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Characterization of local seed business farmers marketing common bean seed in Western Uganda

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Abstract

Local Seed Business (LSB) farmers play a crucial role in improving access to affordable quality declared seed (QDS) and strengthening farmer seed sovereignty in Uganda. However, their effectiveness in common bean seed production and marketing varies across regions, and the socio-economic and geographical factors influencing this variation are not well understood. This study assessed the socio-economic characteristics of common bean LSB farmers and evaluated their influence on effectiveness in seed production and marketing in Western Uganda. A cross sectional research design using mixed method was used. Data was collected from 386 common bean seed farmers selected from 14 LSB groups. Data were gathered using questionnaires, focus group discussions and in-depth interview guides. Descriptive statistics, chi-square tests and

ordered probit regression model were used for analysis. Results showed that more men (51.8%) than women (48.1%) participated in bean seed marketing, and majority were from rural areas. Significant geographical disparities in effectiveness were observed, with Kisoro District recording the highest proportion of high effective farmers (32%) and Kamwenge dominate in the low effective category (44%). The ordered probit model revealed that women, years of active membership in LSB, and land allocated to beans increased the likelihood of being in the high effectiveness seed category. However, total land owned, and distance to district headquarters had a negative association to effectiveness. There is need to promote strategies that encourage allocation of more land to bean production and to rely on experienced farmers for effective seed production and marketing.

Key words: Effectiveness; groups, infrastructure, land ownership, mobility, socioeconomic parameters

Introduction

A projected 45% increase in global food demand by 2050 has raised concerns about the effectiveness of current strategies in meeting the growing food needs of the world population (Van Dijk *et al.*, 2021). One such approach is the establishment of reliable seed systems, which not only promote increased production of safe and nutritious food, but also prioritize the preservation of endangered biodiversity in terms of plant genetic resources and ecological systems (McKenzie and Williams, 2015; Dwivedi *et al*., 2017).

Globally, seed is a critical reproducible resource for agricultural production (Njingulula, 2014). Seed links conservation, cultivation, production, consumption and trade to the commercialization of agriculture (Mastenbroek *et al*., 2021). Despite the involvement of Local Seed Business (LSB) farmers in seed production, poor-quality seeds continue to reduce crop yields. In addition, poor quality seed hinder the ability to achieve sufficient production to meet domestic consumption and market demands (Njingulula, 2014; Essegbemon, 2020).

In Uganda, LSB farmers are market-oriented producers of quality declared seeds (QDS) that are professionally organized, technically equipped, and strategically linked to key seed sector stakeholders and institutions (Mastenbroek *et al*., 2015). These LSB farmers produce and market QDS of various crops like common beans that are neglected by certified seed companies for being less profitable (Munyaka *et al*., 2017). Outside Uganda, LSB farmer groups are also known as community seed banks, seed wealth centers, and biodiversity conservation community seed reserves (Shrestha *et al*., 2013).

Between 2012 and 2020, local seed businesses were supported by Integrated Seed Sector Development-ISSD Uganda in partnership with National Agricultural Research Organization (NARO) and Ministry of Agriculture Animal Industry and Fisheries (MAAIF) as one of the ways to ensure seed security. This was aimed at increasing farmers' access to affordable quality seed for crops like legumes that are neglected by commercial seed companies but with the potential to improve farmer's incomes, food and nutritional security. In addition, these groups were formed to promote collective action, share experiences, and provide market access to farmers (Sanginga *et al*., 2007; Kule, 2024).

In order to strengthen the relationship of the public seed research institutions with LSBs, ISSD Uganda efforts focused on LSB capacity building and the formulation of the national seed policy 2018 that recognizes farmers' role in multiplication of seed and their innovations in conservation of genetic crop resources (Brouwer *et al*., 2015). The ISSD aided the synchronization of government interests, regulations, interventions and practices relating to production and marketing of LSBs as they would fill the gap left by commercial seed companies that are more involved in production of highly profitable hybrid seeds like that of maize and some vegetable crops (Mastenbroek and Ntare, 2016). ISSD also linked LSB farmers to research centers to source foundation breeder seed, finance institutions for contractual seed multiplication business funds, and to agriculture extension workers for advisory services, market connection and quality assurance through inspection. Nevertheless, Retief and Letsosa (2018) noted that for agriculture extension services to succeed, extension workers need to understand the diversity of the individuals they work with.

According to Coe (2012), when agricultural extension workers grasp the social and economic traits of their target population, there can be gains from collaborating with development partners. They can plan, implement, and evaluate development efforts based on a shared understanding of the local geographic context and specific needs of the targeted beneficiaries. This awareness helps them address the special needs of women, youth, the elderly, and people living with disabilities (PWDs), who are often left out of agricultural development and extension efforts. Such inclusiveness leads to solutions tailored to farmers with different needs, opportunities, and specific challenges, rather than applying a one-size-fits-all approach (Retief and Letsosa, 2018). Therefore, the aim of this study was to understand how socio-economic conditions and characteristics of farmers in LSBs in western Uganda are linked to effectiveness in supply of quality declared bean seeds in western Uganda, as a basis to informing policies and interventions to improve participation and enhance development outcomes. Two guiding questions were 1) What are the social economic characteristics of LSB farmers marketing bean seed? and 2) How do socio-economic characteristics affect LSB farmer's effectiveness or lack thereof in marketing quality declared bean seeds?

Methodology

The study was conducted in Kigezi and Rwenzori sub regions of Western Uganda. In each sub region, two districts were chosen: Kabale and Kisoro for Kigezi, and Kabarole and Kamwenge for Rwenzori. These districts were selected because they have active LSB members. They also had noticeable production volumes of beans, significant LSB activities, a variety of bean types grown, and cultural diversity. Each district was divided into rural and urban LSB populations involved in marketing common bean seed. LSB farmers were chosen from rural sub counties and urban town councils where LSB farmer groups were started by efforts of NARO, MAAIF, Integrated Seed Sector Development-ISSD, and the local governments of Kabale, Kisoro, Kamwenge, and Kabarole. Focus group discussions (FGD) of selected LSB members and key informant interviews (KII) were used to gather qualitative data. All LSB members were included in a cross-sectional survey to collect quantitative data. Therefore, the study used a cross-sectional research design with a mixed methods approach. This design was selected because it is quicker, cheaper, and effective in identifying potential links between variables.

The sampling process occurred in two phases: the first phase involved selecting participants for qualitative data. These included purposive sampling of 8 to 12 LSB members for each FGD. In total, 13 FGDs were conducted across the four districts thus: Kabale (3), Kisoro (3), Kabarole (3), and Kamwenge (4). Additionally, 15 KIIs were conducted with four production staff, four community development officers, two NARO agronomists, three LSB leaders, and one loans officer to provide deep insights into the social, cultural, policy, and institutional factors affecting farmers' participation in marketing common bean seed. In phase two, given the small size of LSB farmers ranging from 25-30 members, all LSB members who were accessible from 14 LSBs were interviewed. For studies involving small populations like these LSBs, data collection from every member of the study population is recommended. This eliminates sampling error and yields more accurate and comprehensive information on socio economic characteristics (Greenwood and Robinson, 2006; Groves *et al*., 2009; Creswell, 2014). For quantitative data, a total of 420 farmers was planned for, but data was collected from 386 bean seed farmers (200 males and 186 females) representing a 92% response rate.

Data was collected through semi-structured questionnaires; focus group discussions, and in-depth interviews. Descriptive statistics (means, percentages, and frequencies), chi-square tests, and ordered probit regression were used to analyze the data. To examine the socio-economic conditions of common bean local seed business farmers, the independent variables were: age, sex, farmer experience, leadership role, land size, location; and the dependent variable was effectiveness of LSB farmers in supplying

bean seed. Effectiveness was measured at 3 levels namely; Low effective, Moderately effective and High effective based on 6 items; joint marketing, increased bean seed volumes, contract farming, market access, new bean seed varieties, and number of bean buyers maintained. And individuals who scored 4-6 items were rated as high effective, those who scored 3 items out of six items were rated as moderately effective, and an individual who scored less than 3 items was recorded as low effective.

Empirical model to determine the factors influencing effectiveness

The dependent variable was effectiveness of LSB members in supplying quality declared seed, measured at the three levels described above, as influenced by the socio-economic factors of members (Table 1). The ordered probit regression model (Greene, 2002) as outlined below was deemed an appropriate analysis to determine the relationship:

$$y_i^* = X'\beta + \varepsilon$$

$$y_i = \begin{cases} 0, \text{ if } y^* \leq 2.99 \\ 1, \text{ if } 3.0 < y^* \leq 4.00 \\ 2, \text{ if } 4.10 < y^* \leq 6 \end{cases}$$

Table 1. Variables specified in the ordered probit model

Variable description	Measurement	Expected signs	
		Low	High
Education	Years of school	-	+
Age	Years	+/-	+/-
Gender	0 = Male; 1= Female	+	-
Experience in LSB	Years of active involvement in LSB activities	-	+
HH distance to nearest LSB cooperative	Kilometres	-	+
HH distance to nearest sub county	Kilometres	-	+
HH distance to the district head quarters	Kilometres	-	+
HH distance to research station	Kilometres	-	+
Total land owned	Acres	-	+
Land allocated to crops	Acres	-	+
Land allocated to beans	Acres	-	+

This determines the level of relationship between effectiveness in seed supply and the independent variables; by converting each of the dependent variable score to a probability ranging between 0, 1 and 2:

Where: y_i^* = the dependent variable which is an individual's un observed effectiveness level.

X' =Vector of independent variables and,

ε = Error terms

Theoretical framework

This study on performance of local seed business members is informed by the theory of performance (Schechner, 2003), knowledge spillover theory (Zoltan *et al*., 2008), and sustainable development framework (Baser and Morgan, 2008). The theory of performance postulates that farmers participate in groups in order to benefit socially and economically through collective actions and performance is measured in terms of cohesion, social and economic benefits that improves their livelihoods (Schechner, 2003; Tallam,2017).

The knowledge spill over theory of entrepreneurship identifies new knowledge or innovation developed by researchers as a source of entrepreneurial opportunities, which entrepreneurs commercialize by turning new knowledge into a product of economic value or wealth. In addition, the new knowledge to translate into a profitable enterprise is also dependent on absorptive capacity of the entrepreneurs that allows them to understand new knowledge, recognize its economic value, and commercialize it by creating goods and services of economic value in multiple forms to cater for different customers (Zolton, 2008; Qian, 2013).

The sustainable development framework by Baser and Morgan (2008) posits that capacity for sustainable development is centered on five interactive capabilities in the five core capabilities framework, which are considered to play out in every organization and social system namely:1) Capability to relate and partner in scaling the innovation, 2) Capability to commit resources and act for scaling the innovation, 3) Capability to adapt and navigate challenges in scaling the innovation, 4) Capability to balance diversity and coherence among partners in scaling the innovation, and 5) Capability to make scaling the innovation work for development results.

The five capabilities are related and provide a basis for assessing performance. According to Keijzer *et al.* (2011), the ability to achieve coherence in a group is key to unlocking other capabilities to achieve group collective capacity. The sustainable

development framework will be used to assess the local seed businesses' innovations, the interaction of the actors, relationships that sustain the acquisition of knowledge, permit interactive learning, actors' relative importance in innovation processes and practices determining the propensity to innovate for sustainable engagement in local seed business group; which calls for coordinated partnerships by diverse actors in public and private sectors providing a wide range of services for the overall benefit of local seed business group and the targeted community clientele.

Results

Social economic characteristics of common bean seed farmers in western Uganda

Common bean local seed business farmers' categorical social characteristics are described based on gender, disability, location, marital status, household head LSB membership and group leadership (Table 2). By gender, more men (51.8%) than women (48.1%) participated in common bean local seed businesses. By district, men in Kamwenge District dominated LSB Member participation in bean seed business at 60.4 % followed by Kabarole at 52.38% all in Rwenzori sub region, while women were leading in Kisoro district (59.1%) and Kabale at 52.7% all in Kigezi sub region. According to FGDs, women leading in Kigezi sub region was attributed to presence of women only LSB farmer groups like Bugara women's group in Kisoro who specialise in bean seed multiplication and benefited from women entrepreneurship fund, while men dominated groups were dealing in both bean and potatoes seed multiplication. The findings reveal significant gendered difference across districts at (X^2=8.6100; p=0.035).

Overall, participation of people with disability (PWDs) in common bean local seed businesses was 11.1%: highest in Kabale (13.9%) followed by Kisoro (11.2) though not statistically significant, the findings shed some light on inclusion of PWD in Kigezi sub regions compared to Rwenzori sub region. Kigezi sub region benefited from government and non-government programs that supported special interests' groups with focus on people with disability, youth and women for gender equity.

By location, common bean LSB farmers were found to be more in rural areas (54.15%) compared to urban areas (45.15%). Kisoro district was leading with more rural farmers at 97.1% followed by Kabale 65.7% in Kigezi Sub region, while Kamwenge district had 95% of its farmers in urban town councils followed by Kabarole (43%) in Rwenzori Sub region. The differences were significant (X^2=95.020; p=0.000; Table 2).

Table 2. Social economic characteristics of common bean seed farmers in western Uganda

Categorical	Description	Kamwenge (n=144)	Kaborole (n=63)	Kabale (n=108)	Kisoro (n=71)	Overall N=386	X2/Ch Value	Sign.
Gender	Male (F)	87	33	51	29	200	8.61	0.035
	%	60.42	52.38	47.22	40.85	51.81		
	Female	57	30	57	42	186		
Disability	Yes (F)	14	6	15	8	43	1.1705	0.76
	%	9.72	9.52	13.88	11.26	11.13		
	No	130	57	87	63	343		
	%	90.27	90.47	80.55	88.73	88.86		
Location	Rural (F)	49	20	71	69	209	95.02	0.000
	%	34.03	31.75	65.74	97.18	54.15		
	Urban	95	43	37	2	177		
	%	65.97	68.25	34.26	2.82	45.85		
Marital status	Monogamous (F)	87	33	84	33	237	40.2485	0.000
	%	60.42	52.38	77.78	46.48	61.4		
	Polygamous(F)	22	13	3	15	53		
	%	15.28	20.63	2.78	21.13	13.73		
	Single(F)	12	10	8	4	34		
	%	8.33	15.87	7.41	5.63	8.81		
	Divorced (F)	9	5	2	5	21		
	%	6.25	7.94	1.85	7.04	5.44		
	Widowed (F)	14	2	11	14	41		
	%	9.72	3.17	10.19	19.72	10.62		

Table 2. Contd.

Categorical	Description	Kamwenge (n=144)	Kaborole (n=63)	Kabale (n=108)	Kisoro (n=71)	Overall N=386	X2/Ch Value	Sign.
HH-membership	Man only (F)	49	19	29	5	102	36.9428	0.000
	%	34.03	30.16	26.85	7.04	26.42		
	Woman (F)	32	19	40	19	110		
	%	2.22	30.16	37.04	26.76	28.5		
	Both (F)	52	21	32	36	141		
	%	36.11	33.33	29.63	50.7	36.53		
	Both Children (F)	11	1	5	7	24		
	%	7.64	1.59	4.63	9.86	6.22		
	Woman &children	0	3	2	4	9		
	%	0	4.76	1.85	5.63	2.33		
Group leadership	yes	31	24	39	34	128	16.8554	0.001
	%	21.53	38.1	36.11	47.89	33.16		
	No	113	39	69	37	258		
	%	78.47	61.9	63.89	52.11	66.84		

F = frequency

Common bean local seed businesses were dominated by married monogamous families (61.4%) followed by polygamous (13.7%) and widowed (10.6%). Kabale had the highest number of monogamous LSB farmers, Kabarole had the highest number of the polygamous, and Kisoro had the highest number of the widowed who viewed participation in collective bean seed multiplication and marketing as means to overcome their vulnerability and increase their bargaining power for better prices and gain support from government and NGO programs. Marital status was highly significant (X^2=840.25, $p < 0.001$; Table 2).

Household membership in common bean local seed businesses was highest with both husband and wife as members (36.5%), followed by women only (28.5%), and then men only (26.4%). Kisoro had the highest joint membership of husband and wife while Kamwenge had more men dominated membership with significant difference (X^2= 36.94, $p < 0.000$; Table 2).

Overall, 33.1% LSB members reported that they had ever participated in group leadership compared to 66.84% who had never participated in group leadership. Kisoro had the highest proportion of farmers in leadership positions (47.89%), followed by Kabale (36.11%) and Kabarole (38.1%). Kamwenge lagged behind at 21.53%. The difference in LSB member participation in group leadership was significant (X^2=16.8554; P=0.001; Table 2).

Kabale and Kisoro Districts in Kigezi sub region had the eldest common bean LSB farmers; while Kabarole and Kamwenge in Rwenzori sub region had the youngest common bean LSB farmers. Age difference across districts was significantly different (F-test = 15.494, p-value = 0.000; Table 3).

Kabale district had the most highly experienced seed farmers in bean seed marketing with average experience at 28 years, followed by Kisoro at 25.1 years, then Kamwenge at 24.6 years, and to the least experienced were in Kabarole district at 21.2 years. The difference in years of experience were highly significant (F-test =25.14; P=0.000; Table 3).

Kabarole and Kamwenge Districts in Rwenzori sub region had significantly the most educated common bean LSB Farmers while the women-dominated LSB farmers in Kisoro were the least educated, followed by Kabale in Kigezi sub region (F-test 20.57, P=0.000; Table 3).

There was no significant employment difference among LSB farmers across districts (F-test =1.507; P = 0.212) suggesting similar livelihood diversification where majority

Table 3. Individual characteristics of common bean local seed business farmers

Variables	District	N 386	Mean	SD	Mix	Max	Mean dependant variance	F -test	P-value
Age	Kabale	108	53.806	13.853	23	88	49.803	15.494	0.000
	Kabarole	63	40.333	12.316	18	67			
	Kamwenge	144	49.431	12.02	25	82			
	Kisoro	71	52.873	14.984	20	80			
Farm experience	Kabale	108	28.074	14.757	2	65	25.14	0	0.000
	Kabarole	63	21.222	12.293	4	65			
	Kamwenge	144	24.646	10.846	3	60			
	Kisoro	71	25.155	13.897	3	52			
Education	Kabale	108	7.056	3.955	0	15	8.254	20.57	0.000
	Kabarole	63	10.317	4.119	1	20			
	Kamwenge	144	9.431	4.176	0	21			
	Kisoro	71	5.859	4.065	0	20			
Employment	Kabale	108	1.713	1.326	0	7	1.847	1.507	0.212
	Kabarole	63	2.048	1.862	0	10			
	Kamwenge	144	2.007	2.182	0	10			
	Kisoro	71	1.549	1.402	0	6			
HH head's age	Kabale	40	56.625	12.312	30	79	53.718	1.421	0..241
	Kabarole	12	51.75	11.169	37	72			
	Kamwenge	26	51.308	9.723	30	63			
	Kisoro	25	52.52	12.289	32	79			

farmers in both Rwenzori and Kigezi regions mentioned beans, potatoes and peas as their staple food and source of livelihood.

The age of a household head was equally not significantly different across districts (F-test=1.42; P=0.241) with Kabale with an average household age at 56.6 years, Kisoro at 52.5 years, Kamwenge at 51.3 years and Kabarole at 52.7 years (F-test =1.421; P=0.241).

To access foundation seed from NARO Zonal centres, LSB farmers in Kisoro District Kigezi sub region travelled the longest distance of approximately 80.6 km (Table 4). These move to Kachwekano Zonal Agricultural Research Development Institute (KAZARDI) located in Kabale District. The LSB farmers in Kamwenge district travelled approximately 74.3 km to Rwibitaba Zonal Agricultural Research Development institute (RWEZARDI) located in Kabarole District with significant difference across districts of (F-test=235.018; p=0.000). Regarding distance, sometimes LSB farmers acquire foundation seed direct from bean breeders at Namulonge National Crop Resource Research Institute (NaCRRI) or NARO holdings located in Kampala thus increasing transport cost. To support the common bean LSB farmers acquire foundation seed, ISSD linked LSB farmers to zonal agriculture research institutes in Rwebitaba ZARDI for sourcing foundation seed in Rwenzori region and Kachwekano ZARDI in Kigezi region for sourcing foundation seed for both common bean and potatoes. However, LSB farmers in Kamwenge and Kisoro still reported that these ZARDIs are still far making them spend much on transport costs; and it's a double pain when farmers have pooled their money for foundational seed only to reach ZARDI and be told there is no seed for them. One LSB farmer in Kamwenge District had this to say; "The zonal agriculture research centre at Rwebitaba in Kabarole District is still far for us to source foundation seed; sometimes we go there to buy foundation seed and do not find it available," from FGD at Kaburisoke, in Kamwenge Town Council, Kamwenge District.

Similar distance disparities from LSB famer homes to market places, agro input shops, District and sub county headquarters were observed to negatively affecting access of markets, agro-inputs and agriculture advisory services like inspection of seed gardens by agricultural officers and MAAIF inspector for quality assurance.

Influence of social demographic factors on the effectiveness of farmers marketing bean seed

The results showed that LSB farmers were more effective in Kisoro District with 32% of its farmers classified as effective which is the highest score across districts with a balanced distribution of 34 % among moderately effective and low effective (Table 5). Kabale district had 13% of its LSB farmers as effective second to Kisoro

Table 4. Structural factors affecting LSB farmers marketing common bean seeds

Variables	District	N 386	Mean	SD	Mix	Max	Mean dependant variance	F -test	P-value
Produce market	Kabale	108	11.093	10.418	1	29	6.211	33.624	0.000
	Kabarole	63	2.425	2.41	0.75	8			
	Kamwenge	144	4.923	4.098	0.1	31			
	Kisoro	71	4.761	1.94	1	10			
	Kabale	108	2	7.757	0	56	3.652	8.651	0.000
	Kabarole	63	3.373	9.34	0	74			
	Kamwenge	144	5.738	4.924	0.3	50			
	Kisoro	71	2.183	2.87	0	10			
Home LSB	Kabale	108	4.469	31.166	0	325	3.115	0.515	0.672
	Kabarole	63	2.047	1.87	0.5	7			
	Kamwenge	144	3.29	3.215	0.1	18			
	Kisoro	71	1.648	0.965	0	5			
Home input	Kabale	108	11.602	11.047	1	33	6.509	29.082	0.000
	Kabarole	63	3.883	6.279	0.125	30			
	Kamwenge	144	4.764	3.185	0.5	14			
	Kisoro	71	4.634	1.801	3	10			
Research centre	Kabale	108	61.875	17.771	0.5	80	64.469	235.018	0.000
	Kabarole	63	27.984	7.406	3	79			
	Kamwenge	144	74.399	12.201	4	89.75			
	Kisoro	71	80.648	8.548	48	94			

Table 5. Local seed farmers' effectiveness in bean seed marketing (386)

District	Farmers' effectiveness in bean seed marketing			Total	chi value	Sign
	Low effective	Moderately effective	Effective			
Kabale(F)	38	58	14	110	36.174	0.000
%	34.	53	13	100		
Kamwenge(F)	63	70	11	144		
%	44	49	7	100		
Kabarole(F)	22	40	2	64		
%	34.	63	3	100		
Kisoro(F)	23	23	22	68		
%	34	34	32	100		
Total	146	191	49	386		
%	38	49	13	100		

F = frequency

District with majority of its farmers classified as moderately effective in bean seed marketing at 53% but 34% classified as low effective. Although Kamwenge had the highest number of LSBS farmers, they were mostly distributed between moderately effective (49%) and low effective (44%) and only 7% classified as high effective. Kabarole District LSB farmers only had 3% of the farmers as high effective, 63% were moderately effective and 34% were found to be in low effective level (Table 5). A high statistical significance difference (X^2= 36.17; p=0.000) in effectiveness across districts highlights geographical inequalities in bean seed marketing. Kisoro District stand out as a high performing District while other districts especially Kabarole shows high performance gaps that requires deliberate district specific interventions that are essential to promote common bean seed marketing and take full advantage of current available market. Overall farmer involvement in bean seed marketing was moderately effective at 49%, followed by 38 % in low effective, and only 13% were found to be effective. Kigezi sub region performed better than Rwenzori Sub region.

Results of the ordered probit showed sex, active years in LSB, and land allocated to beans by the LSB member increased the likelihood of being in the high effectiveness category (Table 6). However, total land owned and distance to district headquarters had a negative association as detailed below.

Table 6. Factors influencing effectiveness of farmers marketing quality declared bean seed

Variable	Oprobit model		Marginal effects of Effectiveness levels		
	Coef.	St.Err.	Low	Moderate	High
Sex: base male	0.27**	0.123	-0.101**	0.055**	0.046**
Age in years	0.001	0.005	-0.001	0.000	0.000
Education (years of school)	0.01	0.016	-0.004	0.002	0.002
LSB active years	0.055***	0.012	-0.021***	0.011***	0.009***
LSB leadership: base no position	-0.285**	0.13	0.106	-0.058**	-0.048**
HH distance to nearest LSB cooperative (kilometres)	0.014	0.01	-0.005	0.003	0.002
HH distance to the district headquarters (kilometres)	-0.016***	0.006	0.006***	-0.003***	-0.003***
HH distance to nearest sub county (kilometres)	-0.03	0.021	0.011	-0.006	-0.005
HH distance to research station (kilometres)	-0.006*	0.003	0.002	-0.001*	-0.001*
Total land owned (acres)	-0.091***	0.031	0.034***	-0.019***	-0.015***
Land allocated to crops (acres)	0.056	0.066	-0.021	0.011	0.009
Land allocated to beans (acres)	0.154**	0.065	-0.057**	0.031**	0.026**
cut1	-0.597	0.504	-0.2	0.061	0.139
cut2	1.086	0.508	0.108	-0.033	-0.075
Pseudo r-squared		0.110		No of obs	386
Chi-square		82.841		Prob > chi2	0.000

*** = p<.01, ** = p<.05, * = p<.1

Land ownership and allocation

The unit increase in the amount of land owned by the member reduced the chances of having high and moderate effectiveness by 0.02 percentage points. However, a unit increase in land allocated to beans increased the likelihood of being in moderate and high effective category by 0.03 percentage points. Total land owned was negatively correlated with marketing effectiveness, while land specifically allocated to beans

wass positively correlated, indicating that specialization in bean production enhances seed marketing outcomes.

District to headquarters

A unit increase in distance to the district headquarters reduced the chances of moderate and high effectiveness level of supply of seed by an insignificant 0.003 percentage points. Long distance to district headquarters significantly reduces marketing effectiveness, highlighting the role of proximity to administrative and market centers in seed commercialization.

Sex

Females were less likely to be in the low effective category by 0.1 percentage points compared to men but were more likely to be in the moderate and high effective category by 0.05 percentage points. Sex of the household head significantly influences marketing effectiveness of quality declared bean seed, with male-headed households more likely to achieve higher effectiveness level.

Active years in LSB

A unit increase in years of active membership in LSB increased the likelihood of one being in the high effective category by 0.01 percentage points and less likely to be in the low category by 0.02 percentage points. Length of active participation in Local Seed Businesses (LSBs) strongly and positively affects marketing effectiveness, underscoring the importance of sustained engagement in farmer organizations

LSB leadership

People in leadership position were 0.1 and 0.05 percentage points less likely to be in the moderate and high level effectiveness, respectively. The negative relationship may suggest that leadership responsibilities may divert attention from direct marketing activities

No significant association was observed on the variables of age, education, distance to cooperative and land allocation to other crops (Table 6).

Discussion

Social economic characteristics of common bean seed farmers in western Uganda

Results showed that more men (51.8%) compared to women (48.1%) participated in common bean local seed businesses. According to the FGDs, this was attributed to more men compared to women owning land, and with ability to pay for LSB

membership fee and source foundation seed from NARO for multiplication. This observed gender difference in participation echoes findings from studies on gendered access to agricultural resources (Meinzen-Dick *et al*., 2011) who found that women often face constraints related to time, mobility, and social norms, which limit their engagement. Gender-inclusive programming, including flexible scheduling and female-led initiatives, has shown promise in enhancing women's participation according to African Union-AU's gender equality and development report (AU, 2025). Kamwenge district LSBs were the most male dominated (60.42%) and whereas Kisoro had the most females (59.15%). LSBs where women were dominant are those that received support from a women entrepreneurship fund. These findings suggest gendered patterns in seed systems influenced by cultural norms, land access and ownership. This aligns with Doss (2001), who notes that gender roles in African agriculture are highly localized, with women often managing subsistence crops while men dominate commercial farming.

Age differences of LSB members were significantly across districts. Farmers in Kabale and Kisoro Districts, mainly women, were older and more experienced but with lower education levels. This may point to potential resistance to change and challenges with text-based communication in favor of peer learning and field based practical demonstration learning. Kabarole and Kamwenge in Rwenzori sub region had the youngest common bean LSB farmers. From the focused group discussions in Kabarole less experienced LSB farmers who joined Local seed business towards the closure of ISSD program need more external support in form of seed production materials and training in marketing skills, business ethics, maintaining and how to maintain old customers, quality seed production skills and construction of seed stores. Though younger, Kabarole and Kamwenge districts farmers were more educated farmers and may be more receptive to text based communication and use of information communication technology (ICT) tools in agricultural knowledge transfer in regard to seed marketing.

Marital status differed significantly across districts with monogamous households dominating in Kabale (77.78%) while polygamous and widowed households are more common in Kisoro. Marital status influenced labour availability and decision making. Studies show that polygamous households may have more labour but also face intra-household resource competition (Fafchamps and Quisumbing, 2005). Widowed households, often female-headed, may be more vulnerable but also more autonomous in agricultural decisions. The success of female-led local seed business farmers in Kisoro and Kabale Districts to a large extent is attributed to women autonomy in decision making, rights over family labour allocation and membership in groups which attracts funding from government projects like WEP- women entrepreneurship fund and capacity building trainings from NGOs and other government

agencies. The influence of marital status on participation highlights the intersection of social identity and agricultural engagement. Polygamous and divorced farmers experience social exclusion to community networks, as noted by Kabeer (2005) and Quisumbing and Maluccio (2003).

There was a highly significant difference in the rural-urban distribution of LSB farmers with Kisoro having an overwhelmingly rural population (97.18%), while Kamwenge and Kabarole had predominantly urban respondents (65.97% and 68.25%, respectively). Kabale presented a more balanced distribution. These disparities reflect the geographic and infrastructural diversity of the districts and may influence access to markets, extension services, and agricultural inputs. The stark contrast in rural-urban distribution especially of Kisoro's 97.18% rural representation shows spatial heterogeneity of seed systems. Rural farmers typically rely more on traditional seed systems and are less integrated into formal markets (Tripp, 2001) while urban farmers who were more prevalent in Kamwenge and Kabarole, have better access to inputs and information, influencing their adoption of improved seed varieties. This supports the Rogers diffusion theory, which suggests that proximity to information centres accelerates innovation uptake (Rogers, 2003). Lower active participation among rural households reveals geographic inequities in agricultural extension service delivery and marketing which aligns with research on rural service delivery gaps (Chambers, 1994) emphasizing that investments in infrastructure and extension services are critical to bridging rural-urban divide and fostering equitable access.

Education levels did not significantly vary among districts. The lack of a significant influence from education may suggest that technical knowledge alone does not drive participation. This supports arguments by Scoones (1998) that contextual and relational factors such as trust, relevance, and accessibility are more influential in shaping participation in community development activities, and there is a need for context-sensitive planning and addressing spatial, gender, and social barriers in order to enhance participation and contribute to sustainable development (Badstue *et al.,* 2020).

Disability status did not differ significantly across districts. Overall, 11.13% of respondents reported having a disability. The uniformity in disability prevalence suggests that physical ability may not be a major differentiating factor in participation in bean seed farming across the region. However, previous studies emphasize that disabled farmers often face hidden barriers in accessing extension services and labour support (Groce *et al.*, 2011). The relatively low proportion of disabled farmers (11.13%) may, therefore, reflect underreporting or structural exclusion from agricultural programs.

Household membership structure varied significantly among districts. The most common configuration was joint male-female membership (36.53%), with Kisoro showing the highest proportion of such households (50.7%). Households headed solely by men were more prevalent in Kamwenge (34.03%), while female-only households were more common in Kabale (37.04%). The presence of children in household leadership was minimal but highest in Kisoro (9.86%). These dynamics influence labour allocation, income diversification, and resilience strategies. The variation in household composition with Kisoro showing a higher proportion of joint male-female leadership suggests differing family dynamics and labour mobilization strategies. Households led by both adults tend to have better agricultural outcomes due to shared responsibilities (Ellis, 2000). The presence of child-headed households, though minimal, raises concerns about vulnerability and long-term sustainability of farming practices.

Participation in group leadership roles was significantly different across districts, with the majority not having been in leadership positions. Kisoro had the highest proportion of farmers in leadership positions (47.89%), followed by Kabale (36.11%) and Kabarole (38.1%). Kamwenge lagged behind at 21.53%. The significant differences in group leadership participation reflect disparities in social capital and organizational engagement. Kisoro had most farmers participating in leadership and least participation in LSB leadership was in Kamwenge. For Kisoro, it was due to regular change in leadership through election following the LSB constitution, whereas for Kamwenge, FGDs indicated that the low leadership turnover was due to retaining good performing group leaders in fear of group disintegrating when leaders are changed, and failure to conduct elections in some local seed business groups attributed to some members not being interested in leadership, not knowing how to read and write, and some opting to form new LSB groups from existing ones.

Local seed business farmers' effectiveness in bean seed marketing in Western Uganda
The findings of this study reveal significant variation in the effectiveness of LSB farmers in bean seed marketing across districts in Western Uganda as influenced by socio-economic conditions/characteristics. This aligns with the broader research findings on seed system development in Uganda, which emphasizes the uneven performance of local seed businesses due to disparities in market access, training, and institutional support (ISSD Uganda, 2020).

Sex of the household head significantly influences marketing effectiveness of quality declared bean seed, with male-headed households more likely to achieve higher effectiveness levels but females less likely to be in the low effective category. The FGDs indicated that female bean seed farmers were shown to be more likely to save seed and sell it at higher prices, collectively, while males sold more quantities,

individually. These findings suggest underlying gender dynamics in seed sourcing, saving, pricing, and marketing that warrant further qualitative exploration and targeted policy interventions. This finding aligns with prior studies that highlight gender disparities in agricultural commercialization, where men often have more access to resources, networks, and decision-making power. However, it also underscores the need to address structural barriers that limit women's participation in seed markets.

In Kabale and Kamwenge districts, the majority of farmers were categorized as low or moderately effective, with only 13% and 7%, respectively rated as effective. This may reflect challenges posited by Tinsley *et al*. (2019) who found that while LSBs have improved seed availability, their market penetration remains limited, and many farmers lack the capacity to scale up marketing activities. Kamwenge's high proportion of low-effective farmers is attributed to infrastructural constraints especial lack of roads that are passable through the year, few storage facilities and limited access to formal markets in rural areas. Nankya *et al.* (2021), reported that proximity to markets and income from bean sales significantly influences marketing success. Kabarole district showed a strong leaning toward moderate effectiveness (63%), but only 3% of farmers were highly effective. This is in line with the findings of Otieno *et al.* (2020), who argue that while training and group formation improve seed production, marketing effectiveness may be often hindered by weak linkages between producers and buyers.

Ordered probit model on relationship between socio-economic factors and effectiveness of LSB members in seed production and marketing

Kisoro district stood out with 32% of farmers rated as effective, the highest among all districts. This may reflect successful implementation of farmer training programs and better integration into seed value chains. Districts with active farmer groups and access to preferred bean varieties such as NABE 15 and NABE 4 tend to perform better in seed marketing (ISSD, 2020). The results reinforce the need for district-specific strategies to enhance seed marketing effectiveness. As emphasized by Tinsley *et al*. (2019) and Nankya *et al*. (2021), strengthening farmer capacity, improving market access, and fostering institutional support are critical for scaling up the impact of local seed systems.

The non-significant effect of members age on marketing effectiveness aligns with findings by Mponela *et al.* (2020), who observed that age was not a consistent predictor of seed marketing performance among smallholder farmers in Malawi. On the other hand, the negative association between farming experience and marketing effectiveness echoes the work of Ouma and De Groote (2011) who noted that experienced farmers often rely on traditional practices, which may hinder adoption of modern marketing strategies. This aligns with a growing body of literature advocating

for farmer-centred, context-specific interventions that address logistical and informational barriers rather than relying solely on demographic characteristics.

This study revealed considerable location disparities in bean seed marketing effectiveness among LSB farmers. While some Districts like Kisoro demonstrate promising performance, others such as Kamwenge and Kabarole lag behind, probably due to structural and capacity-related constraints. Therefore, improving seed marketing effectiveness requires a shift from demographic targeting to structural and institutional support. By investing in cooperative infrastructure, decentralizing services, and tailoring training, Uganda can unlock the full potential of its local seed businesses. The significant negative impact of distance to sub-county headquarters supports the conclusions of Okello *et al.* (2018), who emphasized that proximity to extension services enhances farmers' access to market information and training, thereby improving seed marketing outcomes. Furthermore, the strong positive influence of proximity to cooperatives is consistent with the findings of Tripp and Rohrbach (2001), who highlighted the role of farmer organizations in facilitating aggregation, branding, and market access for quality seed.

Land ownership was found to be negatively associated with marketing, highlighting a need for targeted interventions that bridge production and marketing. The unexpected negative relationship between larger size of land ownership and bean seed marketing effectiveness reflects the diversification strategies of larger landowners, as suggested by Sperling *et al*. (2013), who found that increased production does not automatically translate into marketing success without adequate post-harvest handling and institutional support. In Kamwenge it was observed that having more land increased one's chance to abandon seed production in favour of grain bean production and marketing while in Kisoro and Kabale having small pieces of land was a motivation to adopt high yielding climbing bean varieties and intensify the use of fertilizer and pesticides to minimise loses. However, the amount of land allocated to bean seed showed a positive relationship indicating that the more land available to bean production, the more effective an LSB member supplied seed for the market. This implies that individuals that focus on individual seed enterprises prioritise production for marketing purposes, also implies that having more land is associated with diverse enterprises with limited focus on seed production due to these competing land uses.

Conclusion

The socio-economic characteristics of common bean seed Local Seed Businesses (LSBs) farmers was marked by significant inter-district variation in gender, location, marital status, household composition, and leadership roles. Sex of the household head significantly influenced marketing effectiveness of quality declared bean seed,

with male-headed households more likely to achieve higher effectiveness levels. Years of active participation in LSBs strongly and positively affected marketing effectiveness, emphasizing the importance of sustained engagement in farmer organizations. Holding leadership positions in LSBs was negatively associated with marketing effectiveness, suggesting that leadership responsibilities may divert attention from direct marketing activities. Long distance to district headquarters significantly reduced marketing effectiveness, highlighting the role of proximity to administrative and market in seed commercialization. Total land owned was negatively correlated with marketing effectiveness, while land specifically allocated to beans was positively correlated, indicating that specialization in bean production enhances seed marketing outcomes. Marketing effectiveness is less about traditional indicators like age or land size and more about access to institutional support, deliberate land allocation, experience and value addition services.

Recommendations

1. There is a need to promote gender-inclusive seed system interventions by supporting collective marketing models for women and improving bulk sales efficiency for men.
2. Policy makers should formalise and reorganize leadership structures in local seed business groups to balance administrative responsibilities with effective seed marketing, including rotational or shared leadership models.
3. Policymakers and extension services should establish decentralized seed marketing hubs and strengthen local administrative structures closer to farming communities, while investing in rural infrastructure such as roads and transport services, to reduce distance-related barriers and improve farmers' access to markets for effective seed commercialization.
4. Further qualitative studies on gender dynamics and socio-cultural factors influencing seed sourcing, saving, pricing, and marketing to inform targeted interventions.

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