in facilitating rural enterprise development.

Demographic variables exhibit noteworthy patterns. Younger age groups (18–30 and 31–45 years) and individuals with primary or secondary education are less likely to participate in agricultural entrepreneurship. This may indicate a disengagement from agriculture or a shift toward alternative economic sectors, such as mining. Additionally, experiences of land conflict and proximity to mining areas negatively affect agricultural entrepreneurship, suggesting the necessity of securing land tenure and addressing potential labour or opportunity trade-offs between agriculture and mining sectors.

Given these conclude remarks for rural economic development in Kasai Oriental, policymakers should prioritize vocational training, access to technology, and extension services to enhance psychological support, boost self-efficacy, and equip rural households with essential skills, thereby reducing fear of failure among rural entrepreneurs. These interventions, including apprenticeship schemes and on-the-job training, should focus on cost-effective, pro-poor business public goods as foundational elements to improve the professional competencies of potential entrepreneurs. This strategy requires a coordinated public-private partnership involving government agencies, civil society, private sector actors, research institutions, and NGOs. Such collaboration is essential to accurately identify training needs, secure funding, and build rural entrepreneurial human capital. Emphasizing vocational programs and technology access addresses the low participation of younger and more educated individuals in agriculture by making it a more attractive and viable sector. The effectiveness of these policies could pass through the implementation of pilot rural-driven agri-business localized training centers in Kasai Oriental, in collaboration with local NGOs and civil society organizations. These centers could provide an array of services, including short-cycle training in agricultural processing, cooperative marketing, agricultural accounting, household financial literacy, and the facilitation of rotating savings and loan schemes. Such initiatives would enable periodic evaluation of policy impacts through metrics such as the number of new agri-ventures launched, their profitability, and household resilience indicators, including income levels and reductions in seasonal food insecurity. Furthermore, given the interaction between mining and agriculture in Kasai Oriental, insights gained from these pilot programs could inform the development of specialized microcredit products and savings plans tailored to households with fluctuating incomes. Importantly, these findings could also guide international donors and private investors interested in supporting livelihood diversification in fragile, resource-dependent economies. Considering the coexistence of agriculture and mining in Kasai Oriental and credit constraints for many households, it may be interesting to test the applicability and performance of these models in other provinces of the DRC such as Katanga, North and South Kivu, as well as in countries such as Botswana, Liberia, Sierra Leone, and Guinea, which share similar artisanal mining-agriculture linkages, land use conflicts, and credit constraints.

Finally, expanding formal credit mechanisms, fostering local social credit networks, and improving land access particularly for youth and educated individuals in rural areas are essential strategies. Addressing land disputes and the challenges posed by thriving artisanal mining activities through inclusive social innovation dialogues and tailored training for rural residents can catalyze constructive reciprocal

interactions between the agricultural and mining sectors. In this way, additional mining income can be adequately allocated to fund agricultural initiatives, while agricultural ventures can supply food to mining sites, thereby enhancing overall well-being and securing both agricultural and mining livelihoods. Motivating civil society to participate in these dialogues further supports inclusive socioeconomic development and helps resolve community-level challenges. This collaborative approach fosters sustainable rural development in Kasai Oriental by leveraging the strengths and resources of both sectors for mutual benefit.

However, this study has several important limitations that must be acknowledged when interpreting its findings. First, the data were collected through a cross-sectional survey conducted in rural areas, which does not capture the evolving nature of rural communities and agricultural enterprises. Consequently, the study focuses merely on identifying the drivers of agricultural entrepreneurship among rural households in Kasai Oriental at one point in time. Any generalization of these results should therefore consider both the cross-sectional design and the specific sociocultural context of Kasai Oriental's rural settings. Furthermore, this research does not explore in depth the behavioral determinants of engagement in agricultural entrepreneurship, such as farmers' self-efficacy and fear of failure. These psychological factors require a deep analysis, ideally disaggregated into multiple dimensions. For instance, self-efficacy could be analyzed through subset variables such as opportunity recognition ability, commitment, conceptual skills, financial management, and operational competence. Similarly, fear of failure could be broken down into risk aversion and hesitation to initiate business activities. The current aggregation of these constructs limits the study's capacity to deepen the complex interrelation of self-confidence, emotional responses, and cognitive processes that influence entrepreneurial decision-making in rural Kasai Oriental. Additionally, this study does not address specific barriers faced by women and youth in accessing resources critical for agricultural entrepreneurship. Nor does it consider issues related to digitalization, including the transfer of e-skills and e-competencies to current and prospective agricultural entrepreneurs in the region. Future research should aim to overcome these limitations by considering a longitudinal approach and conducting in-depth analyses of behavioral drivers, gender- and youth-specific constraints, and more specifically towards digital literacy and its potential to facilitate the emergence and development of digitalized agricultural entrepreneurship in Kasai Oriental. For sure, such studies may serve potential agricultural entrepreneurs and policy-makers as guidelines on how digital tools and platforms could transform traditional agricultural practices and open new entrepreneurial opportunities in similar contexts. Such comprehensive investigations will provide a more nuanced understanding of the factors shaping agricultural entrepreneurship in Kasai Oriental, thereby informing targeted interventions and policy efforts. Above all, although this study primarily lies on Social Cognitive Theory to understand entrepreneurial intentions and behaviors, future work could benefit from incorporating concepts from behavioral economics, such as risk framing, which is highly pertinent to decision-making under uncertainty in fragile agricultural mining-linked economies. In addition, interdisciplinary approaches drawing from anthropology and sociology could illuminate how local beliefs, kinship ties, and community norms influence entrepreneurial pathways. On the empirical side, future studies might leverage satellite

imagery to monitor land use changes linked to livelihood diversification or employ mobile phone data to trace information flows and market connectivity among rural households to enrich understanding of agricultural entrepreneurship in contexts like Kasai Oriental.

Institutional review board statement: The survey protocols and questionnaires were reviewed and approved by the Ethics Committee of the Faculty of Economics at the University of Mbuji Mayi, Democratic Republic of Congo. The study was officially registered under reference number N/Ref:02/FASEG/UM/NKL/2024 on March 14, 2024.

Informed consent statement: All participants provided written or verbal informed consent prior to participation. No individual-level identifying information is reported. Participants were informed that their responses would remain confidential, only for research purposes, and that they could withdraw at any time without penalty.

Data availability statement: The data analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of interest: The authors declare no conflict of interest.

Abbreviations

AFDB	African development Bank
AGRA	Alliance for a Green Revolution in Africa
CEIMIA	International Centre of Expertise in Montreal on Artificial Intelligence
DRC	Republic Democratic of the Congo
FAO	Food Agriculture Organization
ISIC	International Standard Industrial Classification
INS	Institut National de Statistiques
PNUD (UNDP)	Programme des Nations pour le Développement
UN DESA	United Nations Department of Economic and Social Affairs
WFP	World Food Program

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Appendix

**Table A1.** Sensitivity-specificity statistics Logistic model for agricultural-entrepreneurship.

	True		
Classified	D	~D	Total
+	240	13	253
−	8	89	97
Total	248	102	350

Classified + if predicted $Pr(D)$ >= 0.5
True D defined as agri-preneurship != 0.

Table A2. Predictive values of Logistic model for agricultural-entrepreneurship.

Sensitivity	$Pr(+\|D)$	96.77%
Specificity	$Pr(-\|{\sim}D)$	87.25%
Positive predictive value	$Pr(D\|+)$	94.86%
Negative predictive value	$Pr({\sim}D\|-)$	91.75%
False + rate for true ~D	$Pr(+\|{\sim}D)$	12.75%
False – rate for true D	$Pr(-\|D)$	3.23%
False + rate for classified +	$Pr({\sim}D\|+)$	5.14%
False − rate for classified −	$Pr(D\|-)$	8.25%
Correctly classified		94.00%
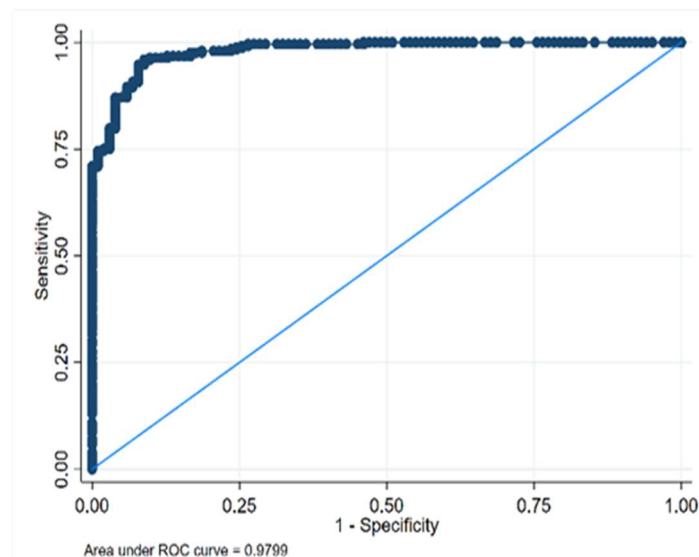
Figure A1. Receiver-operating characteristic curve (ROC).