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Socio-Economic Constraints to Gender Participation in Groundnut Value Chain under the USAID-GUP Initiative in Selected Rural Communities in Sokoto State, Nigeria

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Article History	Abstract
  	Groundnut production serves as a vital source of livelihood for numerous rural households within the regions targeted by the USAID Groundnut Up-scaling Project (GUP), which aimed at enhancing agricultural productivity, market integration, and household income. Despite these efforts, socio-economic and gender-related constraints including traditional gender roles, limited access to productive resources, and restricted decision-making power continue to hinder women's effective participation in the Groundnut Value Chain (GVC). This study examines the socio-economic constraints influencing gender participation in the GVC under the USAID-GUP initiative, with a focus on identifying strategies to promote women's empowerment, gender equity and inclusive agricultural development in the study area. The study adopted a multi-stage and snowball sampling technique to select 200 respondents, comprising 100 participants and 100 non-participants across six Local Government Areas (LGAs). Data were analyzed using descriptive statistics, a three-point Likert scale, and Z-tests. Findings revealed that female participants (72.7%) predominantly engage in processing activities, whereas male participants (92.9%) dominate groundnut production. In non-participating communities, both male (90.5%) and female (75.0%) farmers were primarily involved in production, with no significant engagement in processing activities. Informal credit sources were the primary financing channels across both Participating Local Government Areas (PLGAs) and Non-Participating Local Government Areas (NPLGAs). Men cultivated a higher proportion of the improved SAMNUT-22 variety (21.4% among participants and 39.3% among non-participants), while women predominantly cultivated SAMNUT-21 (31.8%) and SAMNUT-23 (31.3%) in participating and non-participating communities, respectively. Land acquisition was mainly through inheritance across genders in both PLGAs and NPLGAs. The study identified insufficient credit, unstable market prices, inconsistent government policies, middlemen exploitation, and insecurity as the most severe constraints to participation, particularly among non-participant households. Respondents in PLGAs experienced mild constraints (mean = 0.76), while those in NPLGAs reported high-severity constraints (mean = 1.00), indicating the positive impact of USAID-GUP interventions. Although no significant gender difference was observed in income levels, several constraints significantly (P <0.05, P <0.01) affected participation namely insufficient credit, price instability, unstable policies, middlemen interference, and insecurity. The Z-test results (Z = 2.14***, for PLGAs; Z = -1.28^NS for NPLGAs, p< 0.01) indicated significant gender-based differences in the severity of constraints affecting participation. The study concludes that the USAID-GUP intervention has effectively reduced gender-based barriers to participation in the GVC, thereby contributing to enhanced inclusiveness, empowerment, livelihood improvement but systematic gender inequalities remain deeply rooted among participating households. It recommends targeted gender-sensitive policies, improved financial inclusion, and dissolving the problem of middle men interference and strengthening

community-based security to sustain equitable participation and empower women within the groundnut value chain.

Keywords: *Groundnut value chain (GVC), Gender participation, Women empowerment, USAID Groundnut Up-scaling Project (GUP), Socio-economic constraints, Rural livelihood.*

INRODUCTION

Nigeria was once Africa's leading exporter of groundnuts. However, a combination of factors including drought, widespread diseases notably rosette virus, market disruptions, and the emergence of other crop diseases led to the collapse of groundnut production in the 1970s. The discovery and growing dominance of petroleum extraction further accelerated this decline, diverting attention and investment away from agriculture and resulting in the abandonment of many cash crops, including groundnuts. This shift had a significant impact on the Nigerian economy, as a large portion of the population depended on farming for their livelihood (Abdulrahaman, Olayinka, Andrauwus, Aluko, Adebola & Oladele, 2014).

Between 1956 and 1967, groundnut products including cake and oil accounted for about 70% of Nigeria's total export earnings, making it the nation's most valuable export crop, ahead of other major commodities such as cotton, oil palm, cocoa, and rubber (Ibrahim, Ayinde, Dauda & Mukhtar, 2007). However, from the mid-1960s through the 1970s, production declined sharply, with devastating effects on Nigeria's rural economy. As exports decreased, the incomes of rural farmers who relied heavily on groundnut cultivation also dropped significantly, leading to widespread economic hardship and rural stagnation (Idachaba, 1980; Nzeka, 2013). This was particularly evident in the northern regions, where farming was the main source of livelihood and groundnut served as a major source of income.

For several decades, Nigerian groundnut farmers primarily depended on traditional local varieties, which significantly constrained productivity due to their inherent limitations to low yield potential, susceptibility to diseases, and long maturity periods. These factors collectively reduced both productivity and resilience in groundnut production systems (Ahmed et al., 2020). To address these challenges, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), in collaboration with the Institute for Agricultural Research (IAR), Samaru, and other development partners, developed and released a series of improved, high-yielding groundnut varieties with combined resistance to major biotic stresses and enhanced agronomic characteristics (Ajeigbe et al., 2014). Among these are the SAMNUT series (SAMNUT 21, 22, 23, 24, 25, and 26), which demonstrate earlier maturity, superior disease tolerance particularly against groundnut rosette and leaf spot diseases and improved oil content (Ajeigbe et al., 2014).

Recognizing the potential of these innovations, it became imperative to disseminate the improved varieties and associated crop management packages on a large scale to boost productivity and profitability among Nigerian groundnut farmers. This led to the establishment of the Groundnut Up-scaling Project (GUP), supported by the United States Agency for International Development (USAID) as part of its agricultural value chain development initiatives. Under donor-supported interventions such as the Tropical Legumes (TL) Project, ICRISAT and its partners, including USAID, facilitated widespread dissemination of these improved varieties and complementary agronomic practices to enhance awareness, seed availability, and adoption. The outcomes of these efforts were notable: adoption rates in some project states increased from approximately 8% at the baseline to about 57% by the project's conclusion (Ajeigbe et al., 2014; Ahmed et al., 2020).

The USAID GUP (Groundnut Up-Scaling Project) intervention, implemented over three years (2015–2018), covered five northern states of Nigeria: Jigawa, Kebbi, Kano, Sokoto, and Katsina. Its core goal was to strengthen groundnut production systems through a set of targeted objectives:

i. Enhance farmers' knowledge of improved groundnut production technologies, including high-yielding varieties and complementary crop management practices;
ii. Strengthen large-scale seed production and marketing systems;
iii. Promote farmers' understanding and adoption of improved aflatoxin management technologies; and
iv. Improve farmers' access to small-scale groundnut processing technologies.

Gender participation in economic activities among people in Sokoto State has not been encouraging due to religious beliefs and cultural norms that restricted the womenfolk to mainly economic activities that are conducted indoors (Umeukeje, 2025). However, recent evidence has indicated that due to the increase in level of education and advancement in technology the women are now partaking in different economic activities. These economic activity include those that require skilled and unskilled labour for instance groundnut production, processing and marketing has recently driven women from processing to marketing

activities where young women are seen transporting their products from local markets to urban centers (Umeukeje, 2025; Umeukeje, Umar, Osuafor & Anarah, 2024). Analyzing gender participation in the Groundnut Value Chain (GVC) among households in Sokoto State is of paramount importance, as groundnut is one of the major crops cultivated in the state. Its production, processing, and marketing constitute key economic activities for both men and women. This study, therefore, seeks to evaluate the USAID-GUP intervention to determine whether it effectively addressed gender disparities and reduced the severity of constraints affecting participation in the GVC. . Specifically, the study aimed at identifying and comparing the constraints influencing male and female participation in the value chain among households in the study area. Accordingly, the study hypothesizes that there is no significant difference in the constraints faced by participating and non-participating households in the GVC with respect to gender.

METHODOLOGY

The study was conducted in Sokoto State, located in northwestern Nigeria between longitude 4°25′ to 6°46′E and latitude 11°35′ to 13°55′N. The state shares borders with the Niger Republic to the north, Zamfara State to the east, and Kebbi State to the southeast, covering a total land area of approximately 25,973 km² and comprises twenty-three (23) local government areas (Umeukeje, Umar and Isibor, 2023). The Hausa and Fulani constitute the major ethnic groups, and the projected population as of 2023 was about eight million (NPC, 2013 projection). The region's lifeline for growing of crops is through the irrigation systems (SADP, 2023). A multi-stage sampling technique combined with a snowballing approach was used to select households involved in the Groundnut Value Chain (GVC). Three Local Government Areas (LGAs) were purposively selected from the five participating LGAs under the USAID-GUP project in Sokoto State namely Shagari, Tambuwal, and Dange-Shuni. In the second stage, five farmers' associations from each selected LGA were randomly chosen. Lists of registered members were obtained from the Sokoto Agricultural Development Project (SADP) through the Monitoring and Evaluation Unit of the Extension Department. From these lists, 35% of registered members were randomly selected, resulting in a total of 100 participants from a sample frame of 294. These selected association members were considered the study's unit of analysis.

For the non-participating group, three LGAs; Yabo, Wurno, and Kebbe were purposively chosen. Five non-participating communities were then selected from each, and using a snowball sampling technique (due to the absence of an accessible population frame), 100 households were identified and included in the study. Thus, the total sample comprised 200 households across both participating and non-participating LGAs.

Data were analyzed using descriptive and inferential statistics, including frequency counts, percentages, means, Likert scale, and the Z-test. A three-point Likert scale was employed to assess the severity of constraints hampering effective gender participation in the GVC: not severe (0), fairly severe (1), and severe (2). A mean threshold of 1.0 was used as a benchmark and variables scoring 1.0 and above were classified as "severe," while those below 1.0 were considered "not severe."

The likert scale is an ordered scale from which respondents choose one option that best aligns with their view. It is often used to measure respondents' attitudes towards some group of question by asking the extent to which they agree or disagree with a particular statement. The constraints to the challenges identified to have impeded access to productive resources of the GVC programme was captured on 3 points likert scale that reads not severe as 0, fairly severe for 1, and severe for 2. A mean threshold of 1.0 was set as a benchmark for the decision-making process. Variables with a mean score of 1 and above were rated as severe, while those below 1.0 were rated as not severe. Mathematical derivation for the mean threshold is given as: $\sum x / N = 0 + 1 + 2 = \frac{3}{3} = 1$

The Z-test formula used is given as: $Z = \dfrac{\bar{X}_1 - \bar{X}_2}{\sqrt{\dfrac{\delta_1^2}{n_1} + \dfrac{\delta_2^2}{n_2}}}$

Where:

$\bar{X}_1$, $\bar{X}_2$ = Sample means

δ_1^2, δ_2^2 = population variances for gender categories in PLGAs and NPLGAs

n_1, n_2 = sample size (number of observation for men and women in PLGAs and NPLGAs)

The Z-test is a parametric statistical tool used to determine whether a significant difference exists between the means of two large samples when the population standard deviation is known.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of respondents are crucial to understanding gender participation and the nature of constraints within the Groundnut Value Chain (GVC). These characteristics include age, marital status, occupation, household size, education, farm size, household income, land acquisition, improved groundnut variety, access to credit, and extension contacts they all directly influence household decisions, production capacity, and inclusion within agricultural programs.

Table 1: Distribution of Respondents by their Socio-economic Characteristics

	PLGAs Male (n=56) Freq.	%	Female (n=44) Freq.	%	Pooled Freq.	NPLGAs Male (n=84) Freq.	%	Female (n=16) Freq	%	Pooled Freq.
Age < 41	3	5.4	12	27.3	15	18	21.4	4	25	22
41 – 60	44	78.6	30	68.2	74	52	61.9	12	75	64
61 and above	9	16.1	2	4.5	11	14	16.7	-	-	14
Mean	**53**		**47**			**50**		**48**		
Marital Status										
Single	-	-	1	2.3	1	1	1.2	1	6.3	2
Married	56	100	30	68.2	86	83	98.8	6	37.5	89
Widowed	-	-	11	25.0	11	-	-	6	37.5	6
Divorced	-	-	2	4.5	2	-	-	3	18.8	3
Occupation										
Farming	52	92.9	11	25.0	63	76	90.5	12	75	88
Processing	4	7.1	32	72.7	36	6	7.1	4	25.0	10
Civil servant	-	-	1	2.3	1	2	2.4	-	-	2
Household Size										
1 – 5	19	33.9	17	38.6	36	27	32.1	5	31.3	32
6 – 10	29	51.8	26	59.1	55	33	39.3	10	62.5	43
11 – 15	7	12.5	1	2.3	8	19	22.6	1	6.3	20
16 and above	1	1.8	-	-	1	5	6	-	-	5
Mean	**7.39**		**6.05**			**8.49**		**6.44**		
Education										
Quranic	15	26.8	28	63.6	43	31	36.9	13	81.3	44
Primary	12	21.4	13	29.5	25	20	23.8	2	12.5	22
Secondary	21	37.5	3	6.8	24	17	20.2	-	-	17
Tertiary	8	14.3	-	-	8	16	19	1	6.3	17
Farm Size										
≤ 2	8	14.3	18	40.9	26	10	11.9	13	81.3	23
3 – 4	22	39.3	23	52.3	45	33	39.3	3	18.8	36
5 and above	26	46.4	3	6.8	29	41	48.8	-	-	41
Mean	**4.73**		**3.55**			**5.07**		**1.91**		
Household Income										
≤ 500000	27	48.2	19	43.2	46	31	36.9	10	62.5	41
500001 – 1000000	18	32.1	24	54.5	42	29	34.5	5	31.3	34
1000001 – 1500000	2	3.6	1	2.3	3	7	8.3	-	-	7
1500001 and above	9	16.1	-	-	9	17	20.2	1	6.3	18
Mean	**892410.71**		**531386.36**			**1008907.14**		**495000.00**		
Land Acquisition										
Inherited	36	64.3	31	70.5	67	50	59.5	9	56.3	59
Purchased	12	21.4	9	20.5	21	26	31	1	6.3	27
Rented	4	7.1	1	2.3	5	4	4.8	-	-	4
Communal	-	-	-	-	-	-	-	1	6.3	1
Gift	-	-	-	-		-	-	-	-	-
Family land	4	7.1	3	6.8	7	4	4.8	5	31.3	9
Access to Credit										
Informal sources	17	30.4	13	29.5	30	43	51.2	7	43.8	50
Private Commercial Banks	6	10.7	6	13.6	12	8	9.5	2	12.5	10
Agricultural banks	12	21.4	7	15.9	19	13	15.5	4	25.0	17

Government Loan scheme	9	16.1	14	31.8	23	10	11.9	2	12.5	12
Non-Governmental organizations	12	21.4	4	9.1	16	10	11.9	1	6.3	11
Extension Contact										
0	0	0.0	1	2.3	1	38	0.0	7	31.3	45
1- 5	25	44.6	18	40.9	43	23	53.6	5	43.8	28
6 – 10	23	41.1	20	45.5	43	12	33.3	3	18.8	15
11 and above	8	14.3	5	11.4	13	11	13.1	1	6.3	12
Mean	**6.20**		**6.11**			**3.40**		**2.44**		

Source: Field Survey Data, 2021.

Age: Age is often an important factor influencing individuals' decision-making, activity levels and roles within households, whether male or female heads. People's thoughts, behaviours and needs tend to correlate with their age (Umeukeje et al., 2023). Table 1 shows that in both genders of the PLGAs and NPLGAs, households are dominated by heads aged between 41– 60 years. Specifically, the average age for male household heads in PLGAs was about 53 years and female heads averaged 47 years, while in the NPLGAs it was 50 and 48 years for male and female respectively. These findings reveals that the dominance of middle-aged household heads (41–60 years) across both PLGAs and NPLGAs suggests that the majority of participants are in their economically active age, when individuals are more likely to possess the physical strength, experience, and decision-making capacity necessary for productive engagement (Umeukeje, Umar,& Isibor, 2023). However, the slightly lower average age of female-headed households (47 years in PLGAs and 48 years in NPLGAs) compared to their male counterparts (53 and 50 years respectively) may indicate that women tend to assume headship earlier, possibly due to widowhood, divorce, or migration of spouses (Folbre, 2019). Thus, age pattern can influence gender participation in several ways. Younger female heads may face greater challenges in accessing resources such as land, credit, and extension services compared to older more established male heads, thereby limiting their level of participation in agricultural value chains. Conversely, middle-aged male heads, being generally more experienced and resource-endowed, are likely to participate more actively and efficiently. Thus, while both genders are within productive age categories, structural and socio-cultural factors associated with age and gender still shape the extent and nature of their participation in economic and agricultural activities (Umeukeje et al., 2023). Therefore, the age distribution of household heads has important implications for gender participation in agricultural and livelihood activities

Marital Status: This character describes persons' current status as either married or not married (Umeukeje, 2014) and the variable is categorized into; single, married, widow and divorce. The table showed that most male and female for the PLGAs and NPLGAs were married. This implies that the program targets more of married because they are more established and stable and in a better position to participate more than the other categories. These findings underscore the gender-inclusive approach of the USAID-GUP implementation, aimed at supporting married actors and their families. This agrees with (Umeukeje et al., 2023) that marriage was a necessary status for the success of any project invention as married individuals may have greater access to larger household labour, shared responsibilities, access to resources such as land, credit and social networks which are necessary for any project success Bott, E. (2014). Marital status significantly shapes gender inclusion and household participation in agricultural value chains. It can positively influence both men's and women's participation levels. Thus, while marriage can increase participation opportunities for both genders, it still reproduces certain asymmetries granting men greater control over resources and decision-making power within the GVC. Conversely, for women, being married may facilitate joint decision-making and access to spousal labour, whereas widowed or divorced women often face greater economic vulnerability and limited support networks (Bartley, Blanton, & Gilliard, 2005; Egbue, 2012).

Occupation: This refers to the principal business of one's life (a profession in which one majorly engages upon) as a major means of survival. Groundnut farming was the dominant occupation across both gender groups in the study areas. In the PLGAs, the table revealed that 92.9% of males and 25.0% of females were primarily engaged in farming, while 72.7% of females were more active in processing activities. In contrast, in the NPLGAs, 90.5% of males and 75.0% of females were

farmers, with only 25.0% of females engaged in processing. This gendered division of labour reveals that the USAID-GUP intervention enhanced women's participation in processing rather than in farming. The program's emphasis on small-scale groundnut processing technologies and training to encourage this trend, enabling women to engage in post-harvest value addition which is an activity that is socially acceptable within northern Nigeria's cultural context (USAID, 2015). These findings corroborate Umeukeje (2014), who observed that over 90% of women in Sokoto State engaged in groundnut processing daily, often as a result of access to improved processing technologies introduced through donor interventions. Thus, while male participation remains concentrated in production, female participation is expanding within processing, demonstrating gender-specific entry points within the GVC.

Occupation: This refers to the principal business of one's life (a profession in which one majorly engages upon) as a major means of survival. Table 1: it is observed that in the PLGAs, majority (92.9%) of the males and 25.0% of females were involved in groundnut farming, while in the NPLGAs, majority of both males (90.5%) and females (75.0%) were engaged in the groundnut farming. Conversely, only 7.1% of males and majority (72.7%) of females participated in groundnut processing activities in the PLGAs, whereas in the NPLGAs, the figures were 7.1% and 25.0% for males and females, respectively. These findings suggest a notable difference in the involvement of female participants in processing activities within the PLGAs, contrasting with their male counterparts in both PLGAs and NPLGAs who were predominantly engaged in farming. However, in the NPLGAs, both men and women were more involved in farming activities. The program's influence seems to discourage female participation in farming while promoting their involvement in processing within the GVC. This trend may be attributed to the program's support, which enhances processors' access to small-scale processing technologies (USAID, 2015). The high female involvement in groundnut processing was similarly recorded by Umeukeje (2014) whose report revealed that over 92% of women processed about 20 plates of groundnut on a daily basis which was equivalent to 50 kg of groundnut approximately. This result from Umeukeje (2014) was equally attributed to the adoption of improved groundnut processing technologies. The

study revealed that the project has encouraged female participation in processing activities

Household Size: Household size affects the availability of family labour and thus the level of engagement in agricultural production and processing. Household size is an important socio-economic factor in agricultural production and processing and it determines the number of persons available in the household to carry out the farm activities (Umeukeje 2014). As shown in table1, majority of male and female households (51.8% and 59.1%) respectively in the PLGAs had a household size ranging from 6 to 10 persons. Similarly, in the NPLGAs, 39.3% of households of the male GVC actors and 62.5% of those of the female actors fell within this range of household size. The average household size for the male GVC actors in the PLGAs was 7 persons while it was 6 persons for the female actors. In the NPLGAs, the average household size for male actors was 8 persons, and for female actors it was 6 persons. This implies that household size for male usually is greater than that of their female counterparts. However, the marginal difference between male and female household sizes implies that household size may not be a strong determinant of gender disparity in participation. Nonetheless, larger households can still provide a competitive advantage in labour-intensive activities like groundnut farming.

Education: Education is a critical determinant of innovation adoption and value chain participation. It illustrates the level of educational attainment for males and females in both PLGAs and NPLGAs. Findings revealed that most respondents both male and female had Quranic education, with very few attaining secondary or tertiary education. This suggests that limited exposure to formal education have hindered the ability of respondents to adopt new technologies or effectively engage in agribusiness activities. Low literacy levels reduce the capacity to access and utilize information related to improved groundnut varieties, market trends, and extension advisories (Priya, Patil, Vishwakarma, Saikanth, Mishra, Tripathi, ... & Shastri 2025). This limitation likely constrained both male and female actors in terms of efficiency, profitability, and competitiveness within the GVC. The USAID-GUP project thus needs to integrate literacy and agribusiness training to enhance gender-responsive participation and long-term sustainability (Prajapati, Priya, Bishnoi, Vishwakarma, Buvaneswari, Shastri., ... & Jadhav, 2025).

Farm Size: This is the total cultivating areas of a household. Table 1, shows that the average farm size was

4.73 and 3.55 for male and female respondents respectively in the PLGAs while in the NPLGAs male had 5.07ha and the female 1.91ha. This indicates that female farm sizes in the PLGAs were larger than those of their non-participating counterparts, suggesting that the USAID-GUP intervention may have improved women's access to farmland. These figures differ from the findings of Ahmed *et al.* (2020), which reported an average production area of 1.94 hectares, indicating small-scale production in their study on the adoption of improved groundnut varieties in the Tropical Legume Project (TL III). Notably, only the average farm size of females in NPLGAs aligns with Ahmed *et al.'s* (2020) indicating a scaling effect of the USAID-GUP initiative. However, males still control larger farm areas overall, reaffirming gender disparities in access to productive land (Sule & Yusuf, 2019). Facilitating/improving women's access to land could therefore substantially improve participation in groundnut production and profitability

Household Income: Income remains the most direct indicator of program success. Results revealed persistent income disparities between genders. In the PLGAs, male respondents earned an average of ₦892,410.71 annually, while females earned ₦531,386.36. In the NPLGAs, male and female incomes averaged ₦1,008,907.14 and ₦495,000.00 respectively. These figures indicate that males earned more than females across both areas, and unexpectedly, male non-participants (NPLGAs) earned slightly more than male participants (PLGAs). This suggests that participation in the GVC did not automatically translate into higher income as a result of limited value addition, unequal market access, or weak linkages between production and processing nodes which are the potential factors restricting (Coles & Mitchell, 2011). For women, they could be limited to: access to land, credit, and decision-making power. Therefore, addressing gender-based resource inequities is essential for translating participation into tangible economic gains.

Household Income: These are income obtained from GVC activities and other on-farm and off-farm livelihood activities by the respondents in the study area. The findings presented in Table 1 reveal significant disparities in household income between male and female respondents across both PLGAs and NPLGAs. A larger proportion of females in both areas earned between ₦500,000 and ₦1,000,000 annually. Specifically, 80.3% of males and 97.7% of females in the PLGAs fell within this income range, compared to

71.4% of males and 93.8% of females in the NPLGAs. The mean total income earned by males and females in the PLGAs was ₦892,410.71 and ₦531,386.36, respectively, while in the NPLGAs, males earned an average of ₦1,008,907.14 and females ₦495,000.00. Overall, males earned more than females in both areas; however, male respondents in the NPLGAs had higher mean incomes than those in the PLGAs. This suggests that participation in the Groundnut Value Chain (GVC) did not significantly improve the income levels of participants, as non-participants (NPLGAs) recorded higher average earnings, particularly among male respondents. The implication of this finding is that participation in the Groundnut Value Chain (GVC) did not translate into the expected economic advantage or income improvement for participants, especially males, when compared to non-participants. Despite involvement in the GVC, male participants in the PLGAs earned less than their counterparts in the NPLGAs, suggesting that the program's impact on income generation may have been limited or unevenly distributed. This could imply several underlying issues such as: low value addition or inefficiencies within the GVC that limit income growth for participants; gender-based disparities in access to productive resources, market opportunities, or decision-making power, which might have further constrained female income levels; possible differences in market linkages, support services, or local economic conditions between PLGAs and NPLGAs. The result indicates that mere participation in the GVC does not guarantee improved income unless accompanied by enhanced market access, gender-responsive interventions, and capacity-building support. Similar findings have been reported in previous studies, where participation in agricultural value chains did not automatically result in higher income due to structural and gender constraints (Coles, C., & Mitchell, J. 2011).

Land Acquisition: This refers to the means in which land is acquired by the respondents and these include; inheritance, purchase, rent, communal, gift and family land. The table demonstrates that land access largely followed customary inheritance systems. In the PLGAs, 64.3% of males and 70.5% of females acquired land through inheritance, while in the NPLGAs, 59.5% of males and 56.3% of females did so. This pattern underscores the persistence of traditional land tenure systems that favour household or lineage ownership. This highlights the reliance of respondents in the study area on family-owned land that was primarily inherited for cultivating groundnut. The predominance of land

acquisition through inheritance among both male and female respondents in the PLGAs and NPLGAs suggests that access to land in the study area is largely dependent on traditional and family-based systems rather than on market or institutional mechanisms. This finding implies that participation in groundnut production is strongly influenced by customary land tenure systems. The slightly higher proportion of females acquiring land through inheritance in the PLGAs (70.5%) compared to males (64.3%) may indicate some level of gender inclusiveness encouraged by project interventions or shifting socio-cultural norms that increasingly recognize women's rights to family land. However, the overall dominance of inheritance-based access also highlights potential limitations for new entrants—particularly women and youth—who may not have direct inheritance rights under customary practices (Eboson, 2023 and Alsgaard, 2012). Therefore, this pattern underscores the need for policy efforts to strengthen equitable land access mechanisms beyond inheritance, such as through land purchase, leasing, and communal allocations, to enhance gender-balanced participation in agricultural productivity and value chains.

Access to Credit: Finance is an important socio-economic factor or very important resource as ownership and control over it can enable participant have control over other productive assets (Uwajumogu, Nwokoye and Ogbonna 2020). It is a key determinant of agricultural productivity and participation. The sources of finance include; informal sources, private commercial banks, agricultural banks, government loan scheme and non-governmental organizations. The result revealed that both males and females in the PLGAs and NPLGAs predominantly relied on informal sources of credit, with percentages ranging from 29.5% to 51.2%. The dominance of informal sources of credit suggests limited access to formal financial institutions among farmers in both PLGAs and NPLGAs. This may be due to factors such as limited financial literacy, collateral requirements, or bureaucratic hurdles associated with formal banking systems as observed by Uwajumogu *et al.* (2020). The reliance on informal credit limits the ability to invest in improved technologies or expand production (Zewdie, 2015). This situation underscores the importance of developing gender-responsive financial mechanisms that cater to smallholder farmers, particularly women, who often lack collateral and formal credit histories. Expanding microfinance and cooperative credit schemes could enhance inclusiveness and mitigate income inequalities within the GVC

(Zewdie, 2015). Low access to credit facilities has been reported in many parts of sub-Saharan Africa as well as other developing countries as the limiting factor for increased agricultural productivity and constitutes a constraint to participation in GVC (Zewdie, 2015). It therefore emphasizes the need to intensify the provision of formal credit to the participants as an important variable in protecting poor households from shocks to their income due to agricultural risks which include drought and diseases.

Extension Contact: This refers to the frequency of interactions or exposure to agricultural innovations between a household head and agricultural extension workers in the past one year. Result in Table 1 revealed that Male and female participants in the PLGAs had an average of 6.20 and 6.11 contacts per farming season, compared to 3.40 and 2.44 contacts in the NPLGAs. This shows that actors in the PLGAs had more extension contacts than those in the NPLGAs. However, in the PLGAs there was no difference in average contact between male and female actors but in the NPLGAs there was much disparity in the extension contact between males and females actors. This shows the GUP had not only increased the level of extension contacts it had also reduced the inequality of the contacts between the male and female participants. Regular extension contact enhances knowledge transfer, improves productivity, and supports equitable participation in agricultural programs. The reduced gender gap in extension contact among participants demonstrates the project's success in addressing one of the structural barriers to female inclusion in agricultural innovation systems.

The result of this objective is presented in Table 2.

Table 2: Constraints Faced by Respondents in both Participating and Non-Participating Households

| | | PLGAs (N=100) | | | | | | | NPLGAs (N=100) | | | | | | |
| | | Male (n=56) | | | Female (n=44) | | | Z- Score | Male (n=84) | | | Female (n=16) | | | Z-Score |
Sn.	Constraints	Mean	Std. Dev.	Decision	Mean	Std. Dev.	Decision		Mean	Std. Dev.	Decision	Mean	Std. Dev.	Decision	
1	Insufficient credit	1.18	0.34	**Severe**	0.93	0.27	Not severe	4.10***	1.27	0.55	**Severe**	1.69	0.93	**Severe**	-1.75 NS
2	High transport costs	0.73	0.42	Not severe	0.45	0.26	Not severe	4.09***	1.18	0.34	**Severe**	1.13	0.09	**Severe**	1.15 NS
3	Poor processing technologies	0.66	0.35	Not severe	0.52	0.23	Not severe	2.40**	1.05	0.36	Not severe	0.88	0.27	**Severe**	2.18**
4	Inadequate storage	0.34	0.14	Not severe	0.20	0.12	Not severe	5.38***	0.81	0.37	Not severe	0.94	0.66	Not severe	-0.77 NS
5	Price stability	1.14	0.38	**Severe**	1.14	0.36	**Severe**	0.08	1.07	0.32	**Severe**	0.94	0.66	Not severe	0.77 NS
6	Market inaccessibility	0.27	0.15	Not severe	0.14	0.08	Not severe	5.56***	0.57	0.17	Not severe	0.31	0.04	Not severe	12.34***
7	Low literacy	0.41	0.24	Not severe	0.52	0.30	Not severe	-1.98**	0.90	0.31	Not severe	0.88	0.62	Not severe	0.13 NS
8	Seasonal production	0.57	0.30	Not severe	0.82	0.36	Not severe	-3.71***	0.68	0.29	Not severe	0.81	0.40	Not severe	-1.24 NS
9	Poor roads	0.77	0.22	Not severe	0.34	0.10	Not severe	13.02***	0.75	0.24	Not severe	0.50	0.18	Not severe	4.80***
10	Inexperience	0.23	0.13	Not severe	0.45	0.22	Not severe	-5.88***	0.73	0.29	Not severe	0.81	0.57	Not severe	-0.55 NS
11	Weak extension services	0.18	0.10	Not severe	0.43	0.18	Not severe	-8.27***	0.49	0.24	Not severe	0.75	0.35	**Severe**	-2.85**
12	Unstable policies	1.20	0.35	**Severe**	1.41	0.56	**Severe**	-2.18**	1.30	0.38	**Severe**	1.13	0.27	**Severe**	2.15**
13	Middle men interference	1.09	0.41	**Severe**	1.48	0.53	**Severe**	-4.03***	1.58	0.64	**Severe**	1.63	0.80	**Severe**	-0.24 NS
14	Insecurity	1.86	0.95	**Severe**	1.82	0.97	**Severe**	0.21	1.67	0.71	**Severe**	1.81	1.02	**Severe**	-0.53 NS
	Grand mean	**0.76**	**0.32**	**Not severe**	**0.76**	**0.32**	**Not severe**	**2.14***	**1.00**	**0.37**	**Severe**	**1.01**	**0.49**	**Severe**	-1.28 NS

Source: Field Survey Data, 2021. Significant at 1% (***), 5% (**), and 10% (*) level of probability

The GVC plays a significant role in Nigeria's agricultural economy, with implications for household livelihoods and food security. However, gender disparities in GVC can limit the potential benefits, particularly for women. Understanding the constraints to gender participation is crucial for designing interventions that promote equitable access to resources, opportunities and benefits. This study examines the constraints to gender participation in GVC among households in participating and non-participating LGA, highlighting the severe constraints faced by men and women in each category. The constraints identified to have impeded gender participation in GVC are shown in Table 2. having fourteen (14) variables.

The results presented in Table 2 supplied a detailed comparison of the constraints affecting men and women in the participating LGAs (PLGAs) under the USAID groundnut up-scaling project (GUP) intervention and the non-participating LGAs (NPLGAs). The results illustrate how gendered limitations continue to shape the level and quality of participation in the groundnut value chain in the study area. The findings and how they aligned closely with the socioeconomic constraints that influenced gender participation in the GVC under the USAID GUP initiative in rural Sokoto communities are interpreted and discussed below.

Constraints in Participating LGAs (PLGAs)

The study observed a striking pattern within the PLGAs in the gender gap in the severity of certain constraints, and the Z values were used to show where these gaps were statistically significant.

Insufficient credit remained a severe limitation for men, with a mean score of 1.18 and a standard deviation of 0.34, while women rated the constraint as not severe, with a mean of 0.93 and a standard deviation of 0.27. The large Z value of 4.10** indicated a statistically meaningful difference in how credit constraints were experienced. This suggests that the GUP intervention may have enabled women to access more flexible finance through informal networks or women focused groups, while men continued to rely on more formal and less accessible credit sources.

High transport costs followed a similar pattern. Men, in PLGAs rated it as not severe but higher (mean 0.73, SD 0.42) than women (mean 0.45, SD 0.26). The corresponding Z value of 4.09*** significant at the 1 percent level, confirmed that the difference was not incidental. The interpretation is that men, who often take responsibility for bulk marketing, incur greater transport expenses compared to women, whose activities cluster around processing and minor trading.

For poor processing technologies, men recorded a mean of 0.66 (SD 0.35), and women a mean of 0.52 (SD 0.23), both rated as not severe. The Z value of 2.40** significant at the 5 percent level, revealed a meaningful gender difference. Women experienced the constraint less severely, likely reflecting targeted processing support introduced by the GUP project that enabled women to adopt small scale equipment that eased their processing limitations.

Inadequate storage showed a strong difference between men (mean 0.34, SD 0.14) and women (mean 0.20, SD 0.12), both rated as not severe. The Z value of 5.38*** showed a significant difference. Market inaccessibility also showed a notable disparity. Men reported a mean of 0.27 (SD 0.15) and women 0.14 (SD 0.08). The Z value of 5.56*** highlighted a wide gender gap. These findings reinforce the observation that men, being more directly involved in aggregation and bulk trading, feel the absence of storage infrastructure and poor market environments more acutely than women, who mostly operate closer to home.

The results also showed areas where women face relatively more constraints. Low literacy, for instance, had a mean of 0.41 (SD 0.24) for men and 0.52 (SD 0.30) for women, both rated as not severe, but the Z value of -1.98 signaled significant disadvantage for women. Inexperience also demonstrated this pattern with men reporting a mean of 0.23 (SD 0.13) and women 0.45 (SD 0.22), both rated as not severe, yet the Z value of -5.88*** showed a strong difference.

One of the clearest gender disparities appears under weak extension services. Men had a mean of 0.18 (SD 0.10), while women recorded 0.43 (SD 0.18). Although both rated it as not severe, the large Z value of -8.27*** demonstrated a strong statistical gap. This implies that although GUP improved extension access generally, women remained under served relative to men.

For unstable policies, both men and women rated the constraint as severe. Men recorded a mean of 1.20 (SD 0.35), and women recorded 1.41 (SD 0.56). The Z value of -2.18** showed that women experienced policy instability more severely. Across all constraints in PLGAs, the grand mean for men and women was identical at 0.76 (SD 0.32), classified as not severe, but the Z value of 2.14** indicated significant gender differences at specific constraint levels.

Constraints in Non-Participating LGAs (NPLGAs)

A different pattern emerges in the non-participating LGAs. Here, both men and women consistently rated many constraints as severe, and several Z values showed no significant difference between genders. This signaled that without the USAID GUP support, structural barriers in the value chain affect everyone almost equally.

For insufficient credit, men recorded a mean of 1.27 (SD 0.55) and women 1.69 (SD 0.93), both rated as severe, yet the Z score of -1.75^{NS} showed no meaningful gender difference. This reflects the general scarcity of credit in rural groundnut production contexts without external support. Again, in high transport costs, men had a mean of 1.18 (SD 0.34) and women 1.13 (SD 0.09), both severe, with a Z score of 1.15^{NS}, again showing no significant difference.

An exception appeared in poor processing technologies, where men recorded a mean of 1.05 (SD 0.36) rated as not severe, and women a mean of 0.88 (SD 0.27) rated as severe. The Z value of 2.18** indicated a significant gender difference, with women more constrained, likely because they depend more heavily on processing for income.

For poor roads, men recorded a mean of 0.75 (SD 0.24) and women 0.50 (SD 0.18), both not severe, yet the Z value of 4.80*** indicated a significant difference, showing that women were more affected due to their lower mobility.

Weak extension services also reflected gender disparity. Men had a mean of 0.49 (SD 0.24), not severe, whereas women recorded a mean of 0.75 (SD 0.35), severe. The Z value of -2.85** signaled significant disadvantage for women in accessing extension support. Across NPLGAs, the grand mean for men was 1.00 (SD 0.37) and for women 1.01 (SD 0.49), both rated as severe, and the Z score of -1.28^{NS} suggested muted gender differences in areas without project intervention. This demonstrates the equal effect of hardship when there is no targeted support and shows that the USAID GUP initiative played an essential role in reducing specific constraints for women while exposing underlying challenges men continued to face.

Summarily, a large positive Z value indicates that men experienced the constraint more severely than women. This appeared prominently in PLGAs for transport, storage, and market access. Equally, a large negative Z value indicates that women experienced the constraint more severely than men. This was evident in literacy, inexperience, and extension access.

But non significant Z values showed that both genders experienced the constraint similarly. These were more common in NPLGAs, meaning that without project support, both men and women face roughly the same difficulties.

SUMMARY AND CONCLUSION

The findings of the study revealed that majority of PLGAs; 100% male and 68% female were married while it was 98% and 38% for male and female respectively in the NPLGAs. Apart from the PLGAs females whose major occupation was processing, others are majorly farmers at both categories. Method of land acquisition was mainly through inheritance for both genders. The average mean household income was higher for males while it was ₦892,410.71 in the PLGAs it was ₦1,008,907.14 in the NPGLAs compared to that of females which was ₦531,386.36 and ₦495,000.00 in the PLGAs and NPLGAs respectively. The average extension contact recorded by the PLGAs per year for the male and female respondents was 6 contracts each and that of the NPLGAs 3 contacts and 2 contacts respectively. While factor's severe to gender participation include insufficient credit, unstable

The empirical analysis showed that both male and female respondents were within the economically active age range (41–50 years) with low formal education levels. Majority of PLGAs; 100% male and 68% female were married while it was 98% and 38% for male and female respectively in the NPLGAs. Apart from the PLGAs females whose major occupation was processing, others are majorly farmers at both categories. Respondents in PLGAs recorded higher income and more frequent extension contacts than those in NPLGAs, reflecting the effectiveness of USAID-GUP's intervention. Income disparities persisted, with male respondents earning ₦892,410.71 (PLGAs) and ₦1,008,907.14 (NPLGAs) compared to ₦531,386.36 and ₦495,000.00 for females, respectively. The average extension contact recorded by the PLGAs per year for the male and female respondents was 6 contracts each and that of the NPLGAs 3 contacts and 2 contacts respectively. Land acquisition was primarily through inheritance, indicating entrenched gender norms that restrict women's access to land ownership. While factor's severe to gender participation include insufficient credit, unstable price, unstable government policy, problem of middle men among others and were significant. Lastly, result of analysis from the 3point Likert scale revealed that constraints to gender participation between genders in the PLGAs were mild (0.76) while high (1.00) constraints was recorded between gender in the NPLGAs, indicating a significant disparity in perceptions between the two groups. The result also showed that both categories of participants have the same view regarding the constraints to gender participation in GVC. The 3-point Likert scale further revealed Z-test results confirmed significant gender-based differences (Z = 2.14*** for PLGAs; Z = -1.28^{NS} for NPLGAs, p<0.01), implying that the USAID-GUP successfully reduced the constraints to gender participation in GVC, though did not eliminate, gender-related barriers to participation.

The study concludes that while the USAID-GUP has substantially improved gender inclusiveness and reduced barriers to participation in the GVC, systemic inequalities persist particularly regarding access to credit, high transport costs and inadequate storage. The intervention's success demonstrates that gender-focused agricultural programs

can effectively promote equitable participation when designed with inclusive approaches. However, sustaining these gains requires stronger institutional and policy support to address the underlying structural causes of gender disparity

POLICY IMPLICATIONS AND RECOMMENDATIONS

1. **Gender-Responsive Credit Systems:** Financial institutions should introduce flexible, collateral-free credit schemes tailored for women farmers and processors.

2. **Market Regulation and Stability:** Establish stable groundnut pricing mechanisms and strengthen farmer–processor linkages to reduce middlemen exploitation.

3. **Policy Consistency:** Ensure continuity and stability in agricultural and gender equality policies to encourage sustained participation.

4. **Extension and Training:** Expand gender-focused extension programs emphasizing post-harvest handling, processing, and business skills.

5. **Infrastructure and Security:** Improve rural infrastructure—especially roads and storage facilities—and address insecurity in key production zones.

6. **Institutional Collaboration:** Foster partnerships between government, NGOs, and farmer cooperatives to build inclusive, resilient, and sustainable value chains.

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