Strategic business decisions of retailers in the edible insect value chain in Uganda

RESEARCH ARTICLE

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Abstract

Edible insect value chains are expected to contribute to sustainable food and nutrition security, poverty alleviation and job creation in Sub-Saharan Africa. However, there is little empirical evidence on the strategic business decisions of midstream-actors in edible insect value chain. This study fills this knowledge gap by analysing the factors that influence retailers' strategic business decisions, that is, choices of supplier, product to purchase, procurement strategy and the quantity of product purchased in the grasshopper value chain in central Uganda. Using a primary dataset collected from 500 randomly selected retailers from two districts in central Uganda, Cragg's tobit alternative and binary probit models are applied in the empirical analysis. Retailers mainly procure grasshopper products from wholesalers and collectors. The study shows that demographic, economic, transactional and processing-related factors significantly influence retailers' strategic business decisions in the grasshopper markets. Developing retailers' human capital in business management practices and collective action is important to enable them to make informed strategic business decisions in the agrifood chain.

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1. Introduction

Traditional agrifood chains continue to play an important role in economic development and growth in Sub-Saharan Africa (SSA) (Reardon *et al.*, 2019). Many countries in SSA, including Uganda, implement development initiatives and research projects that focus on upgrading the traditional agrifood chains of major crops (grains, vegetables, potatoes, and fruits) and aquaculture (Kaganzi *et al.*, 2009; Kalibwani *et al.*, 2018; Kyomugisha *et al.*, 2018). Many international development organisations, non-governmental agencies, and government agencies use these upgrading initiatives as pro-poor strategies to stimulate economic development (Horton *et al.*, 2010; Kalibwani *et al.*, 2018). The main upgrading strategies include strengthening farmers' collective action, promoting agricultural innovations and value addition, vertical integration, improving stakeholder interactions, and integration into export markets (Kaganzi *et al.*, 2009; Kalibwani *et al.*, 2018; Kyomugisha *et al.*, 2018).

Concurrently, malnutrition, particularly protein deficiency, is a major problem impeding economic growth and development in Uganda (WFP *et al.*, 2013). For example, in 2009, child malnutrition alone was estimated to result in a loss of 5.6% of Uganda's gross domestic product (GDP) (WFP *et al.*, 2013). Edible insect value chains including grasshoppers can contribute to food and nutrition security, poverty alleviation and job creation for many people especially youth (van Huis *et al.*, 2013; Donkor *et al.*, 2022). Grasshoppers, for example, have historically been an integral part of the local diet in Uganda. Grasshoppers are an affordable source of protein harvested from the wild in rural and peri-urban communities (Mmari *et al.*, 2017; Odongo *et al.*, 2018; Ssepuuya *et al.*, 2019). Despite these economic opportunities, the grasshopper value chain has received limited attention in research and policy discourse.

Grasshoppers are seasonal, as they are harvested in the wild during two major seasons: April-June and November-December. The grasshopper value chain attracts many participants, such as collectors, wholesalers, transporters, and retailers, who play different roles in the chain. Retailers, in particular, bridge the gap between consumers and collectors or wholesalers by making grasshoppers in either processed or non-processed forms more accessible to urban consumers. Retailers buy non-value-added or value-added grasshoppers from wholesalers in various markets in central Uganda. They can also purchase raw grasshoppers directly from collectors in peri-urban or rural areas. Strategic business decisions of retailers in relation to their choices of suppliers, product types, procurement strategy and quantities of products purchased are important for them to remain competitive and profitable in the market (Jones *et al.*, 2007). However, previous studies on edible insects have focused on the development of technologies for mass rearing, nutritional composition (Lehtovaara *et al.*, 2017; Ng'ang'a *et al.*, 2018), and consumer behaviour towards insect-based food products (Alemu and Olsen, 2019; Coley *et al.*, 2020; Ghosh *et al.*, 2020; Pambo *et al.*, 2018), while there are few studies on value addition (Donkor *et al.*, 2022) and marketing (Odongo *et al.*, 2018) of edible insects and none on retailers' strategic business decisions.

In addition, compared to consumer behaviour and marketing decisions of producers, there are few empirical studies on strategic business decisions of retailers in the traditional agrifood chain. Most studies on the strategic business decisions of food retailers are from Europe (Insch *et al.*, 2011; Liu *et al.*, 2013; Skytte and Blunch, 2001, 2008) and Asia (Lin and Wu, 2011; Manjeshwar *et al.*, 2013; Skallerud and Grønhaug, 2010). Other empirical studies on the business decisions of traditional food retailers in SSA have focused on marketing decisions (Nakazi *et al.*, 2019; Yami *et al.*, 2020) and technology adoption behaviour (Kamrath *et al.*, 2018), but there is limited empirical evidence on strategic business decisions. Although Nandonde and Kuada (2016) used a qualitative approach to evaluate the purchasing behaviour of modern food retailers in Tanzania, they did not investigate the factors that influence retailers' decisions on the quantity of products purchased and procurement strategy.

This study therefore aims to answer the following research questions:
1. What is the nature of the grasshopper value chains in Uganda?

2. What factors influence retailers' strategic business decisions on the choice of grasshopper suppliers and products?
3. What factors influence the quantity of products purchased from the suppliers?
4. How do retailers procure their products from the suppliers and what factors affect their choice of procurement strategy?

By addressing these research questions, our study builds on the work of Nandonde and Kuada (2016) and contributes to the body of knowledge on strategic business decisions of retailers in the agrifood chain in SSA by using econometric approaches to evaluate retailers' strategic business decisions in the grasshopper markets in Uganda. The study also contributes to the development of upgrading strategies for edible insect chains by understanding the strategic business decisions of retailers. These strategic decisions are important for retailers to be competitive and profitable in the agrifood chain.

1.1 An overview of the grasshopper value chain in Uganda[1]

Compared to other edible insect value chains (termites, crickets), the grasshopper value chain in Uganda is more developed and organised. The grasshopper trade is mostly concentrated in the central part of Uganda and it is also an important source of income for many, especially women and young people (Donkor *et al.*, 2022). For instance, Donkor *et al.* (2022) show that income from the grasshopper retail business contributes to over 80% of the total annual income in Uganda.

As shown in Figure 1, different actors are involved in the grasshopper value chain in Uganda, with the main actors being collectors, wholesalers, retailers, and consumers. Other stakeholders such as financial institutions, transporters, and health services are involved in the chain and offer support services to the main actors so that they can operate. Collectors are in peri-urban and rural areas in central Uganda, where they harvest grasshoppers using locally developed tools such as barrels, roofing sheets, high-voltage electric wires, electric bulbs, and capacitors (Odongo *et al.*, 2018). There are two categories of collectors: commercial and subsistence. Subsistence collectors harvest grasshoppers in small quantities and sell them to actors such

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[1] See Donkor *et al.* (2022) for the detailed description of the grasshopper value chain in Uganda.
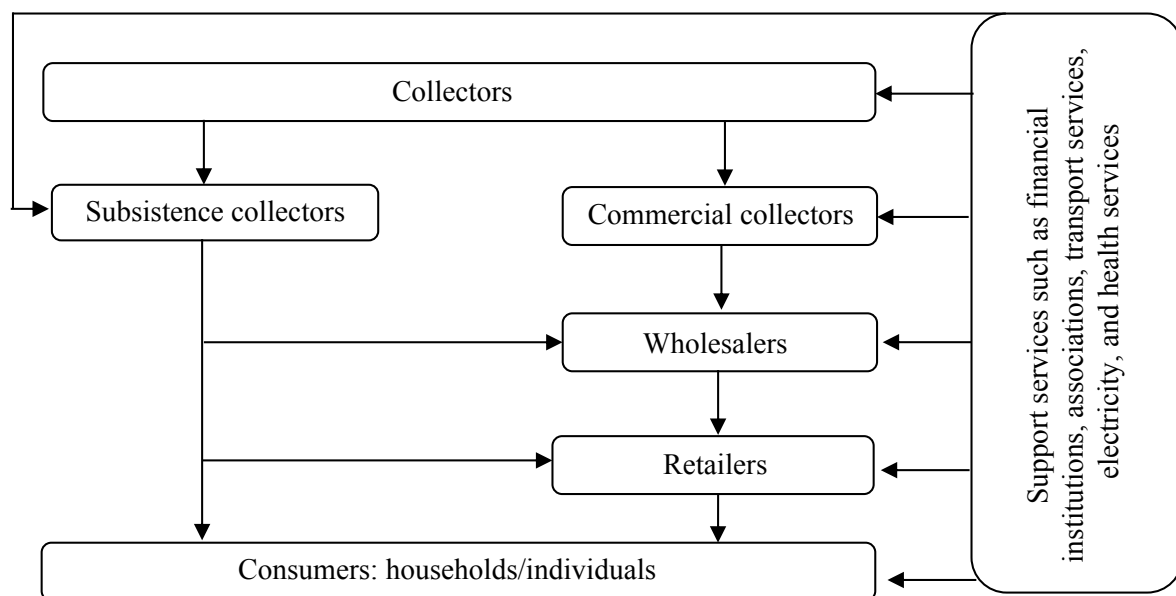

Figure 1. The grasshopper value chain in central Uganda (source: Donkor *et al.,* 2022).

as wholesalers, retailers, and consumers in their communities (Donkor *et al.*, 2022; Odongo *et al.*, 2018). Commercial collectors, however, gather grasshoppers in large quantities and offer them to wholesalers and retailers in urban and rural communities in central Uganda. In central Uganda, Masaka district is known for harvesting large quantities of grasshoppers while the major trading takes place in Kampala district (Donkor *et al.*, 2022). Wholesalers assemble and transport grasshoppers from points of collection in rural communities to various markets in urban communities, especially in Kampala. Some wholesalers add value to the grasshoppers by removing the wings and legs, which Donkor *et al.* (2022) refer to as plucking, and frying them in cooking oil. The fried grasshoppers are sold to retailers. Retailers can also purchase non-value-added grasshoppers from wholesalers in urban areas or directly from collectors in rural areas (Figure 1). Retailers sell different forms of grasshopper to consumers, namely unplucked, plucked, fried, dried, and boiled, in places like bus stations, along busy highways, and in market centres (Donkor *et al.*, 2022). Since grasshoppers are seasonal products, some actors tend to store some grasshoppers for the lean season, when prices are high (Donkor *et al.*, 2022).

2. Methodology

2.1 Survey design

The study was conducted in Central Uganda. The Ugandan economy is driven by the service sector, which contributes 50.3% of gross domestic product, followed by industry (25.5%) and agriculture (24.2%) (GoU, 2022a). The service sector comprises wholesale and retail trade, telecommunication, hotels and restaurants, transport and communication and tourism (GoU, 2022a). The agricultural sector is dominated by smallholders who combine subsistence farming with cash crop and livestock production (GoU, 2022b). The smallholders are also engaged in off-farm activities including the trading of grasshoppers to earn additional incomes.

Cross-sectional data were collected from randomly selected grasshopper retail business owners in Kampala and Masaka districts in Central Uganda during the peak grasshopper season in December 2019. A multistage cluster sampling technique was used for the study. First, Kampala and Masaka districts in Central Uganda were purposively chosen because they are known for trading large quantities of grasshoppers. Second, ten major markets (Busega, Katwe, Old Taxi Park, Ndeeba, Kawerle, Nateete, Kamwokya, Kibuye, Nakasero, and Usafi) known for grasshopper trading were selected from Kampala district and two markets (Nyendo and Masaka Central) from Masaka district. In these selected markets, food items such as vegetable, fruits, and potatoes are also sold. The lists of the traders in these markets were not available; hence, a sampling frame of 1250 retailers was generated, which is available upon request. Five hundred retailers were randomly selected from the sampling frame. The sample size comprised 343 retailers from Kampala district and 157 from Masaka district. A structured digital survey questionnaire was designed using KoboTool Box App to collect relevant information from grasshopper retailers face-to-face in the selected districts in Central Uganda. The questionnaire captured relevant information on retailers' strategic business decisions, demographic, economic, transactional, institutional and processing-related factors. Enumerators from Makerere University were recruited and trained for the data collection.

2.2 Conceptual framework

Figure 2 presents a conceptual framework showing factors that can influence retailers' strategic business decisions. Retailers' strategic business decisions relate to their choice of suppliers, product types, procurement strategy and quantities of products purchased. Procurement strategy refers to how retailers buy their products, whether through spot market transaction or forward contracts. The study draws inspiration from the transaction cost theory as a theoretical guide to explain retailers' decisions on suppliers products and procurement strategy, while in the case of retailers' demand for grasshopper products, the theory of demand is used.

Transaction cost theory states that transaction costs are key determinants of a firm's governance structure, including their strategic business decisions (Williamson, 1981). Transaction costs refer to the costs associated
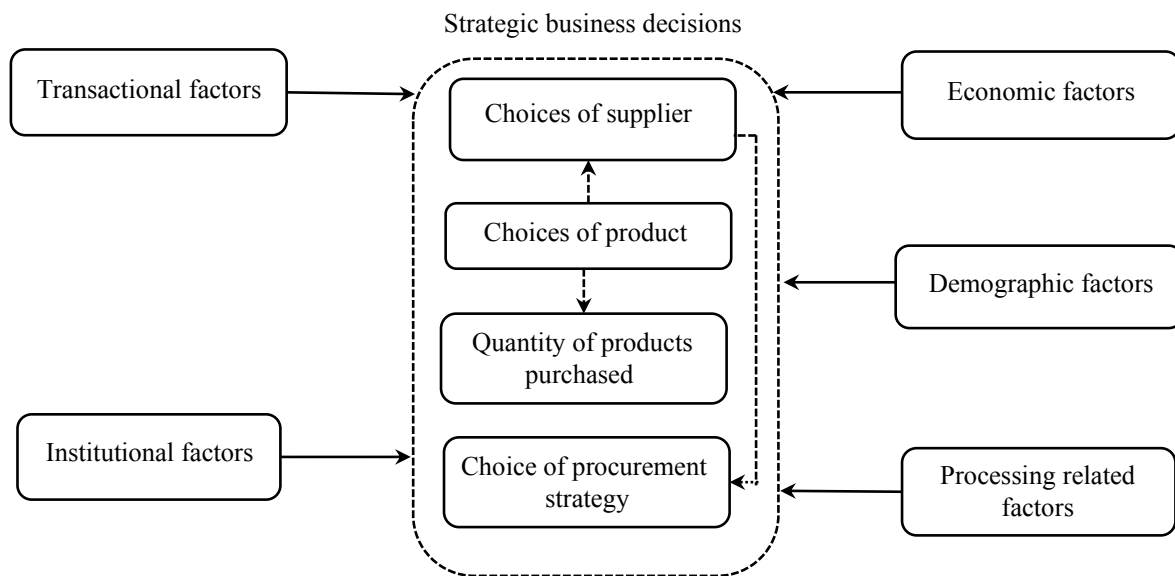
Figure 2. Conceptual framework.

with the exchange of goods and services. These are typically classified into search and information costs, negotiation costs (including transport costs associated with the market transaction component of negotiation costs), and monitoring costs (Hobbs, 1997). Based on transaction cost theory, this study conceptualises that retailers' choices of suppliers, products and procurement strategy are influenced by transactional, institutional, economic, demographic, and processing-related factors.

In this study, transactional factors refer to direct facilitators of market transactions. The transactional factors captured in this study include transport costs, record keeping, access to market information, and ownership of transport assets (motorbikes and vehicles). These variables are selected based on the existing literature on market participation and transaction cost theory (Barrett, 2008; Donkor *et al.*, 2018; Fischer and Qaim, 2012; Kihiu and Amuakwa-Mensah, 2021; Mather *et al.*, 2013; Montalbano *et al.*, 2018). For example, supplier, product type and procurement strategy associated with higher transaction costs are less preferred by buyers because high transaction costs reduce their profit margins. Transport costs are the most important measurable transaction cost in the informal markets in SSA countries such as Uganda. Other transactional factors such as record keeping and market information facilitate retailers' decision-making process in selecting suppliers, products and procurement strategy. This study captures transport costs related to conveying purchased products from the purchasing point to the sales point. Other transactional factors such as trust, number of suppliers that retailer purchased products from and perceived competition among retailers and perceived supply trend of grasshoppers are expected to influence retailers' choice of procurement strategy. For instance, retailers who trust their suppliers are more likely to procure their product through forward contracts such as oral contract, which requires trust between trading partners (Baker *et al.*, 2002).

Institutional factors includes memberships of associations. Through membership in an association, members receive relevant information on suppliers, market conditions, prices and financial support. These benefits enable retailers to make better decisions regarding suppliers, product types and procurement strategy. Economic factors, such as income from non-grasshopper business and credit strengthen retailers' capital base to purchase appropriate products from preferred suppliers using a preferred procurement strategy. Demographic factors encompass location, age, gender, education, and experience. For example, retailers in urban areas may benefit from support services that enable them to develop their business skills which will allow them to make informed decision on choice of suppliers, product and procurement strategy. Access to processing information is classified as processing-related factor, which is expected to influence to retailers

choice of products. Retailers who are well informed on processing of grasshoppers are more likely to purchase raw grasshoppers and process themselves.

According to classical demand theory, there is an inverse relationship between product demand and product price (Machlup, 1957). Retailers can be considered intermediate producers who buy inputs (grasshopper products) and sell them with or without value addition. Based on the demand theory, the prices of grasshopper products (i.e. purchasing and selling prices) are the main determinants of the quantity of products purchased by retailers. It is expected that, holding all other factors constant, retailers will demand lower quantities of grasshopper products when purchasing prices are higher and *vice versa*. On the other hand, retailers will increase their demand for grasshopper products when selling prices are higher if all other factors remain constant. Previous studies suggest that non-price factors influence the demand for factor inputs (Dillion and Barrett, 2017; Kaimba *et al.*, 2021; Kelly *et al.*, 2003). Therefore, other variables such as transactional (excluding trust, number of suppliers that retailer purchased products from and perceived competition among retailers), demographic, economic and processing-related factors, are expected to influence the quantities of grasshoppers purchased from the suppliers.

Moreover, it is expected that retailers' choice of products is likely to influence their decision on supplier choice and quantity of products purchased from the suppliers. Two types of grasshopper products are considered in this study, and they include value-added and non-value-added. Value-added grasshopper products encompass plucked (fresh grasshoppers with legs, wings, and antennae removed) and fried (plucked grasshoppers can be fried in oil) whereas non-value-added products include unplucked grasshoppers (raw grasshoppers that are not plucked) (Donkor *et al.*, 2022). The choice of suppliers is directly influenced by the choice of the product to purchase. Wholesalers supply both value-added and non-value-added grasshoppers, while collectors supply only non-value-added grasshoppers. Retailers who want to purchase value-added products can only get them from wholesalers while those interested in buying raw grasshoppers can get them from wholesalers or collectors. Given that raw grasshoppers are cheaper when purchased directly from collectors, retailers are likely to purchase higher quantity of raw grasshoppers from collectors. Finally, the choice of suppliers is expected to influence retailers choice of procurement strategy. For instance, retailers who purchase from collectors are likely to forge oral contract with them as they are few collectors compared to wholesalers in the grasshopper value chain.

2.3 Empirical models

Based on the conceptual framework, we begin the empirical analysis with retailers' choice of suppliers and the quantity of grasshoppers purchased from them. Based on transaction cost theory, the paper conceptualises that retailers weigh the transaction costs associated with buying grasshoppers from different suppliers, that is, wholesalers and collectors in our case. Wholesalers are usually near the markets where retailers vend their grasshoppers, while collectors are in rural and peri-urban areas where grasshoppers are harvested. Retailers are more likely to purchase from wholesalers when the associated transaction costs, particularly transport costs, are lower than sourcing from collectors. This conceptualisation implies that retailers face a binary choice problem of whether to procure from a wholesaler or collector. Retailers also face another choice problem of what products to purchase, that is, value-added (plucked and fried) or non-value-added (unplucked) grasshoppers. Retailers can choose to either buy from wholesalers or directly from collectors. The availability of products from suppliers is determined by the type of suppliers chosen as wholesalers sell both value added and non-value-added grasshoppers while collectors only supply non-value added grasshoppers. Hence, we can express retailers choice of suppliers as a function of their product choice, transactional, institutional, economic and demographic factors specified as:

$$SuppliersW_i = \alpha_0 + \alpha_1 \, Product_i + \alpha_2 \, Transactional_i + \alpha_3 \, Institutional_i + \alpha_4 \, Economic_i +$$
$$\alpha_5 \, Demograhic_i + e_i \tag{1}$$

where $SuppliersW_i$ represents retailers' choice of suppliers (1 if the retailer purchases grasshoppers from wholesalers and 0 if from collectors). $Products_i$ denotes retailers' choice of product (1 if the retailer purchases value-added grasshoppers and 0 if non-value added products). $Transactional_i$ represents transactional factors which include access to market information, ownership of transport asset, transport costs, record keeping. $Institutional_i$ denotes institutional factor such as membership of association. $Economic_i$ represents economic factors encompasing use of credit to support grasshopper business and monthly income from other businesses. $Demograhic_i$ denotes demographic factors such as district dummy, age, gender and experience. $\alpha_0, \alpha_1, ..., \alpha_5$ represent the parameters to be estimated and e_i is the error term.

In addition, retailers' choice of products is expected to be influenced by transactional, institutional, economic, demographic and processing-related factors given as:

$$Product_i = \beta_0 + \beta_1 Transactional_i + \beta_2 Institutional_i + \beta_3 Economic_i + \beta_4 Demographic_i + \beta_5 Processing_i + \varepsilon_i \tag{2}$$

The variables in the model are defined already above Equation 2. The variables under transactional, institutional, economic and demograhic factors included in Equation 1 are also the same variables used in Equation 2. $Processing_i$ represents processing related factor which includes access to information on processing of grasshoppers. $\beta_0, \beta_1, ..., \beta_5$ represent the parameters to be estimated and ε_i is the error term.

The quantity of grashopper purchased from the suppliers is also a function of choice of product, transactional, institutional, economic and demographic factors, which is expressed as:

$$QuantityW_i = \omega_0 + \omega_1 Product_i + \omega_2 Transactional_i + \omega_3 Institutional_i + \omega_4 Economic_i + \omega_5 Demograhic_i + \xi_i \tag{3}$$

where $QuantityW_i$ represents the quantity of grasshoppers purchased from wholesalers (kg/week). Additional transactional factors such as purchase and selling prices of grasshoppers are included in Equation 3. $\omega_0, \omega_1, ..., \omega_5$ represent parameters to be estimated and ζ_i is the error term. The inclusion of choice of product in Equations 1 and 3 can create endogeneity problem arising from selection bias, that is, retailers who prefer to purchase value-added can only get them from wholesalers. Without addressing this endogeneity problem, the coefficients of product choice (ω_1) can be biased. This problem is addressed using a control function approach developed by Wooldridge (2015), where residuals of Equation 2 is estimated using a binary probit model and included together with choice of product in Equations 1 and 3. The control function approach requires an instrument, that is, a variable that affect choice of products but does not influence choice of supplier and quantity of product purchased from supplier. This implies that the instrumental variable indirectly affects choice of supplier and the quantity of product purchased through the choice of product. In this paper, retailers' access to information on processing of grasshopper is used as an instrument. Retailers who are well informed on processing of grasshoppers are more likely to purchase raw grasshoppers and process themselves instead of buying value-added grasshoppers. However, having access to processing information may not necessarily affect the choice of supplier and quantity purchased. Equations 1 and 3 are respecified as:

$$SuppliersW_i = \alpha_0 + \alpha_1 Product_i + \alpha_2 Transactional_i + \alpha_3 Institutional_i + \alpha_4 Economic_i + \alpha_5 Demographic_i + \alpha_6 ResidProduct_i + e_i \tag{4}$$

$$QuantityW_i = \omega_0 + \omega_1 Product_i + \omega_2 Transactional_i + \omega_3 Institutional_i + \omega_4 Economic_i + \omega_5 Demographic_i + \omega_6 ResidProduct_i + \varepsilon_i \tag{5}$$

where $ResidProduct_i$ is the predicted residuals from Equation 2. Equations 4 and 5 are estimated with the Cragg's Tobit Alternative (CTA) model which jointly estimates Equation 4 using a binary probit model and Equation 5 with a truncated normal regression model. The parameters in Equations 4 and 5 are estimated simultaneously using maximum likelihood approach. Compared to the standard Tobit, the CTA is more

flexible and allows the two processes to be determined separately (Burke, 2009; Cragg, 1971). The craggit Stata command developed by Burke (2009) is used to estimate the CTA model.

The dependent variables (quantities of the different grasshopper products) and some explanatory variables such as selling prices, purchase prices, transport costs, and monthly incomes are transformed into inverse hyperbolic sine (asinh) because the dependent variables contain zero observations. Unlike natural logarithm transformation, inverse hyperbolic sine transformation retains zero observations (Bellemare and Wichman, 2019).

Equations 4 and 5 focus only on retailers' decision to purchase grasshoppers from wholesalers and quantity purchased. We are also interested in analysing the factors influencing the quantity of grasshoppers purchased from collectors. This is done by using the CTA model to jointly estimate retailers' decision to purchase from collectors and the quantity of grasshoppers purchased from them. The same variables included in Equations 4 and 5 are used explanatory variables except that the choice of product is excluded because collectors only supply non-value added grasshoppers.

We proceed to examine factors influencing retailers' choice of procurement strategy used to get grasshoppers from the suppliers. The choice of procurement strategy is expected to be influenced by choice of suppliers, transactional, institutional, economic and demographic factors which is given as:

$$Procurement_i = \Phi_0 + \Phi_1 Supplier_i + \Phi_2 Transactional_i + \Phi_3 Institutional_i + \Phi_4 Economic_i + \Phi_5 Demographic_i + \Phi_6 ResidSupplier_i + \xi_i \tag{6}$$

where *Procurement*$_i$ denotes choice of procurement strategy such as oral contract and spot market transaction. However, there are no retailers who use only oral contract to procure grasshoppers instead they combine oral contract with spot market transaction. Hence, retailers have two choices, that is whether to combine spot market transaction with oral contract or use only spot market transaction. In this paper, we refer to the combination of oral contract and spot market transaction as a diversified procurement strategy. Procurement strategy is coded as 1 if the retailer uses the diversified procurement strategy and 0 if only spot market transaction is used. We include additional transactional factors such as trust, number of suppliers that retailer purchased products from, perceived competition among retailers and perceived supply trend of grasshoppers, which are expected to influence retailers' choice of procurement strategy. The predicted residual (*ResidSupplier*$_i$) of choice of supplier is included in the choice of procurement strategy to account for possible endogeneity problem associated with the inclusion of choice of supplier, as the choice of suppliers is an outcome variable in Equation 4. A binary probit model is applied in the estimation of Equation 6 and the parameters are estimated using the maximum likelihood estimation approach. The coefficients in Equations 2, 4-8 do not have direct interpretation; hence, marginal effects of the explanatory variables are computed.

3. Results and discussion

3.1 Choices of products and suppliers and retailers' characteristics

Table 1 presents summary statistics of the variables included in the models. The majority of retailers purchase grasshoppers from wholesalers and mostly procure non-valued added grasshoppers. Only 21% buy value-added grasshoppers, such as plucked and fried (Table 1). Of those who purchased value-added grasshoppers, most of them bought fried grasshoppers while the remainder purchase plucked grasshoppers. The purchase price per kilogram (kg) of non-value-added grasshoppers is lower when retailers buy them from collectors than wholesalers. The majority of retailers procure grasshoppers through spot market transaction while the remaining few combine oral contract with spot market transaction.

Educated young women dominate the grasshopper retail business in Uganda (Table 1), which is consistent with the finding of Donkor *et al.* (2022). Previous studies have also shown that female entrepreneurship

Table 1. Descriptive statistics of the variables included in the models.[1]

Variables	Description	Mean	SD
Dependent variables			
Choice of suppliers	1 = wholesalers and 0 = collectors	0.84	(0.37)
Choice of products	1 = value-added and 0 = non-value-added grasshoppers	0.23	(0.44)
Procurement strategy	1 = diversified procurement strategy (oral contract combined with spot market transaction) and 0 spot market transaction only	0.21	(0.41)
Demand for grasshoppers from wholesalers	Quantity of grasshoppers purchased from wholesalers (value and non-value added) (kg/week)	100	(163)
Demand for grasshoppers from collectors	Quantity of grasshoppers purchased from collectors (non-value added) (kg/week)	628	(1,817)
Demographic factors			
District	1 = Kampala district	0.69	(0.47)
Age	Age of retailers in years	33	(10)
Gender	1 = female retailers	0.59	(0.49)
Education	Number of years of formal education	8	(3)
Experience	Experience in trading of grasshoppers in years	7	(6)
Institutional factor			
Association	1 = membership of association	0.59	(0.49)
Economic factors			
Credit access	1 = used credit to support grasshopper business	0.26	(0.44)
Monthly income (100,000Ugx)	Monthly income generated from other businesses	3.53	(7.42)
Transactional factors			
Record keeping	1 = record keeping of business activities	0.39	(0.49)
Market price information	1 = access to information on market prices	0.74	(0.44)
Transport asset	1 = ownership of transport assets such as motorbike or vehicle	0.11	(0.32)
Transport cost	Cost of transporting grasshoppers from purchasing point to the selling point (Ugx)	17,642	(22,744)
Purchase price value added product (wholesalers)	Purchase price of value added product bought from wholesalers (Ugx/kg)	15,890	(3,816)
Purchase price nonvalue added (wholesalers)	Purchase price of value added product bought from wholesalers (Ugx/kg	6,450	(2,437)
Purchase price (collectors)	Purchase price of nonvalue added product bought from collectors (Ugx/kg)	5,194	(1,870)
Selling price of grasshopper products	Selling price of grasshopper products (Ugx/kg)	21,377	(11,998)
Supply trend	1 = perceived increasing supply trend of grasshopppers	0.66	(0.47)
Trust	∞Summated trust score of three trust items	2.99	(2.49)
Number of suppliers	1 = less than 6 suppliers, 2 = 6-10 suppliers, 3 = more than 10 suppliers	2	(0.79)
Competition	1 = perceived high competition among retailers	0.39	(0.49)
Processing factor			
Processing information	1 = access to processing information	0.19	(0.39)

[1] Summated index of three trust items, trust suppliers in terms of quality, price and quality. These items were measured using 5 point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). These scores were further transform into -2 to 2, where -2=1, 2=-1, 3=0, 1=4 and 2=5. A negative summated trust score represents mistrust and a positive indicates trust. 1 USD = 3,669 Ugx as at 20 December 2019. Ugx refers to Ugandan Shillings (Ugandan currency). SD = standard deviation.

is increasing rapidly in Uganda (Dawa and Namatovu, 2015; Namatovu *et al.*, 2017, 2018). Most young entrepreneurs, especially women, are in the consumer-oriented sector (Dawa and Namatovu, 2015; Namatovu *et al.*, 2017). The high rate of female entrepreneurship is attributed to a historical cultural change from when women were mainly subsistence farmers and housewives but were not expected to start, own, or manage a business in Uganda (Namatovu *et al.*, 2017). Today, women are expected to contribute to household welfare, as a single-income source is insufficient to sustain a family. Therefore, women engage in diverse income-generating activities, including grasshopper retail businesses. Most retailers also sell food items, particularly women, while men are primarily involved in non-food item retailing. This finding is consistent with the observation that trading is constructed as a female occupation, while construction, manufacturing, and transport are considered male-oriented economic activities in Uganda (Namatovu *et al.*, 2017). Retailers engage in the grasshopper business as a secondary economic activity because of the short season. More than half of the retailers are members of an association. The mean trust index shows that retailers trust their suppliers in terms of product price, quality and quantity. On average, retailers purchase grasshoppers from two suppliers in the season and less than half of the retailers perceive high competition among themselves in the market (Table 1).

On average, retailers earn a monthly income of USD 96 from non-grasshopper businesses, suggesting that most of them are low-income earners (Table 1). Twenty-six percent of retailers access credit to support their grasshopper business. Less than half of the retailers keep records of their business activities. Few retailers own transport assets such as motorbikes or vehicles and most spend 17,642 Ugx (USD 5 per week) on transporting grasshoppers from the purchasing point to the sale point (Table 1). Access to information on the processing of grasshoppers is low among retailers, which may limit their capacity to add value to their raw grasshoppers.

3.2 Factors affecting retailers' choice of suppliers and grasshopper products

The empirical results of the retailers' choices of suppliers (Tier 1-binary probit of Cragg's tobit alternative model) and grasshopper products (binary probit) are presented in Table 2. Variance inflation factor was used to check for multicollinearity in the models. The mean variance inflation factors (VIF) for models are below the threshold of 10, indicating that multicollinearity is not a problem in the models. In addition, we tested endogeneity of choice of products in the wholesaler model using Durbin-Wu-Hauman and the result shows that product choice is endogenous as indicated by the statistical significance of the χ^2 value (Table 2). This endogeneity problem was corrected using the control function approach. The presence of the endogeneity problem renders the marginal effect and the standard errors of product choice to be low. In addition, the marginal effect of product choice is not statistically significant (Supplementary Table S1). This may have led to the erroneous conclusion that product choice has no influence on retailer decisions to buy grasshoppers from wholesalers.

After accounting for possible selection bias, we find that the probability of retailers sourcing value-added grasshoppers from wholesalers are 0.70 higher (Table 2). This is due to the fact that only wholesalers sell value-added grasshoppers. The results show that retailers in Kampala district are 0.17 more likely to purchase grasshoppers from wholesalers compared to those in Masaka district. The probability of buying value-added grasshoppers is 0.13 higher for retailers in Kampala district than those in Masaka district. Grasshoppers are harvested by collectors in the rural district (Masaka) and transported to the urban centre (Kampala) by wholesalers. Therefore, retailers in the rural district purchase raw grasshoppers directly from collectors while those in the urban centre buy grasshoppers, particularly value-added grasshoppers (plucked or fried), from wholesalers. Female retailers are 0.08 less likely to purchase value-added grasshoppers than males. Women play an active role in grasshopper value addition; hence, they would prefer to purchase non-value-added products and perform value addition themselves rather than buying value-added products (Donkor *et al.*, 2022). Table 2 further shows a year increase in retailers' experience in grasshopper trading decreases their probability of purchasing from value-added grasshoppers by 0.01. Experience is an indicator of the accumulation of human capital or learning acquired via interactions in the market over time (Abdulai and

Table 2. Retailers' choices of suppliers and products.[1]

Variables	Choice of suppliers (wholesalers)		Choice of products (value added products)	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Choice of product (value added)	3.87**	0.70*		
	(1.67)	(0.36)		
Residual	-3.25*	-0.59		
	(1.68)	(0.36)		
Demographic factors				
District dummy (Kampala)	0.93***	0.17***	0.51***	0.13***
	(0.24)	(0.05)	(0.17)	(0.04)
Age	0.01	0.002	-0.01	-0.004
	(0.01)	(0.002)	(0.01)	(0.002)
Gender (females)	0.30	0.06	-0.31*	-0.08*
	(0.21)	(0.04)	(0.16)	(0.04)
Education	-0.05*	-0.01*	-0.01	-0.002
	(0.03)	(0.005)	(0.02)	(0.01)
Experience	-0.02	-0.003	-0.04**	-0.01**
	(0.02)	(0.004)	(0.02)	(0.005)
Institutional factor				
Association	-0.09	-0.02	-0.02	-0.004
	(0.16)	(0.03)	(0.15)	(0.04)
Economic factors				
Asinh (monthly income)	0.005	0.001	0.02	0.01
	(0.02)	(0.005)	(0.02)	(0.01)
Credit	0.23	0.04	-0.02	-0.01
	(0.20)	(0.04)	(0.17)	(0.04)
Transactional factors				
Record keeping	0.36*	0.07*	-0.24	-0.06*
	(0.19)	(0.04)	(0.15)	(0.04)
Market price information	-0.02	-0.003	-0.44***	-0.11***
	(0.27)	(0.05)	(0.15)	(0.04)
Transport asset	0.05	0.01	-0.55**	-0.14**
	(0.32)	(0.06)	(0.24)	(0.06)
Asinh (Transport cost)	0.04***	0.01**	-0.0001	-0.00001
	(0.02)	(0.003)	(0.01)	(0.004)
Processing factor				
Processing information			0.36**	0.09**
			(0.18)	(0.05)
Constant	-0.64		-0.15	
	(0.82)		(0.41)	
Diagnostic statistics				
Variance inflation factor	1.21			1.22
Durbin-Wu-Hausman test of endogeneity	χ^{2h} value = 8.63***			
Observation	468			468

[1] *, **, *** denote 10%, 5%, and 1% statistical significance, respectively. Asinh denotes inverse hyperbolic sine transformation. The value parentheses are robust standard errors. Thirty-two of the retailers purchased both value-added and non-value-added and they were excluded from the analysis to ensure that the choice of product is a mutually exclusive option.

Birachi, 2009). Experienced retailers are knowledgeable about market dynamics; hence, they (especially those in Masaka) prefer to buy non-value-added grasshoppers.

The results show that retailers who keep records of their business activities are more 0.07 likely to purchase grasshoppers from wholesalers, but 0.06 less likely to buy value-added grasshoppers. Retailers with access to information on prices are 0.11 unlikely to buy value-added grasshoppers. Market information and record keeping allow retailers to compare the market prices of different products. Purchasing prices are higher for value-added grasshoppers; therefore, retailers with knowledge of market prices tend to purchase non-value-added grasshoppers at lower prices. The ownership of transport assets decreases retailers' probability of purchasing value-added grasshoppers by 0.14 (Table 2). Retailers with transport assets such as motorbikes and vehicles can easily travel to rural areas to purchase non-value-added grasshoppers directly from collectors, compared to those without transport assets. The results also show that an increase in transport costs increases retailers' probability of purchasing grasshoppers from wholesalers by 0.04. High transport costs increase retailers' transaction costs and reduce their profit margins (Table 2). Hence, they tend to minimise transport costs by purchasing grasshoppers from wholesalers located close to them. Furthermore, access to information on processing of grasshoppers increases retailers' probability of buying value-added grasshoppers by 0.09. Retailers with knowledge of grasshopper processing are well informed about the benefits of selling value-added products, which encourages them to purchase the products (Donkor *et al.*, 2022).

3.3 Factors affecting retailers' demand for grasshopper products from the suppliers

Table 3 shows estimates of retailers' demand for grasshoppers from wholesalers and collectors (Tier 2-truncated normal regression of Cragg's tobit alternative model). The choice of products was considered as endogenous variable in the demand for grasshopper from wholesalers. Chi-square value from the DWH is statistically significant at 5%, showing that product choice is endogenous in the model. The endogeneity was corrected using a control function approach. We find that the quantity of grasshoppers bought from wholesalers is 187% lower for retailers who prefer to purchase value-added grasshoppers compared to those who prefer non-value added grasshoppers (Table 3). Value added grasshoppers from wholesalers are expensive compared to non-value added grasshoppers, and most retailers have inadequate capital to purchase large quantities. The results show that retailers in Kampala district reduce the quantity of grasshoppers purchased from wholesalers by 41% compared to those in Masaka district (Table 3). Retailers in Masaka district are closer to suppliers than those in Kampala district, suggesting that they spend less on transport costs and purchase grasshoppers at lower prices.

As retailers' advance in age, their demand for value-added grasshoppers tends to decline whereas as retailers become more experienced in trading grasshoppers, they decrease the demand for value-added grasshoppers (Table 3). We find that the quantity of grasshopper purchased from collectors is 52% higher for association members compared to non-members. Members of an association can easily share information on sources of suppliers, especially collectors, where prices may be lower. As retailers' monthly income increases by 100%, they are likely to increase the quantity of grasshoppers purchased from collectors by 6%. This result show that retailers are likely to invest some of their incomes generated from other businesses in the grasshoppers by increasing their supplies from collectors.

The quantity of grasshoppers purchased from wholesalers are 35% higher for retailers who keep record of grasshopper business activities compared to those do not. Record keeping is an essential for the success of agribusiness firms (Kay *et al.*, 2012; Nuthall, 2006) including that of grasshopper retailers as it enables them to make informed and strategic decision on how much products to purchase from a supplier to maximize profit. The demand for grasshoppers from collectors are 72% lower for retailers with access to market information on prices of grasshoppers compared to their counterparts. With access to reliable market prices, retailers can easily compared the product prices across different suppliers. Retailers with access to such information may have noticed that it is costly to purchase from collectors, especially for those in Kampala, considering the associated transaction costs. However, the quantity purchased from both wholesalers and collectors

Table 3. Factors influencing retailers' demand for grasshopper products.[1]

Variables	Quantities of grasshopper purchased from wholesalers		Quantities of grasshoppers purchased from collectors	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Choice of products	-1.87*	-1.87*		
	(1.05)	(1.13)		
Residual	0.10	0.10		
	(1.05)	(1.09)		
Demographic factors				
District dummy (Kampala)	-0.41**	-0.41**	0.07	0.07
	(0.16)	(0.17)	(0.29)	(0.38)
Age	0.01*	0.01	0.002	0.003
	(0.01)	(0.01)	(0.02)	(0.03)
Gender	-0.08	-0.08	-0.20	-0.20
	(0.16)	(0.18)	(0.26)	(0.36)
Education	-0.001	-0.001	0.03	0.03
	(0.02)	(0.02)	(0.03)	(0.04)
Experience	0.005	0.005	0.03	0.03
	(0.01)	(0.01)	(0.03)	(0.05)
Institutional factor				
Association	0.14	0.14	0.52**	0.52*
	(0.12)	(0.12)	(0.24)	(0.29)
Economic factors				
Credit	0.11	0.11	0.25	0.25
	(0.12)	(0.11)	(0.33)	(0.33)
Asinh (monthly income)	0.01	0.01	0.06**	0.06*
	(0.02)	(0.02)	(0.02)	(0.03)
Transactional factors				
Asinh (selling price)	-0.02	-0.02	0.07	0.07
	(0.05)	(0.07)	(0.21)	(0.26)
Asinh (purchasing price)	0.08	0.08	0.41	0.41
	(0.12)	(0.17)	(0.39)	(0.48)
Record keeping	0.35***	0.35***	-0.26	-0.26
	(0.13)	(0.13)	(0.26)	(0.32)
Market information	-0.23	-0.23	-0.72**	0.72**
	(0.17)	(0.20)	(0.30)	(0.35)
Transport asset	0.61**	0.61**	1.18***	1.18**
	(0.24)	(0.25)	(0.44)	(0.59)
Asinh (transport cost)	0.02*	0.02*	0.01	0.01
	(0.01)	(0.01)	(0.03)	(0.04)
Constant	5.24***		0.89	
	(1.44)		(4.28)	
Diagnostic statistics				
Variance inflation factor (VIF)	2.37		2.37	
Durbin-Wu-Hausman test of endogeneity (DWH)	Chi-square = 4.20**			
Test of weak instrument	F-value = 3.3*			
Observation	468		468	

[1] Asinh denotes inverse hyperbolic sine transformation. *, **, and *** denote 10%, 5% and 1% statistical significance, respectively. Since the dependent variables were transformed into inverse hyperbolic sine transformation, the marginal effects which are also the same as coefficients are interpreted as partial elasticity. The value parentheses are robust standard errors. Thirty-two of the retailers purchased both value-added and non-value-added and they were excluded from the analysis to ensure that the choice of product is a mutually exclusive option.

are 61 and 118% higher for retailers with transport asset. Retailers with transport assets can easily travel to suppliers' locations and purchase preferred products. Unexpectedly, transport costs positively influence demand for value-added grasshoppers. Wholesalers who usually sell value-added grasshoppers are close to retailers, especially for those in Kampala, and pay lower transport costs. Hence, an increase in transport costs may have little effect on their profit margins, particularly if they purchase in bulk.

3.4 Factor affecting retailers' choice of procurement strategy

We used DWH test to check whether the inclusion of the choice of suppliers can create endogeneity problem in the procurement strategy model. However, the chi-square statistic from the DWH test shows that the choice of supplier is statistically not significant, even at 10% (Table 4), indicating that we do not reject the null hypothesis that the choice of suppliers is an exogenous variable. This also suggests that including the choice of suppliers in the model may not create an endogeneity problem. To verify this, we used the control function approach to account for a possible endogeneity problem from the choice of supplier, assuming that it is an endogenous variable (Supplementary Table S2). The coefficient and marginal effect of choice of wholesalers remained statistically insignificant (Supplementary Table S2). The result shows that the coefficients, marginal effects, and their corresponding standard errors of the variables (trust, number of suppliers, credit, transport asset, and supply trends) that show statistical significance did not change remarkably (Supplementary Table S2).

We find that a unit increase in trust index is associated with 0.06 increase in likelihood of retailers of using diversified procurement strategy (that is, combination of spot market transaction and oral contract) (Table 4). The result is also in line with observations made in previous studies (Baker *et al.*, 2002; Brown *et al.*, 2004; Fafchamps, 2004, 2020; Michler and Wu, 2020; Tadesse and Shively, 2013) that emphasise that trust is important in forging oral contract which cannot be enforced by a third party. The probability of retailers' using the diversified procurement strategy is 0.13 lower for retailers who purchase grasshoppers from more suppliers compared to those buying from few suppliers. Retailers who deal with many suppliers would not see the need to diversify the procurement strategy by forging oral contract with a supplier, knowing that it is easy to switch suppliers at no cost.

The probability of using diversified procurement strategy is 0.09 higher for retailers who use credit to support their grasshoppers business compared to those do not use credit (Table 4). Credit enables poor-resourced retailers to overcome liquidity constraint and increase their financial capacity to purchase more grasshoppers from suppliers, which can serve as an incentive for suppliers to accept to diversify the procurement strategy by relying on both spot market transaction and oral contract. This finding is contrary to evidence by Ma and Abdulai (2016) that apple farmers with access to credit were less likely to engage in oral contract in China. We find that retailers who own transport assets are 0.13 more likely to use diversified procurement strategy to source their grasshoppers compared those without transport assets. Retailers with perception of increasing the supply trend of grasshoppers are 0.07 less likely to procure grasshoppers through diversified procurement strategy. Retailers with such knowledge are convinced that they can easily get grasshoppers to purchase in the spot market as there is high supply of the product, and no need to forge oral contract with suppliers.

4. Conclusions and policy implications

This paper has provided insights into strategic business decisions, focusing on the factors that influence decisions on choices of products, suppliers and procurement strategy as well as the quantity of products to buy from the suppliers, using a primary dataset of 500 retailers from grasshopper markets in central Uganda. The empirical findings show that different sets of factors influence retailers' strategic business decisions on the choice of suppliers, grasshopper products, quantity purchased and procurement strategy. Retailers' location, choice of products, record keeping and transport costs positively influence their decision to purchase grasshoppers from wholesalers. We also find that retailers' decision to purchase value-added grasshoppers is positively influenced by location and access to processing information but negatively

Table 4. Retailers' decision to use diversified procurement strategy over spot market transaction.[1]

Variables	Coefficients	Marginal effects
Choice of supplier (wholesalers)	-0.06	-0.01
	(0.20)	(0.04)
Demographic factors		
District dummy (Kampala)	-0.21	-0.05
	(0.18)	(0.04)
Age	-0.01	-0.001
	(0.01)	(0.002)
Gender (females)	0.19	0.04
	(0.18)	(0.04)
Education	0.02	0.004
	(0.02)	(0.005)
Experience	0.02	0.004
	(0.01)	(0.003)
Institutional factor		
Membership of association	0.07	0.02
	(0.17)	(0.04)
Economic factors		
Asinh (monthly income)	0.001	0.0003
	(0.02)	(0.004)
Credit	0.41**	0.09**
	(0.17)	(0.04)
Transactional factors		
Record keeping	0.03	0.01
	(0.16)	(0.03)
Market price information	-0.15	-0.03
	(0.18)	(0.04)
Transport asset	0.62***	0.13***
	(0.23)	(0.05)
Asinh (transport cost)	0.02	0.003
	(0.02)	(0.003)
Supply trend	-0.34**	-0.07**
	(0.17)	(0.04)
Trust	0.26***	0.06***
	(0.05)	(0.01)
Number of suppliers	-0.59***	-0.13***
	(0.11)	(0.02)
Competition	0.24	0.05
	(0.20)	(0.04)
Constant	-1.00**	
	(0.47)	
Diagnostic statistics		
DWH test of endogeneity (null hypothesis: choice of supplier is exogenous)	Chi-square = 1.16	
Observation	468	

[1] Asinh denotes inverse hyperbolic sine transformation. *, **, and *** denote 10%, 5% and 1% statistical significance, respectively. The value parentheses are robust standard errors. Thirty-two of the retailers purchased both value-added and non-value-added and they were excluded from the analysis to ensure that the choice of product is a mutually exclusive option.

affected by gender, experience, record keeping, access to market information, and ownership of transport assets. Choice of product and location are negatively correlated with retailers' demand for grasshoppers from wholesalers while record keeping, ownership of transport asset and transport cost show a positive correlation. In addition, membership of association, monthly income, and ownership of transport asset are positively related to demand for grasshoppers from collectors whereas access to market price information shows a negative relationship. Trust, ownership of transport asset and credit are positively associated with retailers' choice of using diversified procurement strategy while number of suppliers and perceived supply trend have a negative association.

The findings have important policy implications for improving retailers' strategic business decisions and market relations, which are necessary for developing edible insect markets in Uganda. To increase the scale of business operations of retailers in the grasshopper markets, Uganda's National Agricultural Policy needs to strengthen retailers' collective action by encouraging them to form groups, highlight the benefits of joining associations, and provide existing trader organisations with the necessary assistance. In addition, the policy should focus on developing retailers' human capital in business management practices, especially proper record keeping. Retailers are also encouraged to keep proper records of their business activities so that they can make informed strategic decisions on the choice of products and the quantity of products to buy. It is also important to develop roads linking urban and rural markets so that traders can minimise transport costs. There should be creation of an awareness of the benefits of value addition innovations among retailers. Enhancing retailers' access to affordable credit is crucial for diversification of procurement strategy. Retailers are also encouraged to maintain good relationship and trust with their suppliers to be able to diversify their procurement strategy.

Considering the important role retailers play in revolutionising the traditional agrifood chain (Reardon, 2015), more empirical studies are required in SSA to deepen our understanding of the strategic business decisions of retailers in different agrifood chains.

Supplementary material

Supplementary material can be found online at https://doi.org/10.22434/IFAMR2021.0125.

Table S1. Retailers' decision to purchase grasshoppers from wholesalers.
Table S2. Factors influencing retailers' procurement strategy.

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Conflict of interest

The authors declare no conflict of interest.

References

Abdulai, A. and E.A. Birachi, 2009. Choice of coordination mechanism in the Kenyan fresh milk supply chain. *Review of Agricultural Economics* 31(1): 103-121.

Alemu, M.H. and S.B. Olsen, 2019. Linking consumers' food choice motives to their preferences for insect-based food products: An application of integrated choice and latent variable model in an African context. *Journal of Agricultural Economics* 70: 241-258.

Baker, G., Gibbons, R., and Murphy, K. J. 2002. Relational contracts and the theory of the firm. *Quarterly Journal of Economics* 117: 39-84.

Barrett, C.B., 2008. Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy* 33: 299-317.

Bellemare, M.F. and C.J. Wichman. 2019. Elasticities and the inverse hyperbolic sine transformation. *Oxford Bulletin of Economics and Statistics* 82: 50-61.

Brown, M., A. Falk and E. Fehr. 2004. Relational contracts and the nature of market interactions. *Econometrica* 72(3): 747-780.

Burke, W.J. (2009). Fitting and interpreting Cragg's tobit alternative using Stata. *Stata Journal* 9(4): 584-592.

Coley, K.M., J.E. Perosky, A. Nyanplu, A. Kofa, J.P. Anankware, C.A. Moyer and J.R. Lori. 2020. Acceptability and feasibility of insect consumption among pregnant women in Liberia. *Maternal and Child Nutrition* 16: e12990.

Cragg, J.G. 1971. Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica* 39(5), 829-844.

Dawa, S., and R. Namatovu. 2015. Social networks and growth of female-owned ventures: A Sub-Saharan Africa perspective. *Journal of Developmental Entrepreneurship* 20: 1550009.

Dillion, B. and C.B. Barrett. 2017. Agricultural factor markets in Sub-Saharan Africa: An updated view with formal tests for market failure. *Food Policy* 67: 64-77.

Donkor, E., R. Mbeche and D. Mithöfer. 2022. Gender differentials in value addition and lean season market participation in the grasshopper value chain in Uganda. *Food and Energy Security* 11: e411.

Donkor, E., S. Onakuse, J. Bogue and I. De los Rios-Carmenado. 2018. Determinants of farmer participation in direct marketing channels: a case study for cassava in the Oyo State of Nigeria. *Spanish Journal of Agricultural Research* 16: e0106.

Fafchamps, M. 2004. *Market institutions in Sub-Saharan Africa: theory and practice*. The MIT Press, Cambridge, MA, USA.

Fafchamps, M. 2020. Formal and informal market institutions. In: J.-M. Baland, F. Bourguignon, J.-P. Platteau and T. Verdier (eds.) *Handbook of Economic Development and Institutions*. Princeton University Press, Princeton, NJ, USA, pp. 376-413.

Fischer, E. and M. Qaim. 2012. Linking smallholders to markets: Determinants and impacts of farmer collective action in Kenya. *World Development* 40: 1255-1268.

Ghosh, S., C. Jung, V.B. Meyer-Rochow and A. Dekebo. 2020. Perception of entomophagy by residents of Korea and Ethiopia revealed through structured questionnaire. *Journal of Insects as Food and Feed* 6: 59-64.

Government of Uganda (GoU). 2022a. *The economy*. Kampala, Uganda. Available at: https://www.gou.go.ug/about-uganda/sector/economy

Government of Uganda (GoU). 2022b. *Agriculture*. Kampala, Uganda. Available at: https://www.gou.go.ug/topics/agriculture

Hobbs, J.E., 1997. Measuring the importance of transaction costs in cattle marketing. *American Journal of Agricultural Economics* 79: 1083-1095.

Horton, D., B. Akello, L. Aliguma, T. Bernet, A. Devaux, B. Lemaga, D. Magala, S. Mayanja, I. Sekitto, G. Thiele and C. Velasco. 2010. Developing capacity for agricultural market chain innovation: Experience with the 'PMCA' in Uganda. *Journal of International Development* 22: 367-389.

Insch, A., R.S. Prentice and J.G. Knight. 2011. Retail buyers' decision-making and buy national campaigns. *Australasian Marketing Journal* 19: 257-266.

Jones, K., K.C. Raper, J.M. Whipple, D. Mollenkopf and H.C. Peterson. 2007. Commodity procurement strategies of food companies: a case study. *Journal of Food Distribution Research* 38: 37-52.

Kaganzi, E., S. Ferris, J. Barham, A. Abenakyo, P. Sanginga and J. Njuki. 2009. Sustaining linkages to high value markets through collective action in Uganda. *Food Policy* 34: 23-30.

Kaimba, G.K., D. Mithöfer and K.M. Muendo. 2021. Commercialization of underutilized fruits: Baobab pulp supply response to price and non-price incentives in Kenya. *Food Policy* 99: 101980.

Kalibwani, R.M., J. Twebaze, R. Kamugisha, M. Kakuru, M. Sabiiti, I. Kugonza, M. Tenywa and S. Nyamwaro. 2018. Multi-stakeholder partnerships in value chain development: A case of the organic pineapple in Ntungamo district, Western Uganda. *Journal of Agribusiness in Developing and Emerging Economies* 8: 171-185.

Kamrath, C., S. Rajendran, N. Nenguwo, V. Afari-Sefa and S. Bröring. 2018. Adoption behavior of market traders: an analysis based on technology acceptance model and theory of planned behavior. *International Food and Agribusiness Management Review* 21: 771-790.

Kay, D.K., W.M. Edwards and Duffy, A.P. 2012. *Farm management* (8th ed.). McGraw Hill Education, New York, NY, USA.

Kelly, V., A.A. Adesina and A. Gordon. 2003. Expanding access to agricultural inputs in Africa: a review of recent market development experience. *Food Policy* 28: 379-404.

Kihiu, E.N. and F. Amuakwa-Mensah. 2021. Agricultural market access and dietary diversity in Kenya: Gender considerations towards improved household nutritional outcomes. *Food Policy* 100: 102004.

Kyomugisha, H., C. Sebatta and J. Mugisha. 2018. Potato market access, marketing efficiency and on-farm value addition in Uganda. *Scientific African* 1: e00013.

Lehtovaara, V.J., A. Valtonen, J. Sorjonen, M. Hiltunen, K. Rutaro, G.M. Malinga, P. Nyeko and H. Roininen. 2017. The fatty acid contents of the edible grasshopper *Ruspolia differens* can be manipulated using artificial diets. *Journal of Insects as Food and Feed* 3: 253-262.

Lin, P.-C. and L.-S. Wu. 2011. How supermarket chains in Taiwan select suppliers of fresh fruit and vegetables via direct purchasing. *Service Industries Journal* 31: 1237-1255.

Liu, A.H., M. Bui and M. Leach. 2013. Considering technological impacts when selecting food suppliers: comparing retailers' buying behavior in the United States and Europe. *Journal of Business-to-Business Marketing* 20: 81-98.

Ma, W. and Abdulai, A. 2016. Linking apple farmers to markets. *China Agricultural Economic Review* 8(1): 2-21.

Machlup, F., 1957. Professor Hicks' revision of demand theory. *American Economic Review* 47: 119-135.

Manjeshwar, S., G.M. Eckhardt, B. Sternquist and L.K. Good. 2013. Decision making of retail buyers: perspectives from China and India. *Qualitative Market Research* 16: 38-52.

Mather, D., D. Boughton, and T.S. Jayne. 2013. Explaining smallholder maize marketing in southern and eastern Africa: the roles of market access, technology and household resource endowments. *Food Policy* 43: 248-266.

Michler, J.D. and S.Y. Wu. 2020. Relational contracts in agriculture: theory and evidence. *Annual Review of Resource Economics* 12(1): 111-127. https://doi.org/10.1146/annurev-resource-101719-034514

Mmari, M.W., J.N. Kinyuru, H.S. Laswai, and J.K. Okoth. 2017. Traditions, beliefs and indigenous technologies in connection with the edible longhorn grasshopper *Ruspolia differens* (Serville 1838) in Tanzania. *Journal of Ethnobiology and Ethnomedicine* 13: 60.

Montalbano, P., R. Pietrelli and L. Salvatici. 2018. Participation in the market chain and food security: the case of the Ugandan maize farmers. *Food Policy* 76: 81-98.

Nakazi, F., I. Babirye, E. Birachi and M.A. Ugen. 2019. Exploring retailer marketing strategies for value added bean products in Kenya. *International Food and Agribusiness Management Review* 22: 675-687.

Namatovu, R., S. Dawa, A. Adewale and F. Mulira. 2018. Religious beliefs and entrepreneurial behaviors in Africa: a case study of the informal sector in Uganda. *Africa Journal of Management* 4: 259-281.

Namatovu, R., T. Langevang, S. Dawa and S. Kyejjusa. 2017. Youth entrepreneurship trends and policies in Uganda. In: Gough, K.V., Langevang, T. (eds.), *Young entrepreneurs in Sub-Saharan Africa*. Routledge Taylor and Francis Group, Abingdon, UK, pp. 18-31.

Nandonde, F.A. and J. Kuada. 2016. Modern food retailing buying behaviour in Africa: the case of Tanzania. *British Food Journal* 118: 1163-1178.

Ng'ang'a, J., S. Imathiu, F. Fombong, M. Ayieko, J. Vanden Broeck and J. Kinyuru. 2018. 'Microbial quality of edible grasshoppers *Ruspolia differens* (Orthoptera: Tettigoniidae): From wild harvesting to fork in the Kagera Region, Tanzania. *Journal of Food Safety* 39: 1-6.

Nuthall, P.L. 2006. Determining the important management skill competencies. *Agricultural Systems* 88(2-3): 429-450.

Odongo, W., C.A. Okia, N. Nalika, P.H. Nzabamwita, J. Ndimubandi and P. Nyeko. 2018. Marketing of edible insects in Lake Victoria basin: the case of Uganda and Burundi. *Journal of Insects as Food and Feed* 4: 285-293.

Pambo, K.O., J.J. Okello, R.M. Mbeche, J.N. Kinyuru and M.H. Alemu. 2018. The role of product information on consumer sensory evaluation, expectations, experiences and emotions of cricket-flour containing buns. *Food Research International* 106: 532-541.

Reardon, T., 2015. The hidden middle: the quiet revolution in the midstream of agrifood value chains in developing countries. *Oxford Review of Economic Policy* 31: 45-63.

Reardon, T., R. Echeverria, J. Berdegué, B. Minten, S. Liverpool-Tasie, D. Tschirley and D. Zilberman. 2019. Rapid transformation of food systems in developing regions: Highlighting the role of agricultural research and innovations. *Agricultural Systems* 172: 47-59.

Skallerud, K. and K. Grønhaug. 2010. Chinese food retailers' positioning strategies and the influence on their buying behaviour. *Asia Pacific Journal of Marketing and Logistics* 22: 196-209.

Skytte, H. and N.J. Blunch. 2001. Food retailers' buying behaviour: An analysis in 16 European countries. *Journal on Chain and Network Science* 1: 133-145.

Skytte, H. and N.J. Blunch. 2008. Buying behavior of western European food retailers. *Journal of Marketing Channels* 13: 99-129.

Ssepuuya, G., R. Smets, D. Nakimbugwe, M. Van Der Borght and J. Claes. 2019. Nutrient composition of the long-horned grasshopper *Ruspolia differens* Serville: Effect of swarming season and sourcing geographical area. *Food Chemistry* 301: 125305.

Tadesse, G. and G. Shively. 2013. Repeated transaction in rural grain markets of Ethiopia. *Journal of Development Studies* 49(9): 1172-1187. https://doi.org/10.1080/00220388.2012.740

Van Huis, A., J. van Itterbeeck, H. Klunder, E. Mertens, A. Halloran, G. Muir, and P. Vantomme. 2013. *Edible insects: future prospects for food and feed security*. Food and Agriculture Organisation of the United Nations, Rome, Italy.

WFP, UNECA, AU, 2013. *The cost of hunger in Uganda: implications on national development and prosperity*. WFP, UNECA, AU, Kampala, Uganda.

Williamson, O.E., 1981. The economics of organization: the transaction cost approach. *American Journal of Sociology* 87: 548-577.

Wooldridge, J.M. 2015. Control function methods in applied econometrics. *Journal of Human Resources* 50(2): 420-445.

Yami, M., F. Meyer and R. Hassan. 2020. Should traders be blamed for soaring food prices in Ethiopia? Evidence from wholesale maize markets. *International Food and Agribusiness Management Review* 23: 19-33.