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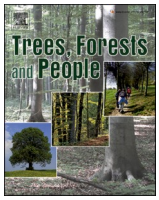

Factors influencing smallholder participation in commercial tree growing outgrower schemes: The case of Namwasa outgrower scheme in Uganda

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ABSTRACT

Over the past 30 years, outgrower/contract farming has been promoted as an institutional innovation to boost agricultural and farm forestry in less developed countries. Understanding factors that make outgrower arrangements beneficial is crucial to realizing their full potential. This study examines a commercial tree-growing outgrower scheme in Uganda, assessing socioeconomic factors influencing farmers' participation and their motivations. Data collection utilized a mixed-method approach, including semi-structured interviews ($n = 80$), focus group discussions, and key informant interviews. Findings revealed that participation was significantly associated with the purpose for the trees ($\chi^2 = 19.7875$, $p = 0.00005$), membership in farmer-based organizations ($\chi^2 = 76.05$, $p = 2.77E\text{-}18$), and household size ($\chi^2 = 14.12667$, $p = 0.000856$). Key motivations were access to quality seedlings, rated very important by 95 % of respondents, and farm credits, rated very important and important by 43.8 % and 36.3 % of farmers, respectively. Additionally, 96.3 % and 95 % considered training in agrochemical application and in planting, maintenance, and harvesting techniques, respectively, as very important. Most farmers (93 %) preferred on-spot cash payment over payment in kind. 55 % of farmers preferred donation with charge while 45 % preferred purchasing inputs at a subsidized price. Most farmers (65 %) favored a cost-sharing arrangement for harvesting costs, and 98 % wanted the company to cover post-harvest expenses. This study highlights the need of considering farmers' socioeconomic characteristics and preferences for contractual arrangements when designing outgrower schemes, as well providing seedlings, financial support, and training to enhance participation.

1. Introduction

The global demand for forest products is increasing, driven by the potential substitution of non-renewables with biomass-based materials (Barua et al., 2014). However, globally, the forest area has reduced from 32.5 % to 30.8 % of the total land area in the last three decades (FAO 2020), posing severe challenges, especially in developing countries, where forests are vital for livelihoods and economies (Kumar et al., 2022). While forests continue to decline rapidly, many tropical countries have turned to plantations to restore degraded lands and provide environmental services.

In Uganda, the loss of forests due to various socioeconomic and institutional factors has led to a scarcity of wood products, resulting in an increased reliance on imported timber in local markets (Kaboggoza, 2011; Mukasa et al., 2012; Nabanyumya, 2017). Uganda's forest cover reduced from 24 % of the total land area in 1990 to 9 % in 2015, with nearly half of unprotected forests cleared (Ministry of Water and Environment, 2016). Moreover, the domestic wood consumption in Uganda is anticipated to rise due to a 3 % annual population growth rate, coupled with a booming construction industry and insufficient alternative fuel sources (Kaboggoza, 2011; Nabanyumya, 2017; UBOS, 2018).

Consequently, Uganda is actively promoting investment in tree plantations to meet future demands for both industrial and non-industrial wood (NFA, 2016; Nabanyumya, 2017). Private investment in commercial tree plantations, spurred by initiatives like the Sawlog Production Grant Scheme (SPGS) and the Uganda Timber Growers Association (UTGA), is gaining momentum, with increasing interest among small-scale tree growers to establish woodlots (Kyeyune, 2018; Mugerwa, 2011; Nabanyumya, 2017). However, these small-scale tree growers encounter challenges that impede productivity and

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commercialization, including limited access to essential inputs, a lack of technical assistance, and the absence of profitable markets for wood products (ActionAid, 2015; Kaboggoza, 2011; Nabanyumya, 2017; NPA, 2013).

Given the need to expand the forest plantation base to meet future wood consumption demands, outgrower schemes hold strategic importance in promoting sustainable wood production and addressing challenges of small-scale farmers (Key and Runsten, 1999; Felgenhauer and Wolter, 2008; Wigboldus, 2018; Gonçalves et al., 2019). Outgrower schemes are increasingly used worldwide as a mechanism to link smallholder farmers to larger enterprises (Desmond and Race, 2002; Vermeulen et al., 2008). Such arrangements are crucial for coordination, reducing transaction costs, improving access to quality and timely inputs (seedlings, pesticides, farm tools, etc.), improving productivity, increasing incomes, and providing environmental benefits, such as reducing pressure on native forests (Abebe et al., 2013; Key and Runsten, 1999; Prowse, 2012; Gonçalves de Moraes et al., 2019). They also help to avoid the problem of displacement of local people, provide improved market access to the farmers, hence creating 'win-win' outcomes for local communities and private investors (Smalley, 2013).

Forestry outgrower schemes constitute a type of partnership between tree farmers and wood processing companies that is formed when companies with limited forest holdings or limited access to public forests seek to acquire more resources to meet the demand for timber and fuel wood (Desmond and Race, 2002). Under agreements, small-scale tree growers allocate a part of their land and other resources to the cultivation and management of trees on behalf of a processing company, and in return, the company guarantees a steady market for their forest produce (Desmond and Race, 2002). Profitability hinges on the company identifying a viable market while ensuring that outgrowers in a particular locality can lucratively supply that market (Abwino and Rieks, 2006). The government's role is crucial for the success of contract farming, particularly in establishing legal frameworks that ensure fair agreements in outgrower systems. These frameworks address key issues like land tenure, resource allocation, and market guarantees, promoting sustainable forest management and reducing risks for smallholder farmers (Abwino and Rieks, 2006).

Outgrower schemes can be categorized based on the contractual relationship between forest enterprises and smallholder farmers (Eaton and Shepherd, 2001). The Food and Agriculture Organization (FAO) identifies four main types of forestry outgrower arrangements: I) partnerships in which growers are largely responsible for the production, with a company assurance or guarantee that they will purchase the product; II) partnerships in which the company is largely responsible for the production, paying the landholders market prices for their wood allocation; III) land lease agreements in which the landholders have little involvement in plantation management; and IV) land lease agreements with additional benefits for the landholders (FAO, 2001).

Outgrower schemes hold significant potential for promoting sustainable forestry, but their success relies on effective management of the complex relationships between smallholders, investors, and local communities, all of whom have diverse capabilities, expectations, and priorities (World Bank, 2014). For farmers, participation in such schemes depends on their tolerance for the inherent risks and their perception of the potential returns compared to alternative activities or enterprises. If the expected returns from participating in the outgrower scheme outweigh those from other opportunities, farmers are more likely to engage in such partnerships (Abwino and Rieks, 2006). Motivations for participation in these schemes include economic benefits, reduced market risks, and access to inputs and technical support (Abebe et al., 2013; Auren and Krassowska, 2004; Bijman, 2008; Barrett et al., 2012; Rudy, 2010). Additionally, clearly defined contracts specifying the inputs, tools, and equipment expected from the partnering companies, along with the associated costs and clear payment terms, play a crucial role in ensuring the success of outgrower partnerships (Rudy, 2010). Such transparency helps align expectations and reduces the potential for disputes. Furthermore, several studies emphasize the significant influence of socioeconomic factors, such as education, age, farm size, and membership in farmer organizations, on smallholder participation in outgrower schemes (Dhillon and Singh, 2006; Sharma, 2008; Sambuo, 2014; Akuriba et al., 2020).

Effective outgrower programmes typically integrate technical assistance and address broader socioeconomic and environmental considerations (Barrett et al., 2012; Guo et al., 2005; Mayers, 2000). In countries like Brazil, contracts that equitably share benefits and risks, as well as forest certification programs, which ensure sustainable forestry practices, have been instrumental in the success of outgrower schemes (Gonçalves de Moraes et al., 2020). Similarly, contract farming in India, which often includes private extension services, has been shown to boost productivity and improve farm income (Sharma, 2008). In Indonesia, timber outgrower schemes, such as the PT Finnantara Intiga scheme in West Kalimantan, successfully integrated local communities, providing technical support, market access, and community development benefits with positive support from provincial and local government authorities (Nawir et al., 2003). However, challenges remain. For instance, in Brazil, there are concerns over land security due to political shifts and land redistribution and uncertainty from growers seeking alternative buyers (Gonçalves de Moraes et al., 2020). In Indonesia disputes over pricing, environmental hazards like fires and diseases and risks like timber theft also pose threats to these partnerships (Nawir et al., 2003). Other issues include the high costs of harvesting of dispersed smallholder plantations as reported in India (Sharma, 2008).

Despite the growing interest in outgrower schemes in Uganda (Mugerwa, 2011; Nabanyumya, 2017), there is limited empirical information on such arrangements in commercial tree growing. Previous studies in Uganda have largely focused on outgrower schemes involving cereal and export-oriented crops, such as maize, pineapple, and coffee, with little attention to tree crops (Bolwig, 2012; Mugerwa, 2011). This knowledge gap limits the initiation of feasible outgrower schemes and their effective implementation in commercial tree-growing in Uganda.

This study contributes to closing this knowledge gap by exploring the operation of a commercial tree-growing outgrower scheme in Uganda, assessing socioeconomic factors influencing farmers' participation, and investigating their motivations to participate in these schemes. It addressed the following questions: How are commercial tree growing outgrower schemes organized in Uganda? What socioeconomic factors influence smallholder participation in commercial tree growing outgrower schemes? What motivates smallholder tree farmers to participate in commercial tree-growing outgrower schemes?

In this study, smallholder participation is defined as being a member and actively engaged in outgrower schemes of individual farmers who typically cultivate on small farms, rely almost exclusively on family labor, and have limited resources (ActionAid, 2015; International Finance Corporation, 2016; Verdone, 2018). The study considers smallholder participation as an essential element for understanding the dynamics of outgrower schemes, emphasizing the investigation of motivations and socioeconomic factors influencing their engagement in these initiatives.

2. Framework analysis

2.1. Policy, legal and institutional framework relevant to commercial tree growing schemes in Uganda

Uganda's National Forest Policy, adopted in 2001, aims for an integrated forest sector with sustainable economic, social, and environmental benefits, especially for the poor and vulnerable (Minister of Water, Lands, and Environment, 2001). Policy Statement 3 within this framework promotes the development of profitable and productive forest plantations. Other relevant policies include the promotion of a modern, competitive, efficient, and well-regulated wood and non-wood processing industry (Policy Statement 4), the promotion of tree growing

on farms, and the development of innovative mechanisms for forestry extension services (Policy Statement 6) (Byarugaba, 2007).

The National Forestry and Tree Planting Act of 2003 further supports the integrated forest sector, guiding and encouraging tree planting among the people of Uganda (National Forestry and Tree Planting Act, 2003; Auren and Krassowska, 2004). The Act introduces the registration of forests either as a private owner or as a community, providing incentives for private owners or communities in terms of security of tenure and extended advisory benefits (Auren and Krassowska, 2004).

Despite existing policies and legal frameworks supporting commercial tree growing, there are not yet any specific guidelines for supporting and guiding the operation of outgrower schemes in commercial tree growing.

In terms of the institutional framework (see Fig. 1), the Forest Sector Support Department, under the Ministry of Water and Environment, formulates national policies and coordinates forest management projects. The National Forestry Authority (NFA) serves as the lead agency for forest management, supplying forestry products and services to the government and private sector. District Forestry Services, mandated for the management of local forest reserves, private and customary forests, on-farm forestry, community forests, tree planting, and advisory services, also play a crucial role in the institutional framework.

Forestry research entities in Uganda encompass the National Forestry Resources Research Institute, the School of Forestry, Environmental, and Geographical Sciences at Makerere University, and Nyabyeya Forestry College. These institutions conduct studies providing insights into plantation forest management, socioeconomics, and forest products.

Private sector organizations such as Busoga Forestry Company, Global Woods, The New Forests Company, and Nileply actively engage in large-scale afforestation efforts. Forums like the Uganda Tree Growers Association, Uganda Forest Working Group, and Uganda Forestry Industries Development Association (UFIDA) assist forest industries in navigating interactions with the government, statutory bodies, and non-governmental organizations.

Civil society organizations, officially recognized by the government and registered as non-governmental associations, serve as lobbying bodies. They are represented through UFIDA, which requires a yearly membership fee. These organizations, including farmers associations, the Uganda Manufacturers Association, and the Private Sector Foundation, play roles in forestry extension, forest policy dissemination, and skill capacity building.

2.2. Analytical framework of the study

This study adopted the Input-Process-Output (IPO) model (Auch et al. 2014) as the analytical framework for this study. The model was selected because its generic structure proved to be useful to allow for the examination of the interplay between socioeconomic factors, motivation, and smallholder participation in outgrower schemes (see Fig. 2).

The model delineates three stages: socioeconomic factors as inputs, motivation as a process, and the output is viewed as the outcome and, in this context, farmer participation in outgrower schemes. Factors such as gender, age, marital status, household size, education level, membership in farmer-based organizations (FBOs), land ownership, and tenure shape the socioeconomic status of farmers. These variables are crucial for

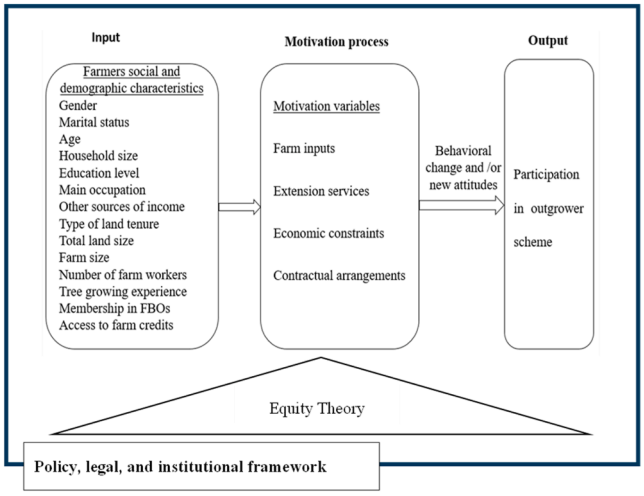

Fig. 2. Analytical framework to analyze smallholder tree farmers' motivation to participate in outgrower schemes. (Auch et al., 2014; Juneja 2015).

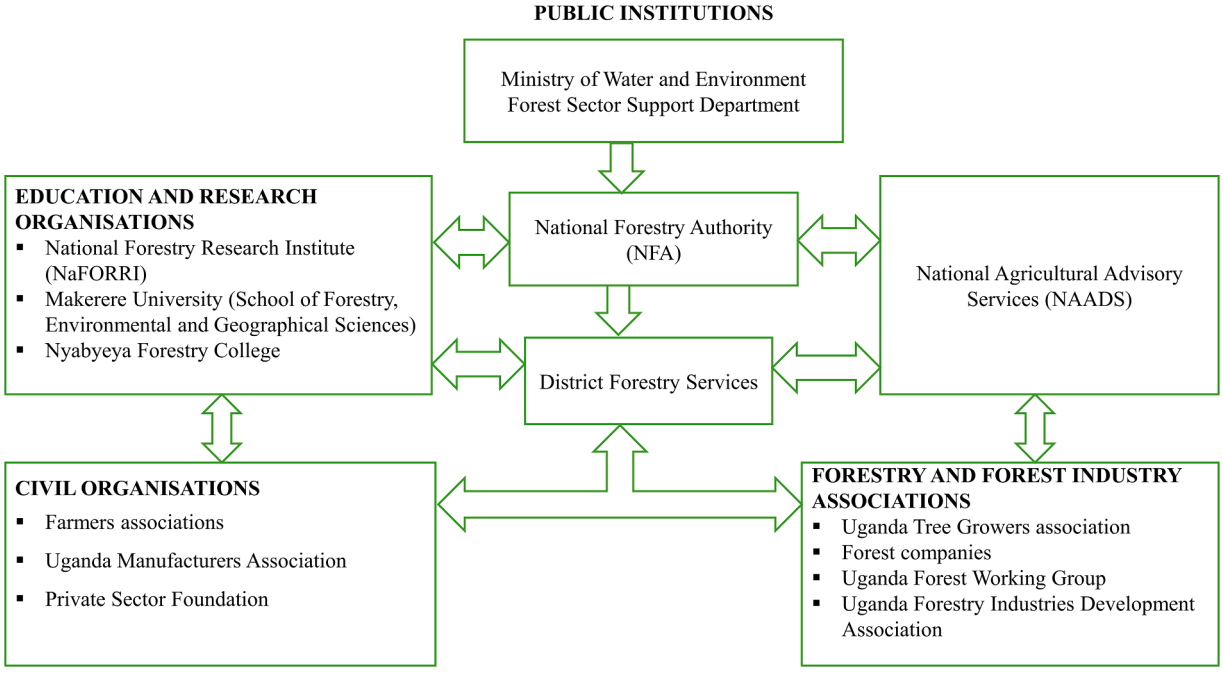

Fig. 1. Institutional framework relevant to commercial tree growing in Uganda. Source: author's compilation.

identifying potential limitations to farmer participation and are expected to affect the perception of farmers about the various motivation factors.

Motivation, in this study, specifically refers to those actions of change agents which induce the active participation of the target group in the planned change. The Equity Theory, emphasizing fairness and equity, is adopted as the foundational framework, where an individual's motivation level is correlated to perceptions of equity, fairness, and justice in management (Juneja, 2015). The higher the perception of fairness, the greater the motivation level (Juneja, 2015). Using the Equity Theory and an extensive literature review, motivation variables are grouped into four categories: farm inputs, extension services, economic constraints, and contractual arrangements.;

Farm inputs include access to good quality seedlings, access to fertilizers, access to agrochemicals (pesticides and herbicides), provision of farm tools (hoes, machete, and slashing tools), provision of farm labor and farm credits. A strong relationship is expected between access of farm inputs and willingness to participate or continued participation in the scheme (Dhillon and Singh, 2006; Sharma, 2008; Sambuo, 2014; Smalley, 2013).

Extension services, including training, technical support, and farm visits, are vital for farmer participation. Effective communication through extension agents, especially during farm visits, serves to impart knowledge, provide specific advice, and build rapport. These interactions stimulate interest, increase awareness, and enhance farmer involvement in outgrower schemes (Mayers, 2000; Guo et al., 2005).

Economic constraints, indicating insufficient cash resources, hinder farmers' ability to acquire essential inputs like labor, seeds, fertilizers, and pesticides (Bijman, 2008 and Barrett et al., 2012). These constraints are identified as inhibiting factors, negatively impacting smallholder tree farmers' participation in outgrower schemes. Notably, smallholder tree farmers often cannot pay for land preparations and subsequent inputs for farming (AgDevCo, 2017). They therefore rely on loans and lack of access to farm loans could be a limiting factor to their participation in outgrower scheme.

Contractual arrangements encompass the payment mode for farmers' wood produce, methods of input securing, and arrangements for covering harvesting and post-harvest costs. Farmer preferences for specific arrangements play a crucial role in determining their participation in outgrower schemes (Rudy, 2010; Smalley, 2013).

Government policies, legal frameworks, and institutions influence smallholders' decisions to engage in outgrower schemes. Policies promoting tree growing and innovative extension mechanisms can further support scheme participation. The legal framework helps mitigate risks and enhances participation (Abwino and Rieks, 2006). Additionally, institutional support is important for coordination and advisory services, thereby improving the effectiveness and appeal of outgrower schemes (Abwino and Rieks, 2006).

3. Materials and methods

3.1. Study site description

This research was conducted as a case study of an outgrower scheme between smallholder tree growers in Kassanda district and the New Forests Company (NFC) from May to July 2020. NFC is one of Uganda's biggest tree planters with more than 20,000 hectares of plantation forest (mainly *Pinus spp* and *Eucalyptus spp*). The company manages three plantations namely Namwasa located in the Kassanda district (formerly part of Mubende district), Luwuga in Kiboga, and Kirinya in Bugiri districts (Trickle Out Africa, 2015).

The NFC received a 50-year tree farming license in April 2005 from the National Forestry Authority (NFA) under the Tree Planting Act of August 2003. This license allowed the company to establish a commercial timber plantation spanning 8281 hectares of the Namwasa Central Forest Reserve (CFR), of which 410 hectares of high conservation value forest, protected for natural regeneration purposes to promote biodiversity conservation and watershed enhancement (CDM-Executive board, 2013).

Namwasa CFR is located in Kassanda district, about 110 km west of Kampala, Uganda's capital (CDM-Executive Board, 2013). The district covers 1919 km^2 with a population density of 162.9/km^2 (see Fig. 3), consisting of 52.2 % men and 47.8 % women (City population, 2020). This district is driven by rural agriculture characterized by limited development and a high population density of low-income farmers (City population, 2020).

The Namwasa central forest reserve, situated at an altitude of 1135 to 1540 m above sea level, features hilly terrain with steeper gradients in the south and west. The northern and northeast regions comprise a flat valley with gentle slopes, typically less than 10 %, serving as drainage areas for most wetlands and watercourses within the reserve (CDM-Executive Board, 2013). There are thirty villages surrounding the reserve, which primarily rely on subsistence agriculture or cash-cropping for bananas (matoke) and coffee, while residents also have rights to collect firewood and traditional foods from the reserve (CDM-Executive Board, 2013).

The New Forests Company was certified by the Forest Stewardship Council (FSC) in 2009, and it specializes in tree planting and timber harvesting to produce saw logs, treated poles, and other value-added wood products (CDM-Executive Board, 2013). The company started planting of trees in the Namwasa CFR in March 2006 and launched the Namwasa Outgrower Scheme in January 2010 to promote small-scale timber operations and agroforestry among local communities (CDM-Executive Board, 2013). This scheme has received attention as an exemplary initiative in Uganda, making it a valuable case study for investigating factors influencing smallholders' decisions to participate in outgrower farming.

3.2. Data collection

Our study employed the case study approach (Yin, 2018), focusing on smallholder tree growers as the unit of analysis.

3.2.1. Primary data collection

Data collection took place in four specific sub-counties surrounding the Namwasa Central Forest Reserve. These included Kalwana, Kassanda, Kitumbi, and Bukuya sub-counties in Kassanda district (see Fig. 3). The selection of these sub-counties was based on contact with local authorities and accessibility, considering movement restrictions imposed due to COVID-19 pandemic. Although the original research design aimed to gather primary data in the extension of the Namwasa CFR, movement restrictions because of the pandemic rendered fieldwork in the entire extension unfeasible hence modifications were made to the original research design to adapt to the pandemic challenges.

The study employed a mixed-method approach, combining qualitative and quantitative techniques for data collection and analysis. Semi-structured interviews were conducted for primary data collection. The information obtained from the semi-structured interviews was triangulated with data collected from the focus group discussions and key informant interviews. Such a triangulation of methods aimed at validating findings through convergence of different philosophies and boosting the overall strength of a study, thus eliminating any bias and the challenge that comes with the use of a single method (Creswell, 2007; Noble and Heale, 2019). Triangulation was considered essential in outgrower scheme research due to the complex, multi-dimensional nature of the concept.

Stratified random sampling was used, and the process relied on the lists of outgrowers that are members of the Namwasa outgrowers association obtained from the outgrowers' association leader and the list of smallholder commercial tree farmers in the community obtained from the community liaison officer of NFC Namwasa Forest. This approach ensured a representative and unbiased selection of participants and non-

Fig. 3. Map of Kassanda district showing the locations of the four sub-counties from which data was collected. Source: City population (2020).

participants for the study. The small-scale tree farmers in the study area were categorised into two groups, i.e., participants and non-participants of the outgrower scheme. A total of 80 respondents, comprising household heads managing small-scale woodlots, 40 from each group, were randomly selected from four sub-counties (Kalwana, Kassanda, Kitumbi, and Bukuya) in Kassanda district (see Fig. 3). The selection criteria for these farmers were based on farmers managing small-scale woodlots of at least 0.2 ha of *Pinus* spp. and/or *Eucalyptus spp*. The sample size was determined considering the total of 232 small-scale tree farmers who were in the study area.

Semi-structured questionnaires were administered to respondents ($n = 80$) through a face-to-face interview with farmers either on their farms or homes. This was done with the help of two trained field assistants/interpreters. The questionnaire had both multiple-choice questions in which respondents were asked to select one or more of the alternatives, as well as dichotomous questions with only two response alternatives, i.e., yes or no (see Appendix A in the supplementary material). It included a wide range of information on respondents' socioeconomic characteristics as well as their experiences and perceptions of the outgrower scheme. We used a four-point Likert scale (0–3) to assess the perceived importance of various farm inputs and extension services, where a score of (3) was given to the perceived farm input or extension service that respondents believed were very important, (2) for those that were considered important, (1) for those that were considered less important, and (0) for those that respondents considered not important. The selection of a four-point Likert scale offers a balanced and nuanced approach, providing a sufficient range for respondents to express varying degrees of importance (Bhandari and Nikolopoulou, 2020). This scale strikes a pragmatic balance, allowing for a more nuanced differentiation between varying levels of perceived importance. Farmers were also asked to state their preferences for various contractual arrangements.

The questionnaire was pre-tested on 4 randomly selected farmers from both the participant and non-participant groups. This pre-testing phase aimed to ensure that the questions were clear and easily understood by respondents. It also allowed us to identify and resolve any ambiguities or confusion in the wording of questions, and to refine response options, particularly in multiple-choice questions, by adding or

adjusting categories to better capture respondents' experiences. In addition, the pre-test helped estimate the average time required to complete the questionnaire, enabling more effective planning for data collection. Based on the feedback from the pre-test, minor adjustments were made to the phrasing of certain questions to enhance clarity and ensure that respondents could accurately provide the information required.

Purposive sampling was used to select a total of 11 respondents for the key informant interviews, chosen for their specific relevance to the study. These included: four smallholder tree farmers; three company officials (community development officer, community liaison officer, and technical team supervisor); two local council chairpersons; the chairperson of Namwasa outgrowers association; and the district forest officer (DFO). Interviews were conducted in person, while for some that could not be physically met were sent an interview guide via email. The key informant interviews aimed to elicit responses to issues that the questionnaire could not easily address, as well as obtain in-depth perspectives on the scheme's impact on the community.

The study organized two focus group discussions: one with 12 non-participants, including 3 females, and another with 15 participants of the outgrower scheme, including 7 females. Farmers were purposefully selected to ensure gender representation, particularly to ensure that gender-specific insights were adequately explored. By including a considerable number of female farmers in the discussions, we hoped to capture the often-underrepresented perspectives of this gender. Due to restrictions of movement to curb the COVID-19 pandemic, all farmers selected for the focus group discussions were from the Kalwana sub-county, Kassanda district. The discussions aimed to gather comprehensive insights, perspectives, and opinions from both groups regarding the outgrower scheme, providing a platform to explore the diverse viewpoints and experiences of both participants and non-participants. For details on the focus group structure, see Appendix B in the supplementary material.

3.2.2. Secondary data collection

A desk review was conducted, delving into relevant project files associated with the scheme. Additionally, a comprehensive examination of other relevant documents was undertaken to gain insights into the legal, policy, and institutional frameworks pertinent to commercial tree production in Uganda. The review aimed to extract valuable information from existing records and documents, contributing to a more nuanced understanding of the dynamics and context of outgrower operations and commercial tree production in Uganda.

3.3. Data analysis

Table 1 describes the variables utilised in the analysis. Descriptive statistics, including frequencies and percentages, were used to compare the socioeconomic characteristics of participants and non-participants. A Chi-Square Test of Independence was conducted to assess the association between farmers' socioeconomic characteristics and participation in the outgrower scheme. The Chi-square test analyzes contingency tables to identify significant relationships between two qualitative variables by comparing their frequency distributions (Barceló, 2018).

$$x^2 = \sum \frac{(O-E)^2}{E}$$

$\boldsymbol{O}$ = Observed frequency, E = Expected frequency, $\sum$ = Summation, χ^2= Chi Square value

The null hypothesis is that there is no significant relationship between farmers' socioeconomic characteristics and participation in outgrower scheme. For each significant variable identified, we perform a post-hoc test using pairwise comparison to determine which specific categories of these variables differ significantly regarding participation in the outgrower scheme. This approach helps to understand details of the relationships identified in the Chi-square tests, offering insights into which specific categories within a variable drive the significant relationship.

Table 1
Description of variables used in the analysis.

Variable	Description
Participation in the outgrower scheme (Dependent variable)	0= Non-participant 1=Participant
Gender	1=Male, 2=Female
Age/ Age-group	1= Under 40 years, 2 = 40–60 years, 3= Above 60 years
Marital status	1=Married, 2= Otherwise
Education level	1=Didn't complete primary, 2=Completed primary, 3 = O'level, 4 = A'level, 5=Technical school, 6=University
Household size	1= Below 5 members, 2 = 5–10 members, 3= Above 10 members
Main occupation	1=Farming, 2= Non-farm enterprise
Other sources of income	1=Merchandise, 2=Driving, 3=Salaried work, 4=Vocational, 5=Grazing and poultry, 6=None
Member in FBOs	1= Yes, 2=Not
Tree growing experience	1 = up to 5year, 2 = Above 5 years
Purpose for the trees	1=Electricity transmission poles, 2=Construction poles, 3=Timber
Type of land tenure	1=Customary, 2=Freehold, 3=Leasehold
Total land size	1= up to 5 ha, 2= Above 5ha
Land for tree growing	1= up to 2 ha, 2= Above 2ha
Number of farm workers	1= up to 5 workers, 2 = 6–10 workers, 3= Above 10 workers
Access to farm credits	1= Yes, 2=No

The ratings of the level of importance of various farm inputs and extension services were analyzed by computing the percentage scores for respondents' responses on each variable. The various farm inputs and extension services were then ranked using the Weighted Average Index (WAI).

$$\text{WAI} = \frac{\sum F_i W_i}{\sum F_i}$$

Where F = frequency of response; W = weight of each score; and i= score (3 = very important; 2 = important; 1 = less important; 0 = not important).

The WAI accounts for the frequency of each response category (e.g., "not important," "less important," "important," "very important") and assigns corresponding weights, providing a more nuanced measure than a simple average. This approach enabled the ranking of inputs and services based on farmers' perceived importance, providing more nuanced insights. The ranking help to support more informed decisions when designing outgrower or similar initiatives tailored to smallholder farmers' needs and priorities.

Furthermore, cross tabulations were used to assess the differences in the proportions of preferences for contractual arrangements between participants and non-participants and across categories of farmers' social and demographic characteristics and Chi-square test was performed to examine whether these differences were statistically significant.

4. Results

4.1. Operation of the Namwasa outgrower scheme

The Namwasa outgrower scheme was launched in 2010. Some farmers have individual agreements with NFC, while others are members of the Namwasa outgrowers' association that negotiates on their behalf (NFC community development officer). The Namwasa outgrowers' association, established in 2014, comprises 76 tree farmers. To join, farmers must meet specific criteria, including cultivating *Eucalyptus spp* or *Pinus spp* on at least 0.2 hectares of land and paying a membership fee of $8, along with $2 for the savings cash book. Members are also

required to save a minimum of $3 each month, contributing to a collective fund used to provide credits to members based on their savings (Chairperson Namwasa outgrowers' association).

The contracts between NFC and its outgrowers are informal and lack legal documentation, relying on verbal agreements and trust. Farmers plant trees on their land and manage the production, with the company guaranteed market for their wood. Farmers also receive training in best operational practices from the company's foresters. These practices are then assessed against Forest Stewardship Council (FSC) standards and the International Labor Organization (ILO) code of practice for safety and health in forestry work through monthly and quarterly assessments (NFC community liaison officer, technical team supervisor).

Outgrowers negotiate with the NFC to establish agreements for sales, which are then translated into a local language that farmers can understand (NFC community liaison officer). The prices for wood are not regulated by a price mechanism but are rather determined by the market price at the time of purchase (NFC community liaison officer, focus group discussion (FGD) with participant farmers). The company is willing to purchase the entire tree yield from outgrowers if the quality meets its standards (community liaison officer). However, outgrowers are also free to sell to other clients or middlemen if they choose.

Farmers generally perceived that participating in the Namwasa outgrower scheme has positively impacted their livelihoods, improved their relationships with the company and enhanced farmers' tree management skills (FGD with participant farmers). The company's support has also benefited the community through employment and corporate social responsibility initiatives such as allowing residents to collect firewood and providing financial assistance to schools (disclosed by the local council chairpersons). However, farmers face several challenges, including limited finances for plantation maintenance, lack of access to affordable high-quality seedlings, difficulty in meeting company quality standards, inconsistent company staff, and a lengthy process of inspections and verifications before wood is approved and purchased by the company (FGD with participant farmers).

The main obstacles to the successful implementation of the scheme are farmers' impatience, as well as land conflicts and disputes between neighbors over planting of eucalyptus trees, and destruction of nearby crops during tree felling and skidding (disclosed by the local council chairpersons). Furthermore, price fluctuations of tree products in the country discourage farmers from engaging in tree growing projects (disclosed by the local council chairpersons).

The scheme supports national reforestation and forest conservation goals, and fosters sustainable practices among smallholder farmers, aligning with broader environmental and policy objectives (DFO; NFC community liaison officer; CDM-Executive board, 2013). The implementation of Uganda's National Forest Policy has seen notable progress, particularly in promoting afforestation and sustainable forest management. Key achievements include the active involvement of private sector companies like New Forest Company in large-scale tree planting efforts and the support provided by District Forestry Services to smallholder farmers for on-farm forestry initiatives. However, inadequate stakeholder coordination and the absence of regulations or guidelines pertaining to outgrower initiatives and smallholder farmers protection in these agreements challenge the successful implementation of outgrower schemes (reported by DFO).

4.2. Selling arrangements and perspectives on the outgrower scheme among non-participants farmers

Non-participant farmers detailed their specific approaches to selling wood produce and offered their views on the outgrower scheme. These narratives shed light on the diverse strategies employed by this group and provide a comprehensive understanding of their perspectives regarding the outgrower initiative.

Results from the semi-structured interviews revealed that most non-participant farmers (78 %) sell their wood produce to middlemen, while 22 % sell their wood to electricity companies or small-scale timber companies or even furniture workshops in the nearby trading centres. Most of these non-participant farmers (82 %) expressed interest in joining the outgrower scheme for assured markets. They perceived the outgrower scheme as offering better and more stable prices compared to selling to middlemen.

In a focus group discussion, non-participants pointed out the fear of being restricted to sell their wood produce only to the company and the long duration to reach the tree maturity age required by the company. They preferred to sell their wood produce at any time, especially in case of urgent need of cash. Limited awareness and knowledge about the scheme were also identified, with some non-participants expressing a lack of sensitization and misconceptions about land size requirements. Improved communication is crucial to clarify the scheme's benefits and operations.

4.3. Social and demographic characteristics of smallholder farmers in the study area

Tables S1 and S2 presents the social and demographic characteristics of smallholder tree farmers in the study area (see the supplementary material). Results revealed that smallholder tree farming in the study area is dominated by males (85 %), with 77.5 % among the participants and 92.5 % among the non-participants group. Although female smallholder farmers were in the minority; those who participated in the outgrower schemes were higher than the non-participants (Fig. 4).

The age distribution among participants and non-participant farmers showed a predominant age range of 40 to 60 for both groups with 58 % and 73 % of non-participant and participant farmers respectively. A smaller percentage of farmers fell below the age of 40, with 15 % and 18 % in the non-participant and participant groups, respectively. Furthermore, fewer farmers were over 60 years old, accounting for 28 % and 10 % in the non-participant and participant groups, respectively (Fig. 4).

Marital status was a commonality among farmers in both participant and non-participant groups, as all individuals were married (Table S1). There was a substantial difference in household size between participants and non-participants. The average household size was 7 people among participants and 9 people among non-participants (Table S2). More participants had small household size (up to 5 members) compared to non-participants, representing 16 and 9 respondents respectively. Conversely, more non-participants had large household sizes (Above 10 members) than participants, representing 14 and 1 respondents respectively (Fig. 4).

The study found that 17.5 % of farmers had not completed primary school, and another 30 % had finished their education at the primary level without further advancement. Most farmers (41.3 %) had reached the ordinary level of education (O'level). Notably, the participants demonstrated a higher prevalence of O'level education, with 21 individuals, compared to the non-participants with 12 individuals. A marginal proportion (3.8 %) had successfully obtained the advanced certificate (A'level), while 5 % had completed technical school, and a few 2.5 % had achieved a university education (Fig. 4).

Farming was the primary occupation for all participants (100 %). Similarly, nearly all non-participants (98 %) had farming as their main occupation, with a few engaged in non-farm enterprises (Fig. 4). It is important to note that farming in this context is not limited to tree farming alone but also includes cultivation of agricultural crops such as matoke (bananas) and cash crops like coffee.

Regarding additional income sources, 39 % of respondents earned from trading or merchandise, and 6 % from salaried jobs (Fig. 4). Notably, 43 % of smallholder farmers reported no additional income source beyond farming i.e., crop cultivation (e.g., matoke and coffee), contribute to both income and subsistence.

All smallholder farmers in the study area had either customary or freehold land ownership, with 78.8 % holding customary land tenure (Fig. 4). On average, non-participants had substantially larger land sizes

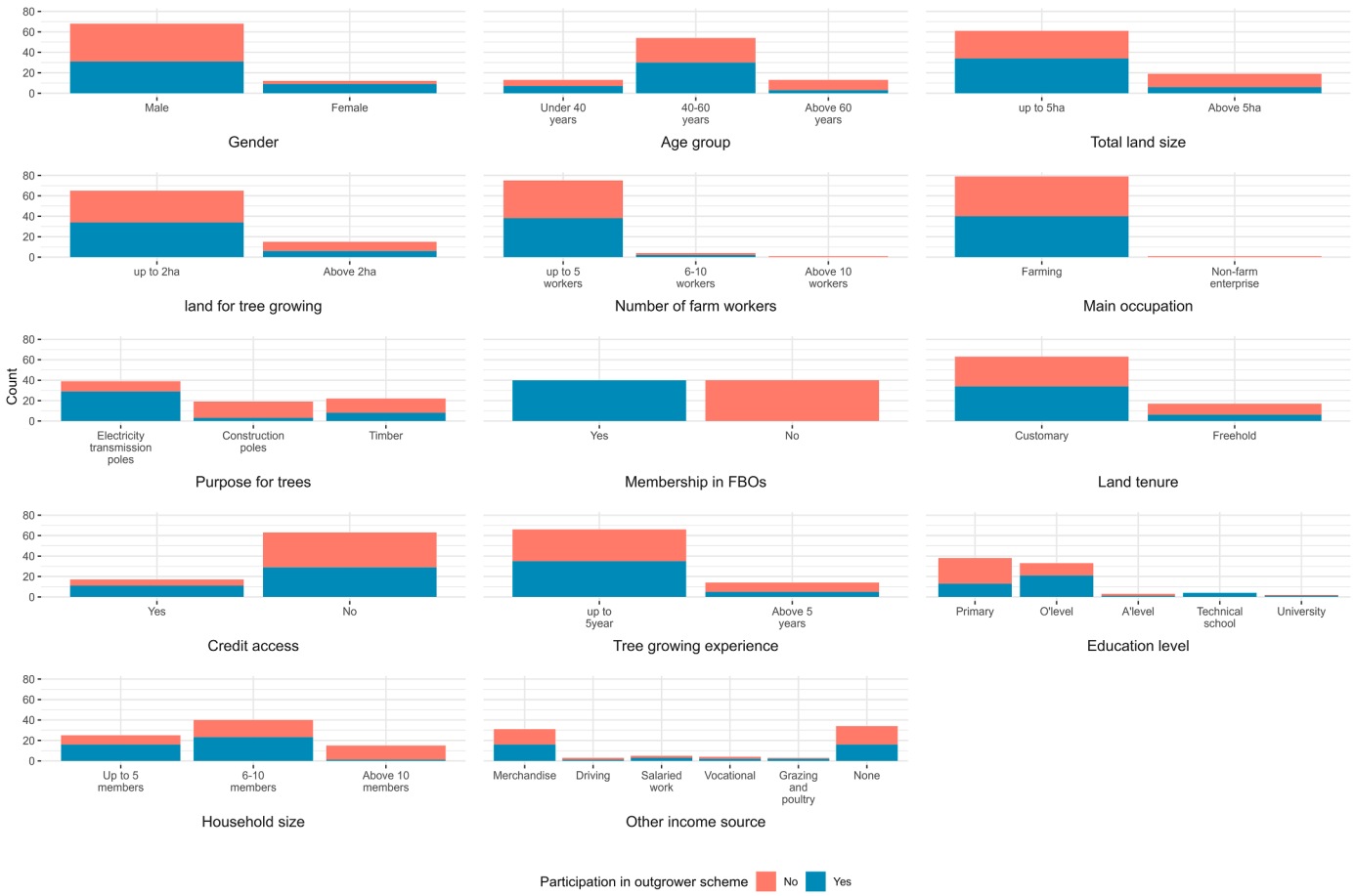

Fig. 4. Participation in the outgrower scheme across categories of farmers' social and demographic characteristics ($N = 80$).

than participants, with 3.9 ha for participants and 9.3 ha for non-participants (Table S2). The same was true for land allocated for tree growing, with participants having an average plantation size of 1.4 ha and non-participants having 3.7 ha (Table S2).

More participants than non-participants had total land size of up to 5 ha, representing 34 and 27 respondents respectively. However, there were more non-participants than participants with total land size above 5 ha, representing 13 and 6 respondents respectively (Fig. 4). Most farmers in both participant and non-participant groups had allocated up to 2 ha of land for tree growing, representing 34 and 31 respondents respectively (Fig. 4). However, farmers who allocated more that 2 ha of land for tree growing were more in the non-participant group than those who were participants in the outgrower scheme, representing 9 and 6 respondents respectively.

Participants had an average of 4.6 years of tree growing experience, while non-participants had 5.2 years. Non-participants also utilized slightly more farm workers, with an average of 3.8 workers compared to 3.2 workers for participants (Table S2). Most farmers in both the participant and non-participant groups use up to 5 workers on their tree farms, representing 38 and 37 respondents respectively (Fig. 4).

Notably, all participants in the outgrower scheme were affiliated with a farmer-based organization (FBO) such as the Kassanda Farmers' Association (specializing in coffee production) and the Namwasa Outgrowers' Association (focused on Eucalyptus and Pinus spp). In contrast, none of the non-participants participated in any FBO, indicating a significant difference in organizational participation between the two groups.

Overall, only 21 % of the smallholder farmers were using external farm credits for their tree farming activities. Notably, a higher proportion of participants (28 %) utilized external credits compared to non-participants (15 %) (Table S1). The primary reasons noted by farmers for not utilizing external credit included the unavailability of loan facilities, lack of necessity for credit, prolonged bureaucratic processes, high interest rates, and the absence of assistance in loan applications (see Fig. 5).

Financial institutions such as banks or microfinances were the primary sources of farm credits for both participants (90 %) and non-participants (67 %), while a smaller percentage obtained loans from family and friends (i.e., 10 % of the participants and 33 % of the non-participants). The utilization of external farm credits among participants was predominantly directed towards acquiring farm inputs like seedlings and agrochemicals (67 %) compared to non-participants (50 %). Moreover, a notable proportion of participants utilized credits for land payments (30 %) and farm labor (20 %), whereas non-participants allocated lesser percentages for these purposes (land: 17 %, farm labor:

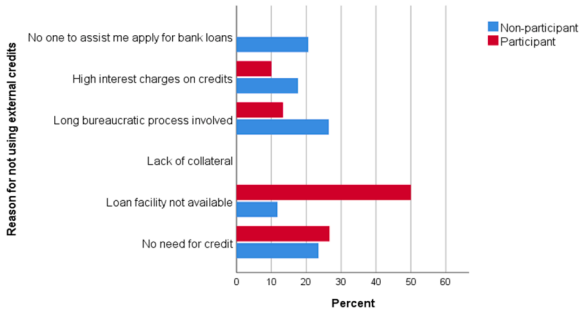

Fig. 5. Reasons why smallholder farmers do not use external farm credits for tree growing. Source: Field survey, 2020.

17 %). The disparity in credit utilization between participants and non-participants may be attributed to factors such as the smaller household sizes among participants, necessitating additional labor procurement, and the customary land tenure systems requiring regular land rent payments. These findings shed light on the intricacies of credit utilization among smallholder farmers, emphasizing the need for tailored interventions to address their specific needs and constraints.

4.4. Relationship between farmer socioeconomic characteristics and participation in outgrower schemes

The Chi-Square test results (Table 2) revealed that participation in the outgrower scheme is significantly associated with the purpose for the trees, membership in farmer-based organizations, and household size. Education level showed marginal significance. Gender, age group, number of farm workers, main occupation, other sources of income, type of land tenure, total land size owned by the farmer, land allocated for tree growing and access to farm credits do not show significant associations with participation in the outgrower scheme.

Results showed a significant association between purpose for the trees and participation in outgrower scheme ($\chi^2 = 19.7875$, $p = 5.05E\text{-}05$). A post-hoc test found a highly significant difference between farmers growing trees for electricity transmission poles and those growing trees for construction poles ($p = 0.00026$). This suggests that participation in the outgrower scheme differs considerably between these two groups. Significant difference was also observed between farmers growing trees for electricity transmission poles and those growing trees for timber ($p = 0.02458$), though not as pronounced as the one between electricity transmission poles and construction poles. No significant difference was found between farmers growing trees for construction poles and those growing trees for timber ($p = 0.77638$).

A chi-square test revealed a significant association between household size and participation in the outgrower scheme ($\chi^2 = 14.13$, $p = 0.000856$). The post-hoc test showed no significant difference in outgrower scheme participation between farmers from small households and those from medium households ($p = 1.000$). However, when comparing large households (above 10 members) with both small and medium households, significant differences are observed. The p-values for these comparisons are 0.0038 (large vs. small households) and 0.0062 (large vs. medium households). These findings suggest that household size plays a significant role in determining participation in outgrower schemes, with larger households (more than 10 members) less likely to participate compared to smaller households (see Fig. 4).

Table 2
Chi-Square test between farmers' participation in outgrower scheme and various socioeconomic factors.

Variable	Chi-Square Statistic	Degrees of freedom	P-value
Gender	2.45098	1	0.117451
Age group	4.512821	2	0.104726
Total land size	2.484901	1	0.114944
Land for tree growing	0.328205	1	0.566718
Number of farm workers	1.013333	2	0.602501
Education level	10.85931	5	0.054242
Main occupation	0	1	1
Other income source	1.016572	5	0.961218
Purpose for the trees	19.78751	2	5.05E-05*
Membership in FBOs	76.05	1	2.77E-18*
Land tenure	1.195145	1	0.274294
Credit access	1.195145	1	0.274294
Household size	14.12667	2	0.000856*
Tree growing experience	0.779221	1	0.37738

* indicates significant association at 0.01 level.

4.5. Motivation factors for farmers' participation in outgrower schemes

4.5.1. Farm inputs

Fig. 6 presents farmers' ratings of the perceived level of importance of various farm inputs. Most of the farmers (95 %) considered good quality seedlings very important. The remaining 5 % believed access to good quality seeds/seedlings is important and no farmer considered it not important. Also, most farmers considered fertilizers as well as access to pesticides and herbicides as being important, representing 72.5 % and 51.2 % respectively. Access to farm credits was considered very important and important by most farmers, representing 43.8 % and 36.3 % respectively. The remainder do not believe access to farm credits as important to them.

However, most respondents said that provision of farm tools and provision of farm labor are less important and/ or not important to them. For the provision of farm tools, 33 % said it is not important and 33.8 % said it was less important. 43.8 % and 33.8 % of the farmers considered provision of farm labor to be less important as well as not important respectively.

To rank the importance of various farm inputs and extension services, we applied the weighted average index (WAI) (refer to Section 3.3). Farmers' perceptions regarding the importance of different farm inputs indicate that access to quality seedlings and farm credits received the highest importance, with Weighted Average Indices (WAIs) of 2.95 and 2.18, respectively. Agrochemicals and fertilizers followed closely, ranking third and fourth with WAIs of 2.16 and 2.01. Conversely, farm tools and labor were regarded as the least important, with WAIs of 1.15 and 0.93, respectively.

4.5.2. Extension services

Fig. 7 presents farmers' ratings of the perceived level of importance of various extension services. Overall, more than 80 % of the smallholder farmers considered all extension services important and very important. 96.3 %, 95 %, 93.8 % and 58.8 % said that the training in agrochemical application, training in planting, maintenance and harvesting techniques, advice on species choice and frequent farm visits by extension agent respectively are very important. However, 1 (1.3 %) farmer indicated that the technical support in application of agrochemicals is not important while for the rest of the extension services, none of the farmers said that they are not important. In addition, 4 (5 %) farmers considered farm visits by extension agent as less important.

A ranking of farmers' perceptions of the importance of various extension services based on the WAI revealed that farmers placed a strong emphasis on training in planting, maintenance, and harvesting techniques, as reflected by the high WAI score of 2.95. This was followed by species selection advice (WAI = 2.94), training in fertilizer, herbicide, and pesticide application (WAI = 2.93), and then frequent farm visits by extension workers (WAI = 2.54). These findings underscore the critical role of extension services in bolstering the success and sustainability of outgrower arrangements.

4.5.3. Farmers' preferences for contractual arrangements

Farmers' preferences for contractual arrangements determines their participation in outgrower schemes. This study examined key components: mode of payments for the wood produce, method of input securing, and arrangements covering harvesting and post-harvest costs. Table 3 outlines the proportion of farmers favoring various contractual arrangements. These preferences highlight key considerations for designing effective and mutually beneficial outgrower schemes.

For securing inputs, 55 % preferred the donation with charge method (wherein the company provides them with inputs such as fertilizer, seedlings, and pesticides, which are then deducted from their wood payments), while 45 % opted for purchasing inputs at a subsidized price from the company. Regarding the mode of payments for the wood produce, most farmers (92.5 %) preferred on-spot cash payment to payment-in-kind. This shows that farmers certainly prefer to receive

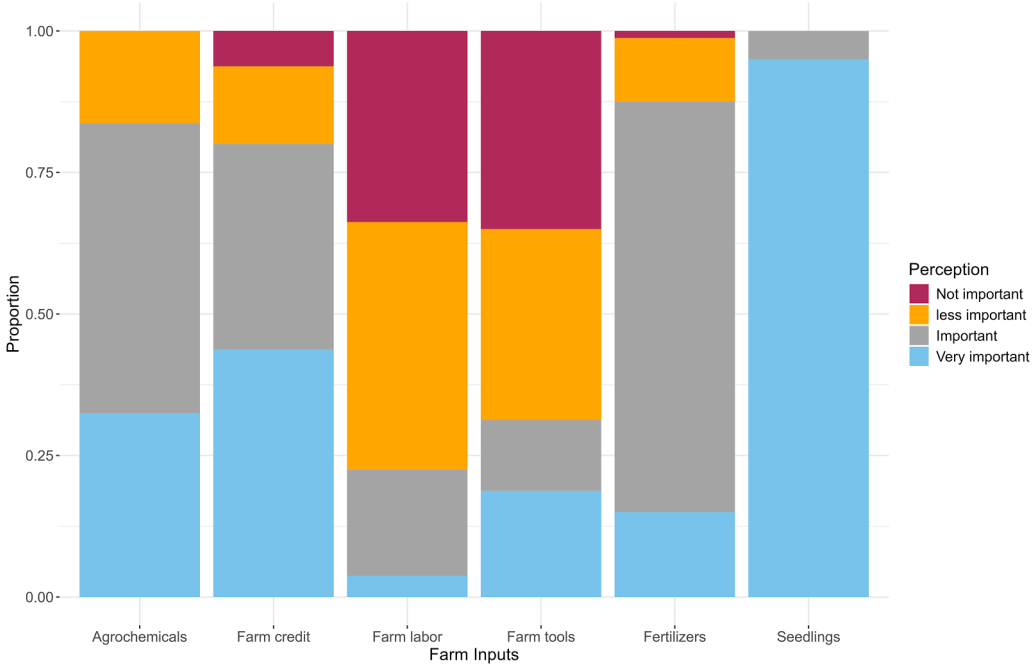

Fig. 6. Farmers' perceptions on how important anticipated farm inputs are to them. Source: Field work, 2020 ($N = 80$).

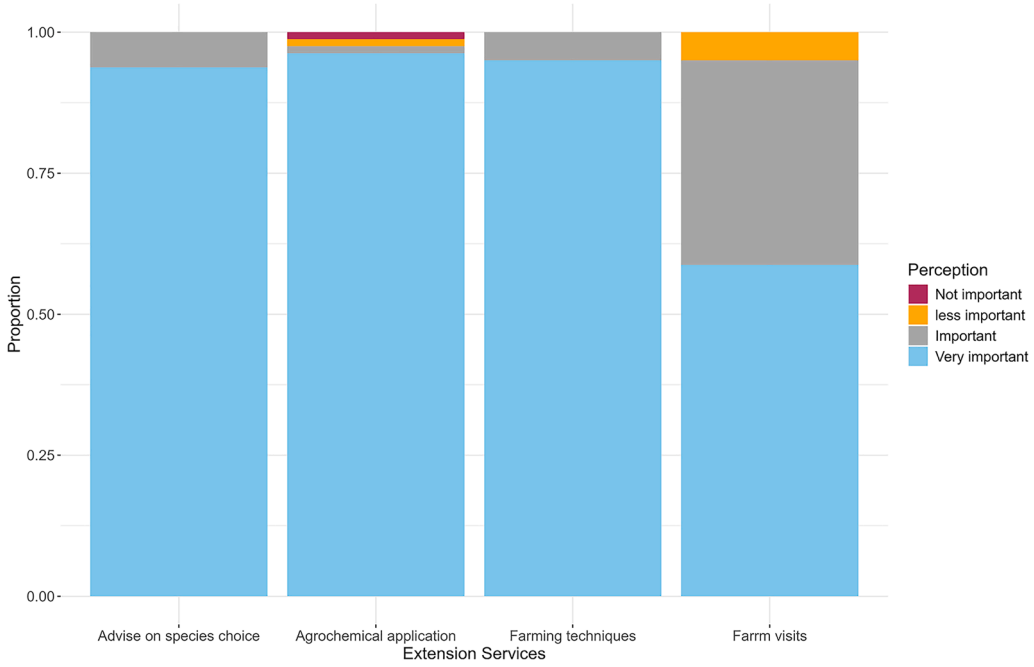

Fig. 7. Farmers' perception on how important various extension services are to them. Source: Field work, 2020 ($N = 80$).

payment in the form of instant cash over non-monetary items or services.

Concerning harvesting expenses, 65 % of respondents favored a cost-sharing approach, where both farmers (providing labor) and the company (supplying machinery) would contribute, as opposed to the company solely bearing the costs and deducting them from the wood payment. Additionally, focus group discussions revealed that some of the farmers possessed tree-felling expertise, negating the necessity for company involvement in harvesting their trees while other farmers expressed concerns that the company might impose a fixed fee for tree harvesting, which may be much higher than what they can pay to hire independent harvest contractors.

Nearly all farmers (98.8 %) preferred that post-harvest costs (transportation and delivery taxes) be fully covered by the company and deducted from their wood payment. According to the opinions expressed during the group discussions, farmers stated they would not want to commit to delivering the wood produce to the company premises because access to reliable transport services for bulk delivery was hard to come by at affordable prices.

When comparing the preferences of participants and non-participants in outgrower schemes across the four contractual arrangements, several trends emerge that highlight the distinctions between

Table 3
Farmers' preference for various contractual arrangement options. Source: Field survey, 2020.

Contract arrangements		Participants $N = 40$	Non-participants $N = 40$	Total $N = 80$	Percentage
Input securing method	Purchase at a subsidized price	13	23	36	45.0
	Donation with charge	27	17	44	55.0
Arrangements to cover harvesting costs	Total costs fully covered by the company and deducted from payment of wood	18	10	28	35.0
	Total costs shared by farmer (labor) and the company (machinery)	22	30	52	65.0
Arrangements to cover post-harvest costs (transport and delivery taxes)	Total costs covered by the company and deducted from payment of wood	40	39	79	98.8
	Total costs covered by farmer	0	1	1	1.3
Mode of payment by farmers	On spot cash payment	39	35	74	92.5
	Payment in kind	1	5	6	7.5

how these two groups approach input securing methods, harvesting costs, post-harvest costs, and mode of payment. The key insights into these differences are outlined below:

Both participants (97.5 %) and non-participants (87.5 %) expressed a strong preference for the on-spot cash payment method. However, a larger percentage of non-participants (12.5 %) compared to participants (2.5 %) also expressed preference for payment in kind. This suggests that non-participants are slightly more open to alternative forms of payment.

More non-participants preferred purchasing inputs at subsidized prices (57.5 %) compared to participants (32.5 %). Conversely, more participants preferred to receive inputs through a donation with a charge (67.5 %) compared to non-participants (42.5 %). This preference reflects a higher reliance on company-provided inputs, which may be seen as a more cost-effective option for participants.

A greater percentage of participants (45 %) preferred the company covering the full costs of harvesting, compared to non-participants (25 %). On the other hand, non-participants are more likely to share harvesting costs (75 %) compared to participants (55 %). This reflects a more self-reliant approach of non-participants, whereby most of them prefer shared responsibility.

There was a strong preference across both groups to have their post-harvest costs fully covered by the company. However, there is a slight difference as one non-participant accepts to cover these costs themselves (2.5 %), while all participants (100 %) have this covered by the company. This suggests that the companies incorporate full coverage of post-harvest costs in outgrower contracts to meet farmers' needs and to attract more farmers to join the outgrower scheme.

4.5.4. Difference in farmers' preferences of the contractual arrangements across categories of farmers' social and demographic characteristics

The differences in the proportions of farmers' preferences for contractual arrangements across categories of farmers' social and demographic characteristics were obtained through cross tabulations, and a chi-square test was performed to examine the significance of these differences.

4.5.4.1. Mode of payment. The cross-tabulation between farmers' characteristics and preferred mode of payment is presented in Table S3. Results revealed that most farmers, both male (92.6 %) and female (91.7 %), show a preference for on-spot cash payments, with only a small proportion preferring payment in kind. This indicates that gender may not be a major differentiating factor when it comes to the preferred method of payment, as both groups exhibit similar patterns.

Except for university-educated farmers, who exhibit a more balanced preference between cash and payments in kind method, potentially reflecting different expectations or needs, most farmers, across all other education levels, favored on-spot cash payments. All farmers whose main occupation is a non-farm enterprise preferred payment in kind, whereas 92.5 percent of farmers whose main occupation is farming, preferred on-spot cash payment for their wood produce.

Farmers with fewer farmworkers tend to prefer on-spot cash payments, but those with more workers show a slightly higher preference for payment in kind, i.e., 94.2 % of farmers with up to 5 workers, 80 % with 6–10 workers, and all farmers with above 10 farm workers preferred on-spot cash payments over payment in kind.

96.7 % of farmers with tree farms up to 2 ha prefer on-spot cash payments, and 3.3 % prefer payment in kind, whereas 80 % of farmers with tree farms above 2 ha prefer on-spot cash payments, and 20 % prefer payment in kind. Similarly, 96.6 % of farmers with tree farms up to 5 ha of total land size prefer on-spot cash payments, while 81.8 % of farmers with above 5 ha of total land size prefer on-spot cash payments.

The results of the chi-square test (Table S4) show a highly significant association between the amount of land allocated for tree growing and the preferred mode of payment. ($\chi2 = 6.671$, $p = 0.0097$). The analysis also found a statistically significant association between total land size and the preferred mode of payment ($\chi2 = 4.2839$, $p = 0.0384$), indicating that the size of land owned by farmers influences their payment preferences.

4.5.4.2. Input securing arrangements. The cross tabulations between farmers' characteristics and preferred input securing arrangements are presented in Table S5 (in the supplementary material).

The cross-tabulations reveal variations in farmers' preferences for payments based on social and demographic variables. Regarding gender, male farmers are evenly distributed between purchasing at a subsidized price and receiving inputs by donations with a charge method (50 % each). On the other hand, most female farmers (83.3 %), prefer donations with a charge payment method, with only 16.7 % choosing to purchase at a subsidised price. Members in FBOs greatly favored donation with charge method (67.5 %), whereas non-members were slightly more inclined to prefer purchasing inputs at a subsidised price (57.5 %). Farmers with freehold land were evenly split between purchasing inputs at subsidised prices (52.9 %) and donation with charge method (47.1 %). However, most (57.1 %) of those with customary land tenure prefer donation with charge method. With regards to the purpose for the trees, most farmers who grow trees for electricity poles (66.7 %) prefer the donation-with-charge method, while 59.1 % of those who grow trees for timber prefer subsidised purchases . Those growing trees for fencing and building poles are more evenly split.

The Chi-Square test results (Table S6) only revealed a significant difference in the preferred mode of payment among the categories of farmers' membership in farmer-based organisations ($\chi2 = 4.0909$, $p =$

0.043). This highlights the influence of FBO membership on farmers' preferences for input securing methods.

4.5.4.3. Arrangements to cover harvesting costs. The cross-tabulations between farmers' characteristics and preferred arrangements to cover harvesting costs are presented in Table S7. The results of the chi-square test (Table S8) revealed no significant differences in preferred arrangements to cover harvesting costs across categories of all socioeconomic characteristics.

4.5.4.4. Arrangements to cover post-harvest costs. The cross-tabulations between farmers' characteristics and preferred arrangements to cover post-harvest costs are presented in Table S9. Overall, most farmers preferred that post-harvest costs be fully covered by the company and deducted from their wood payment rather than costs being covered by the farmers. This trend is consistent across most categories.

All farmers with up to five or more than ten workers preferred that post-harvest costs be covered by the company, while 10 % of farmers with 6–10 workers preferred to cover their post-harvest costs. 94.1 % of freehold landowners and 100 % of customary landowners preferred that post-harvest costs be covered by the company.

35 % of farmers with up to 2 hectares of land for tree growing preferred to cover their post-harvest costs, compared to 65 % who preferred that post-harvest costs be covered by the company. All farmers growing trees on more than 2 hectares preferred that post-harvest costs be covered by the company. 97.4 % of farmers growing trees for electricity poles preferred to cover their post-harvest costs, while all those growing trees for fencing, construction, or timber preferred that post-harvest costs be covered by the company.

All farmers whose main occupation is farming preferred that post-harvest costs be covered by the company, while those with non-farm enterprises preferred to cover their post-harvest costs. Among types of other income sources, all farmers preferred that post-harvest costs be covered by the company, except for one farmer (20 %) with salaried work who preferred to cover their post-harvest costs.

All farmers with lower education levels (who did not complete primary, completed primary, completed O'level, A'level, or attended technical school) preferred that post-harvest costs be covered by the company, while there was one farmer who attended university who preferred to cover their post-harvest costs.

The results of the chi-square test (Table S10) revealed significant differences in preferred arrangements to cover post-harvest costs across categories of education level ($\chi2 = 39.49367$, $p = 5.51E\text{-}08$), main occupation ($\chi2 = 19.49688$, $p = 6.64E\text{-}05$), other income sources ($\chi2 = 15.190$, $p = 1.01E\text{-}05$), and number of farm workers ($\chi2 = 19.24051$, $p = 6.64E\text{-}05$).

5. Discussion

In this paper, we assessed the operation of Namwasa outgrower scheme in Kassanda district, Uganda, as well as the socioeconomic characteristics and the motivations for farmer participation in the outgrower scheme.

5.1. Socioeconomic characteristics of smallholder tree farmers in the study area

The socioeconomic characteristics of smallholder tree farmers in the study area reveal notable patterns. Male dominance in smallholder tree farming is evident, which could be attributed to the fact that women are often engaged in other domestic roles such as housekeeping, which may leave them with less time for farming, and prevailing patriarchal norms considering men as commercial farm owners. This is in line with Adesina et al.'s (2000) assertion that women's insecure land or tree rights may hinder their adoption of tree farming.

All farmers in both participant and non-participant groups were married, consistent with Anderson et al.'s (2016) findings that a significant majority of smallholder household heads in Uganda are either married or cohabiting.

Most farmers, irrespective of participation, fall within the 40–60 age range, with limited representation under the age of 40. This may be because farming is often perceived as a tedious and low-paying occupation in the area and because tree plantation investment requires significant initial costs that may be difficult for young people to afford (Deegen et al., 2011). This highlights the need for tailored financial support and risk management strategies to attract younger participants.

Almost all respondents stated that farming is their main occupation, emphasizing the importance of agriculture in Uganda's economy. This is consistent with Aggrey (2009), who stated that agriculture is the backbone of Uganda's economy, supporting 2.5 million farm families.

The presence of additional income sources like cultivation of bananas and coffee, trading and salaried jobs highlights indicate income diversification. These additional income sources enable farmers to sustain their households and manage financial obligations during the gestation period of tree farming. The cultivation of food crops like matoke also ensures household food security, while cash crops like coffee provide interim income.

Results also revealed that most farmers (78.8 %) have customary land tenure, which is consistent with the findings of Mukasa et al. (2012) and Banana et al. (2012) indicating about 70 % of the country's total forest cover is on private and customary land.

In terms of land allocated for tree growing, most farmers both participants and non-participants typically operated on plots of up to two hectares. This aligns with broader observations that African agriculture is characterized by smallholder farmers working on relatively modest plots, as noted by Felgenhauer and Wolter (2008) and ActionAid (2015). It was also observed that non-participants have considerably larger land sizes compared to participants and allocated more land to tree growing. These findings suggest that farmers with larger land sizes may not find the outgrower scheme as appealing or beneficial compared to smaller landholders.

Notably, all participants in the outgrower scheme were affiliated with a farmer-based organization (FBO), while none of the non-participants were. This pattern may be explained by the strong encouragement for outgrowers to join the Namwasa Outgrowers' Association. According to the association leader, farmers are urged to join to improve coordination and support, even though membership is not compulsory. This likely accounts for the high FBO participation among outgrowers. Additionally, some participants were already involved in other FBOs, like the Kassanda Farmers' Association, which focuses on coffee production. This prior engagement likely influenced their decision to join the outgrower scheme, as FBOs often provide valuable information and networking opportunities, making participation more appealing and feasible. This aligns with studies by Sharma (2008), Sambuo (2014), and Akuriba (2017), which found FBO membership increases the likelihood of outgrower scheme participation, likely due to improved access to information, collective bargaining, and extension services. Further research is needed to clarify whether FBO membership facilitates participation in outgrower schemes or whether it's the participation in outgrower schemes drives farmers to join FBOs.

Furthermore, most farmers did not use credit for tree farming, aligning with Anderson et al. (2016) who noted that many smallholder farmers in Uganda lack formal financial services. However, participants used external credit more than non-participants, likely because they are mandated to maintain their plantations to the company required standards which pushes them to acquire farm credits to be able to perform timely silvicultural activities. Major barriers to accessing farm credit included unavailability of loan facilities, long bureaucratic process, and high interest rates. Similar findings were reported in Zimbabwe, where farmers were unwilling to pursue loans due to the difficult administrative procedures (Cairns, 2000). Also, Desmond & Race (2000) found that

very high interest rates deterred farmers from seeking loans.

5.2. Challenges faced by smallholder farmers

Focus group discussions revealed notable gender-specific challenges: Women face significant barriers in tree farming, such as insecure land rights and heavy domestic responsibilities, which restrict their involvement in tree farming. Focus group discussions revealed that restricted land ownership limits women's ability to allocate land for tree cultivation and manage plantations effectively. Additionally, women's dual responsibilities for household chores and farming limit their time and resources for effective tree plantation management. Financial constraints further exacerbate these issues, making it difficult for them to invest in essential inputs like high-quality seedlings and agrochemicals.

Land tenure security also presents a major hurdle. The reliance on customary land tenure among many farmers complicates long-term investments in tree farming due to uncertainties in land security (Mukasa et al., 2012). The focus group discussions revealed that the lack of clear tenure rights makes farmers hesitant to invest in tree plantations, highlighting the need for improved legal frameworks and enhanced land tenure security to encourage more substantial investments in tree farming.

Limited access to formal credit is a significant barrier for many farmers, which corroborates findings by Anderson et al. (2016). Focus group discussions highlight that these financial barriers hinder their participation. Improving credit facilities and simplifying loan processes are crucial for enabling greater involvement in outgrower schemes and supporting sustainable tree farming practices.

Farmers face operational challenges such as inadequate finances for maintaining plantations and difficulties in obtaining high-quality seedlings due to a lack of reliable local nurseries. This corroborates with findings by ActionAid (2015), Kaboggoza (2011); Nabanyumya (2017), and NPA (2013). Focus group discussions also point to problems with inconsistent support from company staff and frustrations with lengthy inspection and verification processes. Addressing these operational challenges is vital for improving the overall effectiveness and appeal of outgrower schemes.

5.3. Socioeconomic factors influencing farmer participation in outgrower schemes

This study found that participation in the outgrower scheme is associated with membership in farmer-based organizations (FBOs), the purpose for the trees, and the household size. This conforms with some of the findings by Sharma (2008), Smalley (2013), and Akuriba et al. (2020).

It was revealed that the purpose for which farmers grow trees is significantly associated with their participation in the outgrower scheme, particularly when comparing growing trees for electricity transmission poles with both construction poles and timber. Farmers who grow trees for electricity poles are more likely to participate in the outgrower scheme than those growing the trees for timber purposes and construction poles. This could be attributed to the diverse market available for timber and construction poles from middlemen and nearby furniture workshops; hence, growers of trees for these purposes may find the outgrower scheme less attractive.

It was also observed that farmers with larger household sizes (above 10 members) are less likely to participate in the outgrower scheme. This may be because they have sufficient family labor to manage their farming activities. This abundance of labor reduces the financial burden typically associated with hiring farm workers, which might be a key motivation for farmers with smaller households to join the outgrower scheme.

In contrast to findings from past studies (Dhillon and Singh, 2006; Sharma, 2008; and Sambuo, 2014), certain social and demographic characteristics, including gender, age, education level, access to farm credits, type of land tenure, other sources of income, number of farm workers, land size, and the size of land allocated for tree growing, did not significantly association with farmer participation in the outgrower scheme.

5.4. Motivation factors for farmer participation in the outgrower scheme

5.4.1. Perceptions on the level of importance of various farm inputs and extension service

Our findings indicate that the most significant farm input is access to good-quality seedlings, as depicted in Fig. 6. This complements the findings of Auren and Krassowska (2004), emphasizing the importance of addressing the availability of quality tree seed and/or seedlings for smallholder farmers in Uganda, as it is a major constraint for many farmers.

Access to farm credits emerges as another key motivation factor, enabling farmers to invest in their farms and enhance their livelihoods. These findings corroborate with Bijman (2008) and Barrett et al. (2012), emphasizing that farmers' motivations to participate in such schemes are closely tied to the positive impacts facilitated by access to financial resources, and align with Barrett et al.'s (2012) perspective, highlighting the significance of financial loans for growers' participation in outgrower schemes because this can cover the costs of establishment and early maintenance of plantations and may also bridge finances until the trees are sold.

Conversely, the study found that the provision of farm tools and farm labor were ranked low in terms of their importance as perceived by the farmers. This suggests that the farmers may already have sufficient access to these resources or that they are not a major concern for them. It could also be because many farmers have small landholdings and may not need to hire labor for their farm activities as they can be managed by the family. Similarly, it is also possible that farm tools are affordable for most farmers and are not an issue of concern for them.

The study revealed that farmers consider training in planting, maintenance, and harvesting techniques as the most crucial extension service. This is consistent with the findings of Guo et al. (2005) that farmers engage in contract farming arrangements to gain access to technical assistance for improving production. This underscores the pivotal role of training and extension services in helping farmers achieve optimal production yields by providing knowledge and information on appropriate silvicultural practices that optimize the growth of plantations and minimize the risk of environmental damage to the trees.

5.4.2. Preferences for contractual arrangements

The results underscore a strong preference among most farmers for on-spot cash payment over payment-in-kind. This preference is driven by the need for timely cash payments, which help farmers meet immediate household needs (stated by farmers during FGDs). This preference suggests that farmers are more likely to participate in programs where payment is made in cash and promptly. Similar findings were observed in Ghana's cassava outgrower schemes, where on-the-spot cash payments by a private firm increased farmer participation (Poku et al., 2018). Additionally, Rudy (2010) emphasized that prompt payment to farmers, ideally within one month of produce transfer, enhances their willingness to participate in such schemes.

The results also indicated that 55 % of the farmers prefer the donation with charge as an input-securing method, while 45 % prefer purchasing the inputs at a subsidized price from the company. This underscores the significance of incorporating farmer contributions towards input costs, thereby ensuring a higher degree of commitment from farmers.

Most farmers (65 %) displayed a preference for a shared approach to covering the expenses associated with harvesting. This approach entails farmers contributing labor while the company takes care of machinery costs, as opposed to the alternative where the company fully covers the harvesting costs and deducts from the payment of wood produce. This

inclination is informed by insights gathered from FGDs, where certain farmers cited their prior experience in tree felling, rendering company harvesting unnecessary. Conversely, other farmers expressed concerns about the company imposing a standardized fee for tree harvesting, which may be much higher than their own expenses for hiring independent harvest contractors.

Almost all farmers preferred the post-harvest costs to be fully covered by the company and deducted from the payment of wood. This is because reliable transport services for bulk delivery are not affordable by most farmers, as revealed during the FGDs, making it difficult for them to deliver their wood produce to the company premises. This suggests that the company could therefore consider establishing a network of depots to facilitate the delivery of wood by farmers or paying a premium to farmer groups that bulk their produce.

Comparing the contractual preferences of participants and non-participants, it is evident that participants in outgrower schemes tend to favor more supportive arrangements provided by the company. They often opt for mechanisms that minimize their financial burden (donations with charges, fully covered harvesting costs, and company support for post-harvest costs) and prefer clear, on-spot cash payments. This underscores key motivation for their involvement in the outgrower scheme. Non-participants, on the other hand, show a greater inclination towards independence and shared responsibility, relying more on subsidized purchases and shared harvesting costs. This may indicate a greater willingness to assume financial responsibility for certain farming operations. They are also more flexible in payment modes, which could reflect their need for diverse financial arrangements.

5.4.3. Difference in farmers' preferences of the contractual arrangements across categories of farmers' social and demographic characteristics

Socioeconomic factors such as the total land size owned, land size allocated for tree growing, education level, main occupation, and the type of other income sources played a critical role in shaping farmers' preferences for contractual arrangements.

Landholding size emerged as a critical factor, with larger landowners showing greater flexibility in their payment preferences. Farmers with larger land sizes allocated for tree growing were more inclined toward payment in kind. These farmers may be more interested in receiving resources (such as equipment or labor inputs) that can be used to further expand or enhance their farming operations. In contrast, smaller landholders prioritized immediate cash payments to meet household expenses, since their family labor may be sufficient for their farming operations.

Results reveal a distinct preference for input-securing methods between farmers who are members of FBOs and the ones who were not affiliated with any FBO. Members of FBOs exhibited a strong preference for the donation-with-charge, possibly because of the information sharing inherent in their FBOs that this approach likely provides them with better access to inputs with minimal financial strain. On the other hand, the preference for non-members of FBOs was more inclined to purchasing inputs at subsidized prices. This inclination might indicate that non-members of FBOs are not familiar with methods like the donation-with-charge and therefore rely more on market-based solutions to acquire inputs; thus, purchasing at subsidized prices could be seen as a more straightforward way to obtain necessary inputs. The variation in preferences highlights the potential importance of social and organizational networks like FBOs in shaping farmers' economic decisions and preferences.

The significant association between FBO membership and input-securing preferences underscores the potential importance of social and organizational networks in shaping farmers' economic decisions and preferences. Therefore, membership in FBOs should be considered an important factor when designing outgrower schemes or similar support programs.

The observed differences in preferences for post-harvest cost coverage based on farmers' education levels reflect varying perspectives shaped by education level. Farmers with lower levels of education (those who didn't complete primary, completed primary, O'level, A'level, or attended technical schools) may view post-harvest costs as a significant financial burden. This preference suggests that these farmers may perceive the outgrower scheme as more attractive when the company assumes the post-harvest cost coverage. Conversely, farmers with higher education levels (attended university) may have additional income sources like salarized work, which would enable them to cover their post-harvesting costs.

Farmers' preferences regarding post-harvest cost coverage were also influenced by their primary occupation and additional income sources. Farmers whose main occupation was farming consistently preferred that the company fully cover post-harvest costs. This preference is likely driven by their limited financial flexibility, as farming, especially on a small scale, often yields inconsistent income, making it difficult for these farmers to manage additional expenses like transportation and delivery taxes. Covering these costs would alleviate financial pressure. On the other hand, farmers with non-farm enterprises as their main occupation demonstrated a willingness to cover their post-harvest costs. These farmers may have greater financial stability from diversified income streams, allowing them to assume more responsibility in the post-harvest process.

Apart from farmers with salaried work as an additional income source, the majority of those with other income sources preferred the company to fully cover post-harvest costs. This suggests that salaried workers, having a more predictable income, may feel more capable of managing these post-harvest expenses on their own.

6. Conclusion and recommendations

This study contributes to the broader literature on outgrower schemes in commercial tree growing in less developed countries. Specifically, it aimed to explore the operation of such schemes, assess socioeconomic factors influencing farmer participation, and examine farmers' motivations to participate in outgrower schemes. To achieve this, primary data was collected in semi-structured interviews. The information obtained was triangulated with data collected from focus group discussions and key informant interviews.

The study found that the outgrower scheme has delivered notable benefits to participants, including improved livelihoods and access to valuable training opportunities. However, participants also faced challenges, such as limited financial resources for plantation maintenance, difficulty obtaining quality seedlings, and inconsistent support from the company. Non-participants, on the other hand, were largely unaware of the scheme's benefits, highlighting the need for enhanced sensitization and better information dissemination to increase participation and awareness.

The study found that membership in farmer-based organizations (FBOs) is strongly associated with participation, and smaller household sizes (less than 10 members) are also more likely to participate in the outgrower scheme. Additionally, farmers growing trees for electricity transmission poles are significantly more likely to participate in the outgrower scheme compared to those growing trees for other purposes.

Additionally, the findings revealed that key motivations for participating in the scheme are access to good-quality seedlings, farm credits, and training in planting, maintenance, and harvesting techniques. With regards to contractual preferences, farmers expressed mixed preferences between the purchasing inputs at subsidized price and the donation-with-charge method for input-securing. Most farmers expressed a strong preference for on-spot cash payments for their wood produce over payment in kind. Most farmers also prefer sharing harvesting costs where they provide labor and the company provide machinery, minimizing deductions from their final payment and giving them more control over the process. Almost all farmers favor the arrangement where the company fully covers post-harvest expenses.

Based on the findings, there is an indication that smallholder farmers

could be supported through the development of outgrower arrangements. This approach could be complemented by efforts to raise awareness and empower farmers through fostering farmer-based organizations. Furthermore, the study's findings suggest that extending agricultural subsidies, such as access to low-interest financial loans and the provision of high-quality seedlings, could be a potential strategy to increase smallholder farmers' participation in outgrower schemes or similar initiatives.

Moreover, for the improvement of the outgrower scheme, it might prove advantageous for the company to establish well-defined written contracts with smallholder farmers. Such contracts would formalize their partnership, build trust, serve to clearly delineate the rights and responsibilities of both parties, and offer a structured mechanism for addressing potential conflicts. These contracts would also give farmers the security needed to access loans ultimately enhancing their financial stability. Additionally, revising the scheme's terms to better align with farmer preferences would improve farmer satisfaction and the overall sustainability of the outgrower scheme. For instance, most farmers prefer post-harvest transportation costs to be fully covered by the company. Establishing local depots to facilitate easier delivery of the wood produce would further reduce logistical challenges and costs. Offering more flexible options for input-securing is another key area for improvement. For instance, providing subsidies or donation-with-charge models would allow farmers to choose the payment structure that best suits their financial situation.

Although our study sheds light on the dynamics of commercial tree growing outgrower schemes in Uganda, it is imperative to acknowledge certain limitations:

The findings, while valuable, may not necessarily be representative of the rest of the tree-growing outgrower schemes in Uganda, emphasizing the need for further research to ensure comprehensive conclusions. It is also possible that some bias could not be totally avoided due to the use of non-participant farmers within the same villages and subcounties. The use of such homogeneous respondents may have resulted in a lack of variation in the measures.

Additionally, the study minimally addresses the impact of economic constraints on farmers' participation in outgrower schemes, focusing primarily on farmers' need for farm credits. Future research endeavors should address these gaps to enhance the robustness and applicability of findings in the broader context of commercial tree production in Uganda.

The study also faced significant limitations due to the COVID-19 pandemic, further impeding its scope. We encountered significant challenges related to transportation due to the prohibition of the predominant means of public transportation in the area. This restriction posed difficulties in reaching scattered farmer locations over long distances. Additionally, the timing of field data collection coincided with the growing season in Uganda, further complicating efforts to schedule interviews with farmers who were occupied with essential farm activities, such as the sowing of food crops. These combined factors highlight the practical constraints faced during the research process, affecting both accessibility to respondents and the overall execution of the study.

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CRediT authorship contribution statement

Sherry Kyamagero: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Kendisha Soekardjo Hintz:** Writing – review & editing. **Nelson Turyahabwe:** Writing – review & editing, Supervision. **Gerald Kapp:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

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

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.tfp.2024.100718.

Data availability

Data will be made available on request.

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