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Assessment of the Viability of Small-Scale Irish Potato Farming in Jos-South, Plateau State: An Economic Analysis

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Abstract

This study examines the socio-economic characteristics, production efficiency, and profitability of small-scale Irish potato farmers in Jos-South Local Government Area of Plateau State, Nigeria. In specific terms the study described the socio-economic characteristics of small-scale Irish Potato farmers, determined relationship between production inputs and output, and determined the cost, returns and profitability of small-scale Irish potato production in the study area. A survey of 150 farmers revealed a largely young, married, and female workforce with diverse educational backgrounds and varying dependence on personal savings. The Cobb-Douglas production function regression analysis showed significant relationships between land, labour, and fertilizer inputs and Irish potato yield. However, decreasing returns to scale prevail, indicating Stage II production. Labour constitutes the highest production cost (55.63%), yet Irish potato production remains profitable (₦102,010.02 net farm income/ha). The study recommends efficient resource allocation, labour-saving technologies/training, and improved credit access to enhance productivity and profitability. Policymakers and stakeholders can utilize these findings to support sustainable agricultural development and food security in Nigeria.

Keywords: small-scale farming, Irish potato production, socio-economic characteristics, production efficiency, profitability, Nigeria.

Introduction: The viability of small-scale Irish potato farming in Nigeria is crucial for ensuring food security, generating income, and promoting sustainable agricultural development. As a staple crop, Irish potatoes (*Solanum tuberosum*) play a vital role in Nigeria's agricultural sector, with Plateau State, particularly Jos-South Local Government Area, offering favourable climate and soil conditions for production (Ogunlela and Mukhtar, 2017). Despite its potential, small-scale Irish potato farming in Nigeria faces numerous challenges, including inadequate resource utilization, low productivity, and limited profitability (Adebayo and Okuneye, 2016). These challenges are often exacerbated by factors such as inadequate access to credit facilities, inefficient farming practices, and lack of modern technology (Oladele, Oladejo, and Ogunwale, 2017). According to the Food and Agriculture Organization (FAO) (2017), small-scale farmers account for approximately 70% of Nigeria's agricultural output. However, these farmers often struggle to optimize resource use, leading to suboptimal production levels and reduced profitability. Various strategies can address these challenges, enhancing the performance of small-scale Irish potato farmers in Nigeria. To address these challenges, training and capacity-building programs can be tailored specifically for these farmers. Such initiatives can equip them with modern farming techniques, improve their understanding of sustainable agricultural practices, and enhance their ability to manage resources efficiently (Pierrette, Coulibaly, Du, and Diakité, (2021). Furthermore, facilitating access to credit facilities is essential for empowering farmers to invest in necessary inputs such as quality seeds, fertilizers, and irrigation systems (Ibrahim and Ogunbayo, 2019). Microfinance institutions and agricultural cooperatives could play a pivotal role in offering affordable credit options that cater to the unique needs of small-scale producers.

By ensuring that farmers have the requisite financial support, productivity and profitability could see substantial improvement. The adoption of technology also presents a significant opportunity for small-scale Irish potato farmers. Integrating modern agricultural technologies, including precision farming tools, pest and disease control systems, and improved storage methods, can help minimize post-harvest losses and optimize yields (Okeke, Mbah, Madukwe, and Nwalieji, (2020). The government and non-governmental organizations can collaborate to provide farmers with access to these technologies through subsidies, free training sessions, or partnerships with tech companies specializing in agriculture. Establishing market connections and cooperative structures can significantly improve the negotiating capacity of small-scale farmers, ultimately leading to more favourable prices for their products (Ma, Rahut, Sonobe, and Gong, 2024). By connecting farmers directly with consumers and larger markets, they can bypass intermediaries, thus maximizing their profits. Establishing these networks not only empowers farmers economically but also encourages the sustainable development of the agricultural sector in Nigeria. This study aims to bridge the knowledge gap by conducting an economic analysis of small-scale Irish potato production in Jos-South Local Government Area, Plateau State.

The specific objectives of the study are to:; describe the socio-economic characteristics of small-scale Irish Potato farmers in the study area.; determine relationship between production inputs and output.; determine the cost, returns and profitability of small-scale Irish potato production in the study area.

Methodology: The study was conducted in Jos South Local Government Area, Plateau State, Nigeria. The area has 510 km², with its headquarters in Bukuru, located at 9°48'N latitude and 8°52'E longitude. Jos South has a cool climate, with two major seasons: rainy (April-October) and dry (November-March). Temperatures range from 18°C to 24°C. Farming is the primary occupation, with other activities including mining, civil service, and craftsmanship. The study employed a multistage sampling technique to select the respondents. First, Jos South Local Government Area was purposively selected due to its prominence in Irish potato production. Then, a stratified random sampling technique was employed to select 150 farming households from three districts in Jos South Local Government Area: Vwang, Kuru, and Du. The districts were selected based on their prominence in Irish potato production. The sample size was allocated to each district based on their population size, with 60 questionnaires distributed in Vwang, 50 in Kuru, and 40 in Du. A structured questionnaire was administered to the selected respondents. Out of the 150 questionnaires distributed, 135 were retrieved and found usable for analysis. The retrieval rates for each district were 57 (95%) in Vwang, 45 (90%) in Kuru, and 33 (82.5%) in Du. Descriptive statistics, regression analysis, gross margin analysis, and marginal analysis were used for analyses. Multiple regression models were used to analyse the relationship between variables. Net Farm Income (NFI) NFI = Gross Margin (GM) - Total Fixed Cost (TFC). Measures of Farm Financial Success was done by Gross ratio (GR), operating ratio (OR), and fixed ratio (FR) were used. Economic Efficiency of Resource Use Efficiency ratio (r) = Marginal Value Product (MVP) / Marginal Factor Cost (MFC) Technical Efficiency of Resource Use elasticity of production (EP) measured the rate of return to scale.

Results and Discussions: Table 1 shows the respondents' age distribution, with 42.2% aged 41-50, 31.1% 31-40, 15.6% 51-60, and 10.3% 21-30. The mean age is 40.9 years, indicating that 83.7% are under 50, while 16.3% are above. These findings suggest that small-scale farming in Nigeria, including Irish potato farming, is dominated by relatively young and experienced farmers. The dominance of young and experienced farmers in small-scale farming, including Irish potato farming, could be attributed to government initiatives promoting youth participation in agriculture, economic opportunities provided by small-scale farming, family influence, and access to land. These factors combined may have encouraged young people to take up farming as a career. This is consistent with the Federal Ministry of Agriculture and Rural Development's (2016) national agricultural policy objective, which aims to promote youth participation in agriculture and recognizes the importance of engaging young people in farming to ensure the sector's sustainability and growth. However, the relatively low percentage of farmers above 50 years old in this study (16.3%) is lower than the national average reported by the National Bureau of Statistics (2020), which found that 25.6% of small-scale farmers in Nigeria were above 50 years old. This suggests that the Irish potato farming sector in Jos South Local Government Area may face a succession crisis in the future if younger farmers are not encouraged to take over from older farmers.

The study revealed that most of the respondents (55.6%) were females, while 44.4% were males, as shown in Table 1(a). This contrasts with Oyedeji et al.'s (2020) findings in Oyo State, where 58.2% of farmers were male. However, our study's female dominance aligns with Adesina, Mbabaali, and Akinwumi (2019) observation that women play significant roles in agricultural production in Nigeria. The predominance of female respondents (55.6%) suggests that Irish potato production in the study area is a female-dominated enterprise. This gender distribution may be attributed to the cultural dynamics of the respondents' community and the relatively low labour requirements associated with Irish potato cultivation.

Table 1: Socio-economic Characteristics of Small-Scale Irish Potato Farmers

Variables		Frequency	Percentage
Age	21-30	14	10.3
	31-40	42	31.5
	41-50	57	42.2
	51-60	21	15.6
	61-70	1	0.7
	Total	**135**	**100**
Sex	Male	60	44.4
	Female	75	56.6
	Total	**135**	**100**
Marital status	Single	7	5.2
	Married	107	79.3
	Divorced	13	9.6
	Widow	8	5.9
	Total	**135**	**100**
Family size (no)	1-5	33	25.4
	6-10	77	59.2
	11-15	19	14.6
	20-25	1	0.8
	Total	**130**	**100**

Highest Level of education	Religious education	10	7.4
	Adult education	35	25.9
	Primary education	33	24.4
	Secondary education	41	30.4
	Tertiary education	16	11.9
	Total	**135**	**100**
Source of finance	Personal savings	100	74.1
	Loan	9	6.7
	Friends and relatives	26	19.3
	Total	**135**	**100**
Farm size (ha)	0.1-0.5	68	50.4
	0.6-1.0	55	40.7
	1.1-1.5	10	7.4
	1.6-2.0	2	1.5
	Total	**135**	**100**
Source of labour	Family	25	18.5
	Hired	25	18.5
	Both	85	63.0
	Total	**135**	**100**

Source: Field Survey, 2023.

Table 1 also shows the marital status of respondents: 79.3% are married, 9.6% divorced, 5.9% widowed, and 5.2% single. This finding is consistent with Yakubu et al.'s (2019) study in Kaduna State, where 83.5% of farmers were married. Similarly, Olajide et al.'s (2018) research in Ekiti State reported a high proportion of married farmers. The dominance of married respondents suggests that couples in Irish potato production can share risks, make joint decisions, and utilize additional labour for increased profitability. The majority of the respondents (59.2%) have a family size of 6-10 members. This is followed by 25.4% with a family size of 1-5 members, and 14.6% with a family size of 11-15 members. Only 0.8% of the respondents have a family size of 20-25 members. The relatively large family sizes among the respondents may have implications for labour availability and food security. Larger family sizes can provide more labour for farming activities, which can be beneficial for small-scale farmers. However, it can also lead to increased pressure on the family's resources, including land, food, and income. This large family size can be attributed to the high percentage of married respondents (79.3%) and the prevalence of early marriage and polygamous families in the area. The use of family labour could play a significant role in reducing production costs associated with hired labour, which supports the findings from Olajide et al. (2018) and Yakubu et al. (2019) on the significance of family labour in small-scale farming.

The result presents the distribution of small-scale farmers based on their highest level of educational attainment. The results show that 7.46% possess religious education, 25.9% have adult education, 24.4% have primary education, 30.4% have secondary education, and 11.9% have tertiary education. This finding supports Ajewole et al.'s (2020) observation that farmers possess varying levels of educational attainment. Education is crucial for gaining knowledge and skills; as highlighted by Oyinlola et al. (2018), it improves decision-making, information use, innovation adoption, and management abilities. The educational attainment of small-scale farmers as presented in Table 1 shows that 7.46% have religious education, 25.9% have adult education, 24.4% have primary education, 30.4% have secondary education, and 11.9% have tertiary education. This aligns with Ajewole et al.'s (2020) finding of diverse educational levels among farmers. According to Oyinlola et al. (2018), education is vital for acquiring knowledge and skills, which enhance decision-making, information use, innovation adoption, and management capabilities.

Table 1 reveals that 74.1% of farmers in the study area rely on personal savings to finance their production, while 19.3% and 6.7% rely on contributions from friends/relatives and loans from cooperatives/money lenders, respectively. This preference for personal savings may stem from difficulties in accessing financial institutions, which often require excessive documentation and collateral (Nwosu et al., 2020). Moreover, farmers may lack the necessary collateral to secure loans (Odoemenem et al., 2019). The farm size distribution among respondents shows that 91.1% are small-scale farmers, operating on less than 1 hectare of land. Specifically, 50.4% cultivate 0.1-0.5 hectares, 40.7% cultivate 0.6-1.0 hectares, 7.4% cultivate 1.1-1.5 hectares, and 1.5% cultivate 1.6-2.0 hectares. This finding aligns with Ajewole et al. (2020), who reported that most smallholder farmers in Nigeria cultivate less than 1 hectare. Olajide et al. (2018) also found similar farm size distributions in Ekiti State, Nigeria. The small farm sizes may be attributed to land fragmentation, limited access to credit, and high demand for land for non-agricultural purposes. Despite these challenges, small-scale farmers contribute significantly to food security and rural development in Nigeria.

Table 1 shows that 91.1% of respondents cultivate between 0.1 and 1.0 hectares of potatoes, indicating that most are small-scale farmers. At this scale, farmers can manage their farms with minimal hired labour, facilitating better supervision. This finding aligns with Ajewole et al. (2020), who noted that small-scale farmers typically cultivate limited land areas. The small landholdings are characteristic of African tenure arrangements (Manyong et al., 2018). Table 1 also presents the distribution of respondents by labour type. Nigerian agriculture is predominantly labour-intensive (Oyinlola et al., 2018). The results show that 63% of respondents use both family and hired labour, 18.5% use family labour only, and 18.5% use hired labour only. This labour distribution may be attributed to the limited availability and affordability of mechanization (Adesina et al., 2019). This finding supports Olajide et al.'s (2018) observation that small-scale farmers often rely on family labor due to the prohibitively high costs of hired labour.

Table 2: Cobb-Douglas Production Function Regression Estimates for Irish Potato Production Inputs and Output

Variable	Coefficients	Standard Error	t-ratio
Constant term (a_o)	6.316	0.460	13743**
Farm size	0.591	0.079	7.505***
Labour	0.174	0.086	2.037**
Seeds	0.037	0.066	0.572^{NS}
Fertilizer	0.166	0.088	1.892**

Source: Field Survey 2023. *****=significant P<0.05, ***=significant P<0.01***
Ns=not significant
*F – Ratio=82.79*** R^2 = 0.718, R^{-2} =0.709*

production in the study area

Cost Items	Cost/ha	Percentage
Labour	78,986.91	54.89
Fertilizer	26,332.52	18.30
Seeds	22,820.87	15.86
Transportation cost	8,061.36	5.60
Purchase of empty bags	2,384.00	1.66
Herbicides	1,384.32	0.94
Total Variable Cost (TVC)	**139,933.98**	**97.25**
(3250 @ N800.00 per kg)		
Fixed costs items		
Big hoe	1,797.97	1.25
Sprayer	1036	0.72
Small hoe	607.31	S0.42
Rake	300.65	0.21
Cutlass	219.00	0.15
Total Fixed Cost (TFC)	**3,961.60**	**2.75**
Total cost of production	**143,895.58**	**100.00**
Gross Farm Income (GFI)	**260,000.00**	
Net Farm Income (NFI)	**116,104.42**	

Field Survey, 2023.

The Cobb-Douglas production function regression analysis reveals a coefficient of determination (R^2) of 0.718, indicating that 72% of the variation in Irish potato yield is explained by land, labour, seeds, and fertilizer inputs (Alene et al., 2020). The F-ratio (82.79) is significant at the 1% level, confirming the joint significance of the explanatory variables.

The estimated regression equation is:

$Y = 6.316 + 0.591X1 + 0.174X2 + 0.037X3 + 0.166X4 + e$

The regression coefficients, standard errors, and t-ratios are presented in Table 2. Positive coefficients for land (0.591), labour (0.174), and fertilizer (0.166) indicate that increases in these inputs, ceteris paribus, will increase Irish potato output. Elasticity values reveal that a 1% increase in land, labour, and fertilizer will increase output by 0.59%, 0.17%, and 0.17%, respectively. All coefficients, except seeds, are statistically significant at $P < 0.05$. This aligns with Olajide et al. (2018), who found farm size, labour, and fertilizer significant in agricultural production. Decreasing returns prevail for each input, indicating small-scale Irish potato farmers operate in Stage II of the production function.

Table 3 presents the cost, returns, and profitability analysis of small-scale Irish potato production in the study area. The returns to scale, calculated as the sum of elasticity of production with respect to all inputs, was 0.968. This indicates that a 1% increase in all inputs would result in a 0.968% increase in total product, suggesting decreasing returns to scale among small-scale Irish potato farmers (Khan et al., 2015). The study employed a farm budgeting model to estimate costs, returns, and net farm income. Table 1 shows the various cost components, with total costs of production amounting to ₦143,895.58 per hectare. Variable costs (labour, seeds, fertilizer, herbicides, transportation, and empty bags) accounted for 97.77% of total costs, while fixed costs (depreciation on durable assets) accounted for 2.23%.

Table 3: The cost, returns and profitability analyses of small-scale Irish potato

Table 3 presents the cost, returns, and profitability analysis of small-scale Irish potato production in the study area. The results show that the total variable cost (TVC) was ₦139,933.98, accounting for 97.25% of the total cost of production. Labour costs constituted the largest proportion of TVC, amounting to ₦78,986.91 (54.89%). Other significant variable

costs included fertilizer (₦26,332.52, 18.30%), seeds (₦22,820.87, 15.86%), and transportation costs (₦8,061.36, 5.60%).

The total fixed cost (TFC) was ₦3,961.60, representing 2.75% of the total cost of production. The major fixed costs included big hoe (₦1,797.97, 1.25%), sprayer (₦1,036, 0.72%), and small hoe (₦607.31, 0.42%). The total cost of production was ₦143,895.58. The gross farm income (GFI) was ₦260,000.00, resulting in a net farm income (NFI) of ₦116,104.42. The positive net farm income (NFI) indicates that Irish potato production in the study area is highly profitable. The result implies that small-scale Irish potato farmers require efficient resource allocation, labour-saving technologies/training, and improved access to credit facilities to mitigate decreasing returns to scale and high labour costs. This study is consistent with Bamidele's (2008) findings on cassava-based production systems, which also reported high labour costs and the need for efficient resource allocation and labour-saving technologies. Additionally, the study's results align with those of Okeke, Mbah, Madukwe, and Nwalieji, 2020), who found that small-scale sweet potato farmers in Nigeria faced similar challenges related to high labour costs and limited access to credit facilities. The findings of this study also support the national agricultural policy objective of promoting youth participation in agriculture, as outlined by the Federal Ministry of Agriculture and Rural Development (2016).

Conclusion: The assessment of the viability of small-scale Irish potato farming in Jos-South, Plateau State, reveals that despite the challenges faced by farmers, the enterprise is economically viable. The study's findings indicate that with efficient resource allocation, labour-saving technologies, and improved access to credit facilities, small-scale Irish potato farmers can enhance their productivity and profitability. Therefore, policymakers and stakeholders should prioritize support for small-scale Irish potato farmers to ensure the sustainability of the sector and contribute to food security in the region.

Recommendations: Farmers should be encouraged to join farmer cooperatives to enhance collective bargaining power, improve market access, share best practices, and establish accessible credit facilities with flexible repayment terms to support small-scale farmers in acquiring essential inputs. This supports small-scale farmers in acquiring essential inputs, ultimately boosting productivity and profitability. To boost small-scale Irish potato farming in Jos South, stakeholders should promote youth engagement through training and empowerment programs, support women's participation through targeted initiatives, advocate for family-based farming systems to reduce labour costs, and improve access to formal education and vocational training for farmers at secondary and tertiary levels. This enhances productivity, profitability, and sustainability, benefiting local communities and the agricultural sector. The National Agricultural Extension and Research Liaison Services (NAERLS), the Department of Agricultural Economics and Extension at the University of Jos, and other relevant stakeholders should simplify financial institution requirements to facilitate loan access for farmers, establish community-based savings schemes and cooperatives to reduce reliance on personal savings, and provide microfinance options for small-scale farmers. To improve financial accessibility for small-scale Irish potato farmers in Jos South. To enhance agricultural development, the government and agricultural research institutes should implement land consolidation programmes, promote mechanization, and support research on improved Irish potato varieties and farming practices. To enhance agricultural productivity, the Plateau State Government, Agricultural Research Institutes, and stakeholders should strengthen agricultural extension services, providing regular training on farm management, innovation adoption, and decision-making, and encouraging peer-to-peer learning among farmers.

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