

## Assessing The Profitability And Constraints To Irish Potato Production In Plateau State, Nigeria

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**Abstract:** Profitability is a major consideration for any entrepreneur and a driver of investment. This study assessed the profitability of Irish potato production in Plateau State, Nigeria. A multistage sampling technique was employed to select 180 respondents. Data were analyzed using descriptive statistics and gross margin analysis. The return on naira invested was estimated at ₦0.29 kobo. The mean output of potato in the area was 3,742.8kg per hectare. Labour utilization for potato production also revealed high variability. The mean labour utilized by respondents was 4.25 man-days per hectare while the maximum was as high as 545.33 man-days per hectare. About 65% of the total variable cost was expended on seed at the cost of ₦215,263.3/ha. The gross margin of the potato enterprise was ₦95,986.86 /ha. The RNI was ₦1.29. The study further shows that high costs of inputs, inadequate credit facilities, pests and diseases, lack of security were major constraints to Irish production in the study area. It is therefore recommended that; improved extension teaching and training methods can help farmers enhance their productive capacities and therefore raise their profitability. Frequency and quality of extension can improve technical and productive capacities of the farmers thereby leading to higher yield and invariably more revenue; adoption of modern technologies and use of improved Irish potato varieties including improved seedlings can raise the productivity levels of Irish potato farmers and increase their profitability.

**Keywords:** Assessment, profitability, constraints, Irish potato, production

### I. INTRODUCTION

In Nigeria, the harvested area of Irish potato is 345.2 thousand hectares. Production in Nigeria is as high as 1,284,368 tons while yield is 3,720.1 kg/ha (FAOSTAT, 2019). More than 85% of the potato production in Nigeria is done by smallholder farmers who maintain small farms and carry out their operations manually with traditional farm tools, like hoes and machetes. The land is cleared and the thrash burnt. Ridges or flats are made depending on whether it is rain-fed or irrigated potato production. Only about 36% of farmers use tractors (Okonkwo *et al.*, 2009). Irish potato has great potential in both national and regional markets, due to growing demand for chips and snacks/crisps (Anderson,

2008). However, market functions such as assembling, grading and transport do not match with production which is increasing to meet the expanding consumer demands for Irish potatoes (Nyunza and Mwakaje, 2012).

The potato is a very profitable crop in Nigeria. A number of studies (Zaknayiba and Mamman, 2016; Jwanya *et al.*, 2014; Sani *et al.*, 2015; Magit, 2015) have given credence to the potato as a profitability cash crop in the country. Typically, farm gate prices differ from prices in other areas and most often prices are affected by distance from production and the scarce value of the product in the face of huge demand. The Irish potato has become a much-desired food crop in contemporary Nigeria. Irish potato should be a major food security crop but Nigeria's production level does not

match up with her demand. Nigeria produced 1,363,358tons in 2018 (FAOSTAT, 2019). Despite contributing 15% of Africa’s population, Nigeria contributed a mere 5% of the total output of 26,041,721tons produced in Africa (FAOSTAT, 2019). This deficit in demand has been addressed through imports. It has been observed that national output of Irish potato in Nigeria is attributed to low productivity. The productivity has remained low with yield per hectare averaging 3.7tons compared with 13.7tons and 20.1 tons in Africa and the world respectively (FAOSTAT, 2019). This low productivity is believed to be caused largely by technical inefficiencies. Therefore, despite the fact that some studies have been carried out in selected areas of Plateau state previously, an in-depth and a more current assessment of the profitability In Irish potato production in Plateau state, Nigeria is required in a broader study area as assessing profitability by a single local government area does not give a representation of the whole area, and hence this study covering the entire state.

The study sought to assess the profitability in potato production and in effect recommend and escalate the economic benefits of Irish potato enterprise as a means of poverty reduction. The research focused on the following objectives; describing the socioeconomic characteristics of the Irish potato farmers; estimate the profitability of Irish potato production; and, identifying the constraints to Irish potato production.

## II. MATERIALS AND METHOD

### DESCRIPTION OF STUDY AREA

This study was conducted in Plateau State, Nigeria. The study area is located in the middle belt of Nigeria. It has a land mass of approximately 30,913km<sup>2</sup> and has a population of 3.2 million inhabitants (NPC, 2006). It is located between latitude 08° 24<sup>1</sup>N and longitude 008° 32<sup>1</sup> and 010° 38<sup>1</sup> east. The State Comprises Seventeen Local Government Areas (LGAs). It is bounded in the North East with Bauchi State and in the South West with Nasarawa State. The State is mainly an upland zone, rising above 250 metres above the sea level. The State enjoys tropical Climate with two distinct seasons. These are the rainy season (April – October) and the dry season (November – March). Tropical forest exists in the South, while Guinea Savannah Occupies the northern peripheries. The main cash crops grown in the area aside Irish Potato include maize, yam, rice, cassava, guinea corn, apples, grapes, wheat, barley and many other exotic crops. (Gambo *et al.*, 2017). Plateau State has a near temperate climate with an average temperature of between 13 and 22°C. The warmest temperatures usually occur in the dry season months of March and April while the coldest weather is between December and February. The mean annual rainfall varies from 131.75cm in the Southern part to 146cm on the Plateau and the highest rainfall is recorded between the months of July and August.



Figure 1: Map of Nigeria showing Plateau State

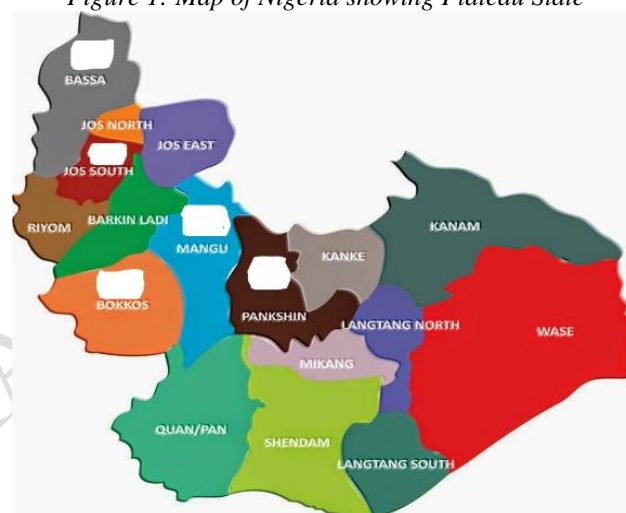


Figure 2: Map of Plateau State highlighting five local governments

### SAMPLING TECHNIQUE AND SAMPLING SIZE

A total of 180 farmers were selected using multistage random sampling techniques and used for the research. The first stage involved the purposive sampling of 5 LGAs out of the 17 LGAs in Plateau State based on their productivity level in potato farming. The selected LGAs are; Bassa, Bokkos, Jos South, Mangu, and Pankshin. The second stage involved the selection of 2 communities with the highest potato production levels were purposively sampled from each LGA giving a total of 10 communities, while in the final (3<sup>rd</sup>) stage, 15% of the respondents were selected randomly from the 10 communities across the 5 LGAs to make a total of 180 respondents and this served as the sampling frame. The lists of the potato farmers from each of the selected LGAs were obtained from Plateau Agricultural Development Programme (PADP)

### DATA COLLECTION/ANALYTICAL TECHNIQUE

Primary data were collected using a structured questionnaire procedure. Data collected include socioeconomic data, data on farmers’ inputs and outputs. The inputs included seed, herbicides, fertilizer and pesticides.

Descriptive and inferential statistics were utilized for the analysis of data collected. Objective I and II were achieved using simple descriptive statistics like mean, frequency and percentage, while objective III was computed using gross margin analysis.

**SPECIFICATION:**

**GROSS MARGIN ANALYSIS**

Gross Margin Analysis, according to Olukosi and Erhabor (1988), is a useful tool in situations where fixed capital is a negligible portion of the farm enterprise as is the case in smallholder Irish potato farming. A gross margin refers to the total income derived from an enterprise less the variable costs incurred in the enterprise. The Gross Margin model is of the form:

$$GM = GI - TVC.$$

Where:

GM = Gross Margin of the Irish potato enterprise in naira per hectare

GI = Gross Farm income of the Irish potato enterprise in naira per hectare. This is the total physical product multiplied by the unit price of the product at the prevailing price.

TVC = Total Variable Cost of the Irish potato enterprise in naira per hectare (cost incurred on the variable inputs: seed, herbicides, pesticides, fertilizer, labour and transportation.)

Similarly, the Gross farm income was determined as:

$$GI = \sum Y_i * pY_i$$

Where:

$Y_i$  = various units of harvested Irish potato.

$pY_i$  = unit price of the various components of harvested Irish potato.

**III. RESULTS AND DISCUSSION**

**SOCIOECONOMIC ATTRIBUTES OF RESPONDENTS**

**AGE:** The mean age of 44 years while 36.7% of the respondents were between 40 and 50 years old being the modal class. This infers that the respondents were relatively young but are actually heading toward old age. The implication of this result is that, with fair level of youthfulness, respondents have the potential of reaching greater levels of technical efficiency.

**ANNUAL INCOME FROM IRISH POTATO:** The farmer with the least income earned ₦45,600, with the highest earner getting ₦4,924,800. The mean annual income of the respondents was ₦624,777.0. This means that the respondents were relatively stable income earners. Table 1 shows the frequency distribution of annual income divided into four classes while the mean income was calculated per respondent. Olalekan and Eyitayo (2015) reported that average arable crop farming household income was about ₦900, 000 per annum in Ekiti State Nigeria. Income equality is important in determining inefficiency. Todaro and Smith (2009) revealed that income inequality can lead to economic inefficiency. In this type of situation only a few of the crop farmers can efficiently determine the viability of the rural economy by

their financial power. This implies that only the high-income earners in an economy can reach optimum levels of technical efficiency.

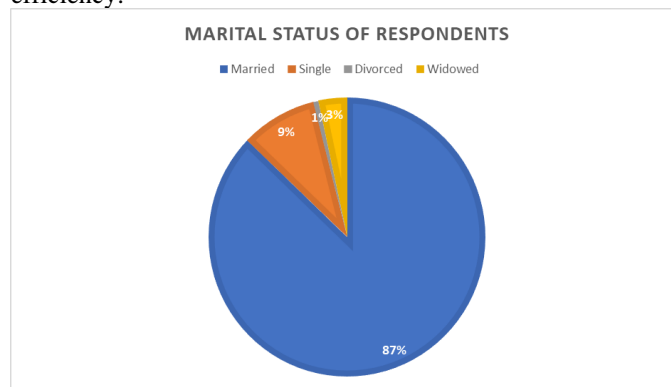


Figure 3

**MARITAL STATUS:** Majority (87.2%) of the respondent were married while 8.9% of the respondents were single. About 0.6% was divorcees and 3.3% of the respondents were widowed. As majority of the respondents had stable family units and a balanced social system, Matanmi *et al.* (2011) advanced that this could improve decision-making in technology adoption, production and domestic life. This is reasonable fact to suggest that marital status may have influence on the technical efficiency of the farmer.

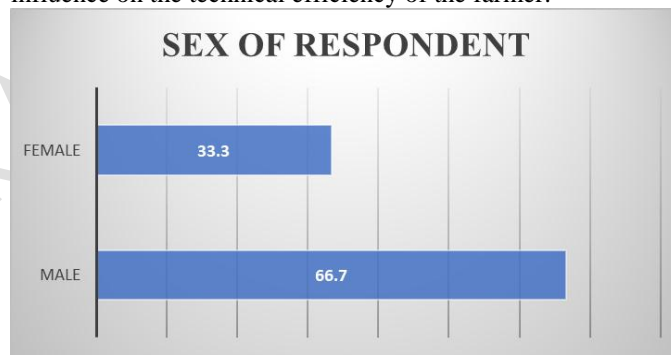


Figure 4

**GENDER:** A good number (66.7%) of the respondents were male while 33.3% were female. The result revealed that there were more men than women producing Irish potatoes in the study area. This depicts the typical case of dominance of men over women in agricultural settings. Zaknayiba and Mamma (2016) reported 70% male and 30% female farmers. Hudu *et al.* (2018) reported 62.5% males and 37.5% females in their study while Jwanya *et al.* (2014) reported that 84.17% of their respondents were male, thus agreeing that men dominate women in agriculture.



Figure 5

**FARM SIZE:** The smallest farm size in the study area for Irish potato production was 0.05 hectares and the largest was 3

hectares. The average size of land under potato cultivation in the study area was 1.5 hectares. The total land area cultivated by the respondents was 263.57 hectares. Most (51.1%) of the farmers had less than 1-hectare of land. The implication of the finding is that the respondents were smallholders. Ogundari and Ojo (2007) previously affirmed that agriculture in Nigeria is characterized by smallholders typically ploughing 0.05 to 3.0 hectares of land area. Umar *et al.* (2017) observed that farm size was significant to technical efficiency. The mean farm size reported by Ojo (2005) was 3 hectares.

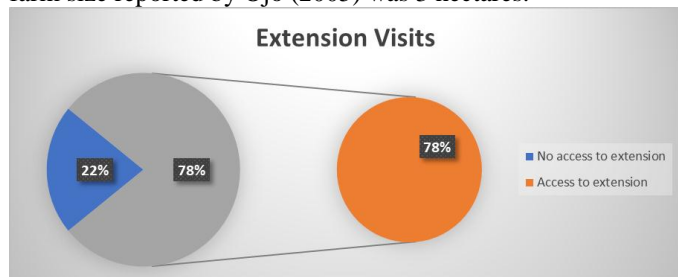


Figure 6

**EXTENSION VISITS:** Majority (78.3%) of the respondents had access to extension while 21.7% had no access to extension services. This result is similar to the finding of Obi-Egbedi and Gulak (2019) who reported 75.4% access to extension. Greater extension contact implies increased exposure to the knowledge of technical skills and expertise on innovations that can improve technical efficiency. Asiabaka (2002) has advanced that extension can be viewed from three important dimensions; they are educational component, economic dimension and social dimension. Okwu and Ejembi (2001) have, however, reported that extension delivery in Nigeria is marked by a myriad of problems. The public agricultural development programme (ADP) has produced below its mandate with most farmers receiving one visit per annum or none at all.

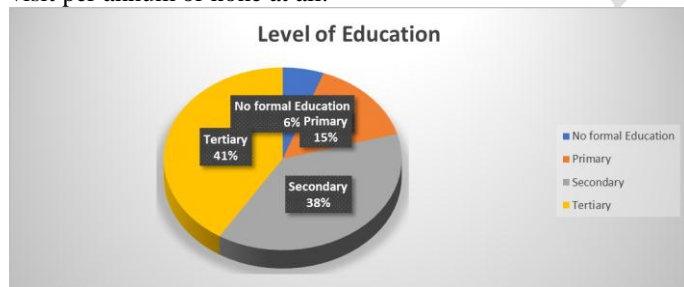


Figure 7

**LEVEL OF EDUCATION:** The result shows that most (41.1%) of the respondents had acquired tertiary education. About 38% of the respondents had acquired secondary education and 15% of the respondents had primary education. Respondents with no formal education were the smallest category with about 5% of the respondents. The result infers that the population has attained a fair level of formal education as most of the respondents have attained tertiary education level. Ballara (1991); Ezeibe (2011) and Okoronkwo *et al.* (2009) have found strong correlation between productivity and a farmer's level of education. Typically, education provides an individual the capacity to understand and apply technical skills and adopt innovations as well as maximise the potentials of available technology.

**HOUSEHOLD SIZE:** The minimum household size in the study area for Irish potato production was 3 persons while the maximum was 18 house members. The mean household size was 8 persons. The household size in the area was large as most (66.1%) of the respondents had between 6 and 10 persons in their households. Another 20% had between 1 and 5 persons in their households and 12.2% had 10 – 15 individuals in their household. The category with the highest number of household members (more than 15 people) was represented by 1.7% of the respondents. There is significant correlation between household size and labour supply as most rural dwellers prefer to have large households that can provide labour for their farms. Oluwatayo *et al.* (2008) have asserted that larger household sizes provide the required family labour and reduce the cost utilized for hired labour. Nevertheless, Ike and Oboh (2009) have found correlation between large household size and poverty. Mbanasor and Kalu (2008) and Bhatt and Bhatt (2014) found household size significantly related to technical efficiency. Past findings show household sizes of 8 persons (Hudu *et al.*, 2019), 11 people by Obi-Egbedi and Gulak (2018) while Ojo (2005) reported household size of 6 persons.

**FARMING EXPERIENCE:** The farmer with the least experience had 2 years while the maximum experience was 45 years. The average farming experience recorded in the study was 16 years. This means that there was high experience among the respondents about potato farming. Most (47.2%) of the respondents had, however, farming experience of 1 – 10 years. About 27% had farming experience of 11 – 20 years while 13.3% had farming experience between 21 and 30 years. The highest range of farming experience (above 30 years) had only 12.2% of the respondents and was the smallest category. The mean here is not significantly different from past studies, Obi-Egbedi and Gulak (2019) reported 18 years mean farming experience. Ojo (2005) also reported 18 years farming experience. Greater levels of farming experience can improve the farmers' ability to make decisions and incorporate new technologies. Girei, *et al.* (2018) found evidence that farming experience influences individual farmer's perception and understanding of the management requirements and consequently improved farm produce. It also help in innovating farmers understanding in improving the quality of farmers output.

Factor	Frequency	Percentage	Mean
<b>Age</b>			
18 – 28	10	5.6	44 years
29 – 39	60	33.3	
40 – 50	66	36.7	
51 and Above	44	24.4	
Total	180	100.0	
<b>Annual Income (₦)</b>			
<b>from Irish potato</b>			₦624,777.0
250,000 and less	43	23.9	
251,000 – 500,000	40	22.2	
500,100 – 750,000	48	26.7	
751,000 and Above	49	27.2	
Total	180	100.0	
<b>Household size</b>			

1 – 5	36	20.0	8 persons
6 – 10	119	66.1	
11 – 15	22	12.2	
Above 15 persons	3	1.7	
Total	180	100.0	
<b>Farming experience</b>			
1 – 10	85	47.2	16 years
11 – 20	49	27.2	
21 – 30	24	13.3	
Above 30	22	12.2	
Total	180	100.0	

Source: Field Survey, 2019

Table 1: Socioeconomic characteristics of respondents

### PROFITABILITY ANALYSIS OF POTATO ENTERPRISE

Profitability analysis of the potato enterprise shows the breakdown of costs and benefits derived from the enterprise by potato farmers in the study area Table 3. Though the farmers' revenue varies, however the computed average total revenue was ₦ 426,679. 29. Table 3 further revealed that the calculated total variable cost (TVC) were ₦ 330,692.43. Breaking down the total variable costs showed that about 65% of the cost was expended on seed which was estimated at ₦215,263.3, and this was followed by the cost of fertilizer with a mean cost of ₦54,087.38 and accounted for 16.4% of the total variable cost (TVC). Further, labour consumed 12.4% of the TVC and had a mean cost of ₦41,004.0. Mean cost of transportation was computed at ₦ 13,331.01 and attracted for 4% of the TVC. The gross margin of the potato enterprise was computed to be ₦95,986.86 /ha, and this is the difference between the total revenue obtained and operating expenses incurred. Similarly, the operating ratio (OR) was calculated to be ₦1.29 indicating that Irish Potato production is profitable in the study area. The Return per Naira (RNI) was computed to be ₦1.29. This infers that ₦0.29 was profited on every ₦1 invested and this result further affirmed that potato enterprise is profitable and could serve as a vehicle for sustainable poverty reduction, in addition to its multiplier effect of steady wealth creation and employment generation. This enterprise if given the required and desired attention will help in ensuring food security and human security. Incongruent to this finding, a previous study by Jwanya *et al.* (2014) analysed the profitability of Irish potato production in Plateau State and arrived at higher RNI of ₦2.64 and a sensitivity ratio of 2.16 with a gross margin of ₦655,637.88. Also, in another study by Wuyah and Yusuf (2015) a positive gross margin of ₦93,642.90 was found in the study which was carried out in Zaria, Kaduna State, Nigeria. Similarly, Ojo (2005) also found NFI of ₦41,615 in his study on the economic analysis of potato production in Plateau State, Nigeria.

Variable cost	Unit	Average quantity	Price/unit	Cost (₦/ha)	Percentage
i. Seed	Kg	841.7	255.75	215,263.3	65.1
ii. Fertilizer	Kg	616.24	87.77	54087.38	16.4
iii. Herbicide	Litres	2.29	1,436.78	3290.22	1.0
iv. Pesticide	Litres	2.29	1,622.29	3715.04	1.1
v. Fertilizer	Kg	616.24	87.77	54087.38	16.4
vi. Labour	Mandays	24.12	1700	41004	12.4

vii. Transportation	₦	13,331.01	1	13,331.01	4.0
2. Total variable cost (TVC) = (i+ii+iii+iv+v+vi+vii)	₦/ha			330,692.43	
3. Output (P*Q)	Kg	3742.81	114	426,679.29	
4. Gross Margin (TR-TVC)	₦/ha			95,986.86	
Operating ratio (TR/TVC)				1.29	
Returns per naira invested = (TR/TVC)				1.29	

Source: Field survey, 2019

Table 3: cost and return from Potato production (₦/ha)

### CONSTRAINTS TO POTATO PRODUCTION

The constraints to respondents' potato production are presented in Table 4. The most important constraint identified by the respondents was high cost of inputs and it was ranked 1<sup>st</sup> with a multiple score of 96.7%. This was followed by inadequate credit facilities, ranked 2<sup>nd</sup> as reported by 93.9% of the respondents. The 3<sup>rd</sup> constraint was pest and diseases selected by 89.4% of the respondents. Lack of security on the farm (81.1%) was the 4<sup>th</sup> most important constraint identified by the respondents.

The 5<sup>th</sup> most important constraint was high cost of credits facilities. Credit facilities have continued to be high and hard to access to the agricultural sector. The sector was only able to access 4.02% of formal credits in Nigeria as at the third quarter of 2019 (Udegbumam, 2019). This low access to formal credits is even an improvement from what it was in 2008 where it was reported to be as low as 1% (CBN, 2008). Formal credits in Nigeria are characterized by collateral requirements and mostly two-digit interest rates both criteria are hard for farmers to meet given their resource and financial levels.

Furthermore, poor price of potato (75.6%) was reported to be the 6<sup>th</sup> constraint. Farm gate prices are usually less than the final prices that middlemen sell the potatoes for industrial use and consumption by big consumable organizations like restaurants and hotels as well as high consuming eateries. Smallholder farmers often accept poor prices for their potato once the sales broker convinces them that their produce is low in quality (Oppong-Yeboah, 2015; Mangisoni, 2006). Poor prices can also be related to poor infrastructural network required for the evacuation of the produce from farms to the areas where required, in addition to the fact that Irish potatoes are imported in very high quantity into Nigeria. Nda-Isaiah (2017) reported that Nigeria lost ₦76 billion every year to the importation of Irish potato. These huge sums would have been used to improve the Irish potato industry in Nigeria and providing better income for farmers and significant employment across the potato value chain. Shiferaw *et al.* (2006) also reported that smallholder farmers usually prefer farm gate prices because they are immediate and will help the farmers not to incur extra cost on marketing and transportation.

Soil fertility as a problem was identified by 74.4% respondents as the 7<sup>th</sup> constraint. Declining soil fertility has been a problem in Nigeria and is intensified by climate change and extreme weather conditions in the country. Nigeria is one of the countries with high declining soil fertility (FAO, 2001).

There is no clean-cut Nigerian government policy on land planning act that protects rich farm lands from being converted into sites for other purposes (Teminski, 2012).

Non-availability of tractors (73.9%) was the 8<sup>th</sup> constraint identified by respondents. This is especially important because potato production is a labour-intensive operation and requires a lot of energy. There are about 35,000 units of tractors in Nigeria; the Country's tractor density put at 0.27 hp/ha is far below the Food and Agriculture Organisation (FAO)'s 1.5hp/hectare recommended tractor density especially in view of increasing population and the imperative to produce more food.

The 9<sup>th</sup> constraint identified was inadequate improved seeds (66.7%). Smallholder farmers' access to improved planting material is usually low. Aheisibwe *et al.* (2015) identified high cost of seeds, absence of clear seed delivery system and limited information are some of the barrier to smallholder farmers accessing improved Irish potato seeds.

Distance from the market was identified by 65.5% of the respondents and ranked 10<sup>th</sup>. This is a constraint as many smallholder farmers are not willing to incur extra cost transporting potato tubers to potential markets (Shiferaw *et al.*, 2006). Distance from the farm was identified as the 11<sup>th</sup> constraint and was posted by 63.9% of the respondents. This is usually a constraint because fertile lands are found in more interior areas of locality. Possibly because farms located in the interior areas may be more fertile due to irregular cultivation than those farm lands that are within accessibility and vicinity of the respondents.

Inadequate knowledge about potato production (60.0%) was the 12<sup>th</sup> constraint identified by respondents. This is often as a result of weak linkage between extension and smallholder potato farmers. The absence of knowledge of modern Irish potato production techniques is a limiting factor of the productivity potentials of potato production in the country. Adetimehin *et al.* (2018) reported a strong correlation between access to extension and knowledge of improve agriculture and increased farmers productivity.

Drought (58.9%) was the 13<sup>th</sup> constraint to potato production identified by respondents. Due to climate change and extreme variability in rainfall patterns the occurrence of flood was observable in the area and had the potential to impact on potato production. Eze (2018) found that agriculture is being currently constrained by the frequency of droughts in certain parts of Nigeria.

Inadequate labour (55.6%) was the 14<sup>th</sup> identified constraint reported by respondents. As there is increasing migration of abled-bodied youths to urban centres getting farm labour was constrained and it had a telling and souring effect on the output of respondents. Lack of extension visits (51.7%) was the 15<sup>th</sup> constraint to Irish potato production identified by the respondents. Yu and Mwangi, (2014) have hypothesized that agricultural extension has consistently played the role of economic diversification, increasing yield and income of farmers. The last constraint (45%) was flood and was ranked 16<sup>th</sup> by the respondents. Bulus and Nimfa (2017) reported that frequent changes in climatic conditions, including floods, have a significant impact on Irish potato farming.

Factor	Frequency*	Percentage*	Rank
High cost of inputs	174	96.7	1 <sup>st</sup>

Inadequate credit facilities	169	93.9	2 <sup>nd</sup>
Pests and diseases	161	89.4	3 <sup>rd</sup>
Lack of security on the farm	146	81.1	4 <sup>th</sup>
High cost of credit facilities	140	77.8	5 <sup>th</sup>
Poor prices of the potato	136	75.6	6 <sup>th</sup>
Soil fertility problems	134	74.4	7 <sup>th</sup>
Non availability of tractors	133	73.9	8 <sup>th</sup>
Inadequate improved seeds	120	66.7	9 <sup>th</sup>
Distance to the market	118	65.6	10 <sup>th</sup>
Distance to the farm	115	63.9	11 <sup>th</sup>
Inadequate knowledge about potato production	108	60.0	12 <sup>th</sup>
Drought	106	58.9	13 <sup>th</sup>
Inadequate labour	100	55.6	14 <sup>th</sup>
Lack of extension visits	93	51.7	15 <sup>th</sup>
Flood	81	45.0	16 <sup>th</sup>

Source: Field Survey, 2019 \* – Multiple response

Table 4: Constraints to Potato production in the area

#### IV. CONCLUSION AND RECOMMENDATIONS

This study concluded that Irish potato production in the study area is a profitable and sustainable enterprise especially is the farmers and encourage. The enterprise could be a major poverty reduction venture which does not discriminate gender participation. The study also revealed that the major constraints faced by the farmers included high cost of inputs, inadequate credit facilities, pests and diseases and poor security in the study area. Based on the results, it can be affirmed that with proper organization of the farmers and adequate support interms of continuous extension education aligning with proper and organize market, the enterprise will provide sustainable employment for teaming citizenry as being an old year business.

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