DETERMINANTS OF WOMEN'S EMPOWERMENT IN AGRICULTURE: EVIDENCE FROM RURAL NORTHERN NIGERIA

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ABSTRACT

Women's empowerment is widely recognised as a critical pathway for improving agricultural productivity and rural livelihoods, yet evidence on the drivers of empowerment among women farmers in Nigeria remains limited. This study examines the determinants of women's empowerment in agriculture among rural farmers in Northern Nigeria using the aggregated individual empowerment index of the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI). The analysis draws on representative survey data collected under the 2018 Nigeria Baseline and Varietal Monitoring Survey, covering rural households across six northern states and three agro-ecological zones. Descriptive statistics were used to contextualise the socioeconomic characteristics of rural women farmers, while ordinal logistic regression was used to identify the drivers of empowerment. The results reveal substantial heterogeneity in women's empowerment, with inadequacies in access to productive resources, control over income, and time allocation. Household characteristics, asset ownership, access to infrastructure and markets, and labour availability emerged as significant determinants. The findings underscore persistent structural constraints facing rural women farmers in Northern Nigeria. To overcome this, it advocates for interventions that strengthen women's ownership of productive resources, reduce time burdens, and enhance intra-household decision-making power as important components of gender-responsive agricultural and rural development policies.

Keywords: ***Women's empowerment, Agriculture, Women's Empowerment in Agriculture Index, Rural women, Nigeria***

INTRODUCTION

Women constitute a significant proportion of the agricultural workforce across sub-Saharan Africa, contributing extensively to crop production, livestock rearing, processing, and marketing (Pierotti *et al*., 2022; Food and Agricultural Organisation, 2023). In Nigeria, women's engagement in agriculture is particularly pronounced in rural areas, where farming remains a primary source of livelihood and food security. Despite their substantial contributions, women continue to experience persistent disadvantages in access to productive resources, decision-making authority, and institutional support (Doss *et al*., 2018; FAO, 2023). These gender-based constraints result in disparities in productivity, income, and well-being, with broader implications for agricultural transformation and inclusive development (FAO, 2023; Ogunlela & Mukhtar, 2009).

In response to these challenges, development policy and scholarship have increasingly emphasised women's empowerment as a central objective of agricultural and rural development. Empowerment extends beyond women's participation in agricultural activities to encompass their ability to make meaningful decisions, exercise control over resources, income and time, as well as

participate in leadership and collective action (Kabeer, 1999). This shift reflects growing recognition that economic participation alone does not guarantee improved outcomes for women when gendered power relations within households and communities remain intact (Kabeer, 1999; Doss, 2013). As such, empowerment has emerged as a critical lens for assessing whether agricultural growth processes are genuinely inclusive.

The Women's Empowerment in Agriculture Index (WEAI) and its abbreviated version (A-WEAI) have become influential tools for measuring empowerment within agrifood systems. The A-WEAI captures women's agency across five domains—production, resources, income, leadership, and time—reflecting the multidimensional and relational nature of empowerment (Alkire *et al*., 2013; Malapit *et al*., 2015). Unlike conventional income- or productivity-based indicators, the A-WEAI explicitly recognises that empowerment is multidimensional, shaped by access to resources and the social and institutional contexts in which women operate (Alkire *et al*., 2013). This makes it suitable for analysing empowerment in smallholder agricultural systems characterised by strong intra-household and community-level norms.

Empirical applications of WEAI variants across Africa have revealed substantial variation in women's empowerment, with recurrent deficits in access to credit, leadership, and time autonomy (Ragsdale *et al*., 2022; Adam *et al*., 2024). However, much of the existing literature has focused on describing empowerment levels or evaluating the impacts of specific interventions, with comparatively little attention to the determinants of empowerment itself. Where such determinants are examined, studies often focus on individual characteristics such as education and income, while giving less emphasis to household composition, dependency burdens, and structural constraints that shape women's agency in everyday agricultural practice (Peterman *et al*., 2014; Doss *et al*., 2018).

In the Nigerian context, empirical research on women's empowerment in agriculture remains relatively sparse. While Adeyeye *et al*. (2019) assessed the effects of women's empowerment on agricultural productivity in Nigerian households, other studies examined the influence of women's empowerment on household food security (Ogunnaike *et al*, 2019; Obayelu *et al*. 2024). While several studies document gender gaps in land access, financial inclusion, and extension services, fewer studies employ multidimensional empowerment indices such as the A-WEAI to examine the factors that influence women's agency. Obayelu and Chime (2020) and Ayevbuomwan *et al*. (2016) came close but utilised secondary data from the 2013 Nigerian Demographic and Health Survey to compute the multidimensional empowerment indicators. Moreover, empowerment is frequently treated as a binary outcome or analysed using linear methods that may not fully capture its graduated and multidimensional character (Olayide *et al*. 2021). Given the prevalence of patriarchal norms, customary land tenure arrangements, and high unpaid care burdens in rural Nigeria, which disproportionately affect women, there is a clear need for analyses that account for complex pathways through which empowerment is produced or constrained.

Nigeria presents an interesting case. As Africa's most populous country and a major agricultural producer, rural Nigerian households are characterised by complex social structures, extended family arrangements, and deeply embedded gender norms that shape women's roles in agricultural activities, care work, and

decision-making (Stavaren & Odebode, 2007; Ogunlela & Mukhtar; Adeyeye & Fischer, 2024). This is more pronounced in Northern Nigeria, where religious and cultural practices significantly limit women's participation in agriculture and, consequently, their empowerment (Pierce, 2003; Baba & van der Horst, 2018). This persists despite the region's vast arable land mass and favourable soil and climatic conditions that support diverse forms of agricultural production (Chiaka *et al*., 2024). Caution should be exercised because the region exhibits wide heterogeneity, with disparity in women's agency as one traverses the North Central to the North West.

Understanding how these contextual factors interact with individual attributes and resource access is essential for designing agricultural and rural development policies that advance gender equity alongside productivity. Consequently, this study examines the determinants of women's empowerment among rural women engaged in agriculture in Nigeria, using the aggregated individual empowerment score across the five domains of the A-WEAI as the outcome variable. The study is premised on the understanding that empowerment is not solely a function of women's individual characteristics or economic participation, but rather the result of factors operating at multiple scales and levels (Brago *et al*., 2025). Accordingly, the analysis distinguishes between individual, household, and resource-related factors. Consequently, the study seeks to achieve the following objectives:

1. Assess the empowerment of rural women in the different domains relevant to agriculture in northern Nigeria.
2. Examine the indicators contributing to their disempowerment; and
3. Assesses the roles of individual, household dynamics and resources on women's empowerment

This study contributes to the literature in three key respects. First, it extends empirical evidence on women's empowerment in Nigerian agriculture by applying the A-WEAI within a determinant-focused analytical framework. Secondly, it establishes the importance of household dynamics and dependency structures, complementing existing work that emphasises income and resource access. Finally, it generates policy-relevant insights for the design of agricultural and rural development interventions that address not only resource constraints but also the social relations that shape women's agency.

THEORETICAL FRAMEWORK

This study's theoretical framework combines Kabeer's Resources, Achievements and Agency (RAA) framework, feminist political economy, and the collective and cooperative bargaining models to explain women's empowerment in agriculture. The data selection and variable classification are theoretically grounded and contextually appropriate, enabling robust analysis of the multilevel factors shaping empowerment among rural women farmers in Northern Nigeria.

Women's empowerment in agriculture is increasingly understood as a multidimensional, relational, and context-specific process rather than a simple outcome of economic participation. This study situates women's empowerment within Kabeer's (1999) RAA framework, complemented by feminist political economy and intra-household bargaining theory. Kabeer (1999) defines empowerment as the expansion of people's ability to make strategic life choices in contexts where such ability was previously

denied. This process unfolds through three interlinked dimensions:

1. Resources – material, human, and social preconditions that enhance choice
2. Agency – the capacity to define goals and act upon them
3. Achievements – the realised outcomes of exercising agency

This conceptualisation is particularly relevant in agrarian societies such as rural Nigeria, where women's productive roles in agriculture coexist with systematic constraints on decision-making authority, asset ownership, and time autonomy (Ogunlela & Mukhtar, 2009; FAO, 2023). Empowerment, therefore, cannot be inferred solely from women's participation in farming or income generation, but must be assessed in relation to control, voice, and autonomy.

Feminist Political Economy and Structural Constraints

While the RAA framework explains how empowerment occurs, feminist political economy explains why women remain disempowered despite economic participation. This perspective emphasises that agricultural systems, households, and markets are gendered institutions, shaped by patriarchy, social norms, and unequal power relations (Agarwal, 1994; Doss, 2013).

In rural Nigeria, women's access to land, labour, credit, and markets is frequently mediated through male relatives or marital status. Customary land tenure systems often deny women independent land rights, while norms surrounding marriage reinforce male authority over production and income decisions (Aluko, 2015). These structural conditions justify the inclusion of household-level and demographic variables in the empirical model, as empowerment outcomes are produced not only by individual characteristics but by embedded social relations.

The Collective and Cooperative Bargaining Models

This study is also informed by collective and cooperative bargaining models, which conceptualise households as arenas of negotiation rather than unitary decision-making entities. These models emphasise that individual outcomes within households depend on members' relative bargaining power, shaped by access to resources, income, assets, social norms, and external opportunities (Agarwal, 1997; Lundberg & Pollak, 1993). In agricultural households, cooperative bargaining arrangements may emerge where men and women pool resources and coordinate labour to maximise joint welfare, while collective bargaining frameworks recognise that cooperation is contingent and mediated by gendered power relations. Women's bargaining power is strengthened when they control income, assets, or labour, but weakened when customary norms and institutional constraints limit their ownership rights or mobility. By examining individual and household characteristics as well as resources, this study draws on collective and cooperative bargaining models to influence women's empowerment.

The Abbreviated Women Empowerment in Agriculture Index (A-WEAI)

The A-WEAI provides a theoretically grounded and empirically validated tool for measuring women's agency in agriculture. It captures empowerment using six indicators in five domains relevant to agriculture (5DE): (i) production, (ii) access to and control over resources, (iii) control over income, (iv) leadership, and (v) time use (Table 1) (Alkire *et al*., 2013).

There is broad recognition of the importance of women's empowerment in closing gender gaps in agricultural productivity (World Bank, FAO & IFAD, 2009). However, indicators that capture the importance of women in agriculture, agency and control over productive resources within the agricultural sector. To address these, the Women's Empowerment in Agriculture Index (WEAI) was developed in 2012 by the International Food Policy Research Institute (IFPRI) and the United States Agency for International Development (USAID) and OPHI, Oxford University, under the United States Government's Feed the Future Initiative (Alkire *et al*., 2013). Since its introduction, the WEAI has been widely adopted by researchers and development organisations to assess levels of empowerment and gender parity in agriculture, track changes over time, and identify priority areas for strengthening women's empowerment (Malapit *et al*., 2015; Quisumbing *et al*., 2014). In addition to measuring 5DE, the WEAI also measures the Gender Parity Index (GPI). The GPI reflects the proportion of women whose empowerment scores meet or exceed those of the men in their households. Together, these components generate an aggregate measure of the extent to which women are empowered within their households and communities (Alkire *et al*., 2013).

The A-WEAI was subsequently developed as an abridged version of the WEAI to reduce data collection burden while maintaining conceptual robustness. Whereas the full WEAI consists of ten indicators, the A-WEAI comprises six indicators across the same five empowerment domains, as presented in Table 1.

Table 1: Description of the Abbreviated Women Empowerment in Agriculture Index

Domains	A-WEAI Indicators	Weights	Conditions for adequacy
Production	Input in productive decisions	1/5	Adequate if the individual participates and has at least some input in decisions or feels he/she can make decisions in at least two agricultural activities
Resources	Ownership of assets	2/15	Adequate if household owns any asset And if the individual own at least one major asset e.g. land or at least two minor assets e.g. chickens, non-mechanized equipment
	Access to and decisions on credit	1/15	Adequate if household has and used any credit source and if respondents participate in any decisions about it
Income	Control over use of income	1/5	Adequate if participates in activity and respondent has some input in decisions about income generated from at least one activity, or feels she/he can make decisions regarding wage, employment and major household expenditure

Domains	A-WEAI Indicators	Weights	Conditions for adequacy
Leadership	Group membership	1/5	Adequate if groups exist in the community and if the respondent belongs to at least onegroup
Time	Workload	1/5	Adequate if the respondent works for 10.5 hours or less in the previous day

Source: Alkire *et al.*, (2013) and Malapit *et al.*, (2015)

METHODOLOGY

Data and sampling

This study utilised data from the 2018 Nigeria Baseline and Varietal Monitoring Survey (NIBAS), a project implemented by Obafemi Awolowo University (OAU), Ile-Ife, Nigeria, in collaboration with the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, and the Nigerian Institute of Social and Economic Research (NISER), Ibadan, Nigeria. The project was funded by the Bill and Melinda Gates Foundation. NIBAS covers six states in Northern Nigeria across three agro-ecological zones—the Southern Guinea Savanna, Northern Guinea Savanna, and Sudan Savanna—and two geopolitical zones (North Central and North West). The states included in the survey are Benue, Kaduna, Kano, Katsina, Nasarawa, and Niger (Fig. 1). The project assesses agricultural production among farming households, with particular emphasis on seven major crops: maize, cowpea, cassava, sorghum, rice, yam, and groundnut. In addition, the survey collects detailed information on gender-differentiated roles, responsibilities, and decision-making patterns within farming enterprises.

A multistage sampling design was used to select 600 households per state. The sample size was informed by power calculations and designed to capture variation in agricultural productivity and key crop and household indicators across the six states. The survey drew on the National Bureau of Statistics (NBS) master sampling frame developed for the 2008 Living Standards Measurement Study survey and subsequently updated in 2011/2012 and 2012/2013. A two-stage cluster sampling approach was applied, with 360 Enumeration Areas (EAs) selected using probability proportional to size in the first stage. This was followed by simple random sampling of approximately 10 households per EA in the second stage, making a total sample of 3600 households, an average of 600 households per state.

Measures

The dependent variable for this study is the aggregate empowerment indicator generated from AWEAI (5DE). It gives the overall empowerment score for each woman across the 6 indicators and 5 domains (see Table 3). It is constructed as an aggregate value of the different empowerment values a respondent takes in each of the six indicators. The choice of the aggregated individual empowerment score as the dependent variable is theoretically justified for three reasons. First, it aligns directly with Kabeer's concept of agency and achievements, capturing women's ability to make meaningful decisions within agricultural and household spheres. Second, the index reflects intra-household power relations, rather than assuming households to be unitary decision-making entities. Third, the A-WEAI has been widely applied in sub-Saharan Africa, including Nigeria, making it suitable for comparative and policy-relevant analysis. The independent variables are assessed at three levels: Individual, household levels as well as access or ownership of resources.

Variables such as household type, household size, dependency ratios, and health status reflect women's care burdens, negotiating power, and role flexibility within households—dimensions critical to empowerment but often omitted in productivity-focused agricultural studies. Variables such as asset value, labour availability, access to mobile phones, electricity, and distance to agro-dealers represent material resources that potentially enhance women's choices. Their inclusion reflects the "resources" component of the RAA framework.

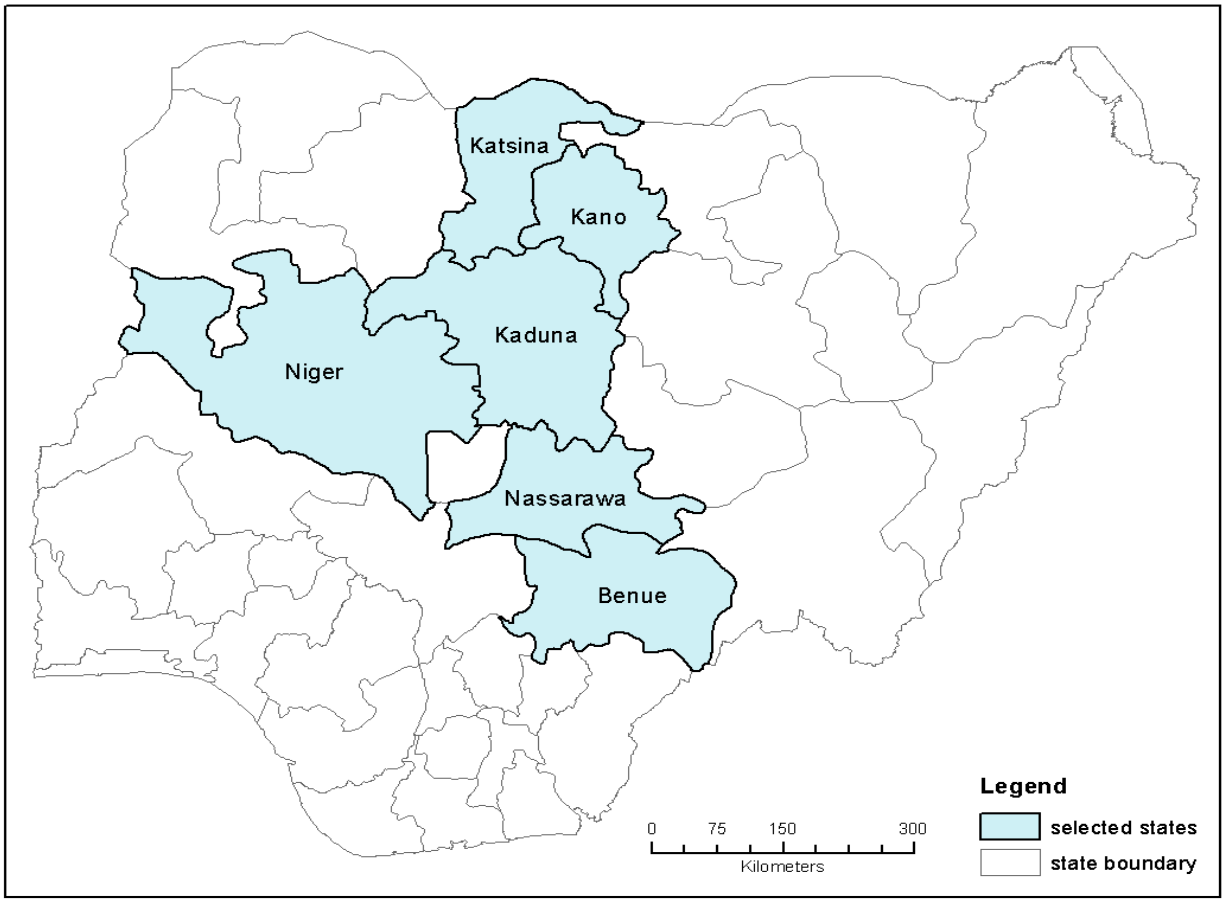

Figure 1: Map of Nigeria showing the six states included in the NIBAS Project
Source: Adeyeye *et al*. (2019)

The selected data are particularly appropriate for rural Nigeria, where women contribute substantially to agricultural labour yet remain constrained by patriarchal norms, weak asset rights, and high unpaid care responsibilities (Ogunlela & Mukhtar, 2009; FAO, 2023). By integrating individual, household, and resource dimensions, the data allow for a nuanced examination of empowerment that reflects the multifaceted live of women farmers in rural areas.

Estimation technique

Given the ordinal nature of empowerment adequacy across domains, ordered logistic regression model was used to estimate the model. This technique fits a model where the outcome variable is an ordinal variable with multivariate explanatory variables (Adeyeye

& Fabusoro, 2019). The regression technique is methodologically consistent with the theoretical understanding of empowerment as a graduated process, rather than a binary state.

RESULTS AND DISCUSSION

Descriptive analysis of the dataset

The summary statistics provide important insights into the socio-economic characteristics, household conditions, and resource access of rural women farmers in Nigeria, highlighting both opportunities and structural constraints that shape their agricultural engagement and livelihoods (Table 2).

Individual characteristics

Based on the coding scheme, the mean marital status score of 2.07 indicates that most rural women farmers in the region are married, reflecting the dominant household structure in rural Nigeria, where women's agricultural activities are closely intertwined with family and spousal responsibilities (Yunusa, 1999; Sumar, 2024). The average income from crop production is ₦430,701.7**,** with a relatively large standard deviation of ₦372,605.8**,** based on 3,209 observations. The minimum and maximum values range from ₦77,500 to ₦1,845,100, indicating substantial variation in crop income among women farmers. While the mean suggests that crop farming remains a central livelihood activity for rural women, the extreme dispersion points to marked inequality in earnings, possibly reflecting differences in farm size, input use, crop mix, and access to markets. The mean farm size is 3.02 acres, with a standard deviation of 1.84 acres, and values ranging from 0 to 6 acres. This indicates that most women farmers operate on smallholder plots, which is typical of rural agricultural systems in Northern Nigeria. The moderate standard deviation suggests some variation in landholding size, although the overall range remains within small-scale farming. The presence of a minimum value of zero may reflect cases where women do not own land but participate in farming through shared plots, family land, or labour contributions, highlighting gendered constraints in land ownership and access. Many rural women in the region still cultivate small plots, often fragmented and acquired through customary tenure arrangements (Baba & van der Horst, 2018).

The mean income from livestock is ₦363,589.4, with a standard deviation of ₦238,391.1, and values ranging from ₦60,000 to ₦1,020,000. This indicates widespread women engagement in livestock production, suggesting that livestock is a consistently viable livelihood activity among rural women. Livestock enterprises managed by women are often small-scale and oriented toward household consumption rather than commercial sale, which may partly explain the low returns observed (Baba & van der Horst, 2018).

Household characteristics

Household characteristics reveal that most respondents lived in male-headed households, as indicated by the mean of about 1 person (Mean 1.029; SD 0.167). This buttresses the finding that most of them are married and live together in a compound that comprises several related conjugal units (Baba & van der Horst, 2018). The average household size of over eight members reflects the large family structures typical of rural Nigeria. Large households can provide an important source of labour for agricultural activities. Yunusa (1999), in a study of farming households in Doma, Plateau State, in Nigeria's Middle Belt, similarly observed that rural families are often large, comprising multiple wives, children, and other dependants. However, the potential labour advantage of large household size is

moderated by the high proportion of household members who are not of working age (45%). This sizeable dependent population may increase pressure on women farmers, intensifying their labour burdens while reducing the time available for productive and income-generating activities (Blackden & Wodon, 2006; Adeyeye *et al*., 2021).

The relatively high mean proportion of chronically ill household members (about 17%) further underscores the vulnerability of rural households. Health-related constraints reduce effective labour supply and divert scarce household resources toward medical expenses, with negative implications for agricultural productivity and food security (Hilhorst *et al*., 2006). Given women's socially assigned caregiving responsibilities, illness within the household disproportionately affects women's time allocation, limiting their capacity to engage in farming, processing, and market activities (Arora & Rada, 2017).

Access to resources

Access to productive and infrastructural resources remains uneven among rural women farmers. While access to mobile phones (81 %) is relatively high and access to electricity (59 %) is considerably lower. High mobile phone ownership presents opportunities for improving women's access to agricultural information, extension services, and market prices through digital platforms. However, limited electricity access constrains the effective use of such technologies and reflects broader infrastructural deficits in rural Nigeria (Aiyetan *et al*., 2021).

The total labour variable shows extreme variation (Mean 231.88; SD 88.811), suggesting significant differences in labour availability across households. Some women rely heavily on family labour while others may depend on hired labour or face labour shortages, particularly during peak farming seasons. Previous studies have shown that women farmers rely more on family labour due to limited financial capacity to hire labour for their agricultural activities (Butterworth *et al*., 2008). Labour constraints are a critical factor shaping women's productivity, especially given their multiple domestic and care responsibilities (Pierotti *et al*., 2022).

Asset ownership is similarly uneven, with a high mean but extremely large dispersion (Mean ₦2,743,481; SD ₦4,612,637). This indicates that while a small number of women possess substantial assets, the majority own very limited productive wealth. Lack of rights over productive assets limits women's resilience to shocks, access to credit, and capacity to invest in improved agricultural technologies (Baba & van der Holst, 2018).

The average distance (mean of 9.808km) to agro-dealers is notably high indicating substantial physical barriers to input access. Long distances increase transaction costs for rural farmers and discourage the adoption of improved seeds, fertilisers, and agrochemicals (Liverpool-Tasie *et al*., 2017).

Table 2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Individual characteristics					
Marital status (single 1, married 2, Separated 3,	3209	2.074	.45	1	5

Variable	Obs	Mean	Std. Dev.	Min	Max
Divorced 4, Widowed 5)					
Income from crops (Naira)	3209	430701.7	372605.8	77500	1845100
Farm area (hectares)	3209	3.019	1.841	0	6
Income from livestock (Naira)	3209	363589.4	238391.1	- 60000	1020000
Household characteristics					
Household type (Dual adult 1; female adult only 2)	3209	1.029	.167	1	2
Household members (continuous)	2877	8.24	4.129	1	43
Proportion of household members not of working age (Percentage)	2877	45.138	20.756	0	100
Household members chronically ill (dummy)	2877	0.170	0.375	0	1
Access to Resources					
Access to a mobile phone (dummy)	2877	0.811	0.391	0	1
Access to electricity (dummy)	2842	0.594	0.491.	0	1
Total labour (Continuous)	3209	231.88	88.811	0	297
Value of assets (Naira)	3209	2743481	4612637	0	1.82e+07
Distance to agro-dealer (km)	3209	9.808	6.243	0	17

Descriptive statistics of women's empowerment across the five domains of the A-WEAI

Table 3 provides an overview of the level of empowerment of women farmers measured using the aggregated Individual Empowerment Score across the five domains of the A-WEAI. The mean empowerment score of 0.755 suggests that, on average, women in the sample have achieved a moderate level of empowerment, although the wide range (0.13–0.997) highlights substantial heterogeneity among rural women farmers. The statistics for women across the domains of AWEAI reveal important variations in empowerment, highlighting areas of relative strength as well as persistent constraints. Each indicator is measured as a binary adequacy score, where a value of 1 denotes adequacy and 0 denotes inadequacy, following standard A-WEAI methodology (Alkire *et al*., 2013).

The production domain, measured by women's input into and autonomy over agricultural production decisions, records a relatively high mean adequacy score of 0.822 with a standard deviation of 0.383. This suggests that a substantial proportion of rural women report meaningful participation in decisions related to crop and livestock production. The resources domain shows a mixed picture. While ownership of assets shows a very high mean adequacy score of 0.985, access to and decision-making over credit remains extremely low, with a mean of only 0.169, the lowest of all the A-WEAI indicators, confirming gender disparity in access to credit as one of the biggest obstacles to women's empowerment (Obisesan and Akinola, 2021). The near-universal adequacy in asset ownership likely reflects women's ownership of minor assets and small livestock rather than major productive assets. Evidence from across Northern Nigeria, just like in many African communities, shows that ownership of major assets by rural women remains heavily skewed toward men. Under customary tenure systems, men typically inherit land and allocate to their wives rather than transferring ownership (Yunusa, 1999; Pierce, 2003; Baba & van der Horst, 2018). Among the Hausa in rural Kano, married women commonly access land through their husbands, while unmarried women borrow from male relatives or other men within the community, highlighting women's limited independent asset and capital ownership (Baba & van der Horst, 2018).

In contrast, low adequacy in access to credit highlights a critical constraint to women's empowerment. Rural women are often excluded from formal lending systems due to limited asset ownership and the lack of collateral. In addition, many formal financial institutions prioritise lending to husbands or other male household members, while prevailing social norms discourage married women from borrowing without spousal approval. To navigate these constraints, women commonly rely on microloans from informal groups, cooperatives, or rotating savings and credit associations (Sumar, 2024). Although such arrangements are widespread across rural areas of Northern Nigeria, they restrict women empowerment, as loan sizes are typically small and tied to members' contributions; hence, insufficient to accumulate resources required for investments in larger assets (Meysonnat *et al*., 2022).

The income domain records the highest adequacy score across all domains, with a mean of 0.993 and a low standard deviation of 0.086. This indicates that nearly all women in the sample report adequate control over and use of income, corroborating existing evidence from the region. Among Hausa communities, married women are widely reported to place a strong value on financial independence, which they often maintain through engagement in income-generating trades (*sana'a*) and by managing their earnings separately from their husbands' finances (Baba & van der Horst, 2018). A slightly different pattern is reported by Yunusa (1999) in the Middle Belt of Nigeria, where both men and women participate in non-farm activities and exercise control over income derived from these activities. However, income from household farming is typically pooled and used to meet household needs, distinguishing it from individually controlled non-farm earnings. Among the Tivs also in the Middle Belt, Sumar (2024), men commonly use pooled household funds to pay for hired labour, particularly on cash-crop farms that are typically male-managed. Although households report pooling production and sales to meet family needs, access to these resources is unequal. As noted by Farnworth *et al*. (2020), men are more likely than women to make unilateral

personal expenditures. Some women described informal strategies to limit their husbands' access to cash in response to such spending (Sumar, 2024).

The leadership domain, measured through group membership, shows moderate empowerment, with a mean adequacy score of 0.573 and a standard deviation of 0.495. This indicates that slightly more than half of the women belong to at least one group, such as farmer associations, cooperatives, savings groups, or social organisations. Groups compensate for weaknesses in formal support systems by providing alternative forms of access to credit, extension systems, market information and social support (Ingutia & Sumelius 2024; Mwambi *et al*. 2021).

The time domain, captured through the workload indicator, records a mean adequacy score of 0.688 with a standard deviation of 0.463. This suggests that nearly one-third of women experience time poverty, characterised by excessive workloads that exceed the A-WEAI adequacy threshold. Taken together, the summary statistics reveal a non-uniform pattern of empowerment across the five A-WEAI domains. In rural areas in the northern part of the country, norms vest the exclusive burden of unpaid, domestic, and caregiving work on women. Men are restricted from doing such work, which increases the workload and burden of care of women with attendant impact on mobility, and participation in agricultural and non-farm economic activities and social groups. Among the Hausa in Kano, women are primarily responsible for domestic labour and household food preparation, while men are expected to provide income as household breadwinners (Baba & van der Horst, 2018). Women undertake cooking, childcare, and other care responsibilities. Married women are often secluded in line with religious practices and therefore do not fetch water, gather firewood, or engage directly in agricultural production outside the home; these activities are typically performed by men (Baba & van der Horst, 2018). Men cultivate crops for household consumption and market sale, while women engage in home-based farming or non-farm economic activities to meet personal needs. Similarly, among the Tiv, domestic work—particularly cooking and childcare—remains the sole responsibility of women (Surma, 2024).

Table 3: Women's empowerment in the five domains of AWEAI

Empowerment domains	Indicators	Obs	Mean	Std. Dev.	Min	Max
Overall empowerment	Individual empowerment in 5DE	3209	0.755	0.171	.13	.997
Production	Input into and autonomy over agricultural production decisions	3209	0.822	0.383	0	1
Resources	Access to and decisions on Credit	3203	0.169	0.375	0	1
	Ownership of assets	3209	0.985	0.120	0	1
Income	Control and use over income	3209	0.993	0.086	0	1
Leadership	Group membership	3209	0.573	0.495	0	1
Time	Workload	3209	0.688	0.463	0	1

Determinants of women's empowerment

Table 4 presents results of the ordinal logistic regression examining factors influencing women's empowerment across the five A-WEAI domains. The model is jointly significant ($\chi^2 = 70.06$, $p < 0.01$), though the pseudo R^2 is relatively low (0.011), which is common in empowerment studies using cross-sectional household data. The findings reveal that household-level factors are more influential than individual and resource variables, underscoring the central role of intra-household dynamics in shaping women's empowerment outcomes in rural Nigeria.

Marital status has a negative and statistically significant effect on women's empowerment ($\beta = -1.054$; $p < 0.05$). This suggests that married women are less likely to be empowered compared to their unmarried counterparts. In the Nigerian context, marriage often reinforces patriarchal norms that limit women's autonomy over productive decisions, income use, and mobility, particularly in rural agrarian communities (Adebayo *et al*., 2025; Obayelu *et al*., 2024). Married Hausa women in Northern Nigeria operate under seclusion where their mobility rights are constrained. Gender norms tend to 'protect' women from sexual harassment or labour slavery in farms by limiting their movements, thus restricting them from travelling for schooling, buying medicine or family visits. Since they are under seclusion, they practice trades around the household from which they earn income, and the autonomy to spend is ultimately the women's (Pierce, 2003). Trading, crafting, cooking for sale or gardening were the prominent economic activities under the arrangement. While they sell largely at home, children are used to marketing products outside the home. While the Hausa women have control over income from the economic markets, their participation in formal markets where they can earn higher income is mediated by men, usually their husbands, male middlemen or relatives. Norms forbid women from active public participation. While this usually does not. The lack of direct access to formal markets may limit profit optimisation from their economic activities (Baba & van der Horst, 2018). As noted earlier, major assets such as land that can enhance productivity are controlled and allocated by men under patrilineal system which is dominant in the region. Similar findings have been reported in other African settings, where household decision-making, especially on major expenditures, asset ownership, and land acquisition, among others are vested in husbands, reducing women's agency despite their substantial contribution to agricultural production (Ajewole *et al*., 2015; Forsythe *et al*., 2015; Obisesan & Akinola, 2021).

Household factors exert the strongest influence on women's empowerment, indicating the importance of intra-household power dynamics in shaping gender relations. The positive association between household type ($\beta = 3.177$; $p < 0.05$) and empowerment suggests that women in female-headed or less patriarchal household arrangements experience greater agency. Evidence from Northern Nigeria indicates that women in female-headed households, despite economic vulnerabilities, exercise greater autonomy over production and income decisions. They can consult their adult sons, but ultimately, the final decision rests with them (Sumar, 2024). The proportion of household members not of working age has a strong negative effect on empowerment ($\beta = -0.007$; $p < 0.01$). This highlights the role of dependency burdens in constraining empowerment. Caring for children and dependents reduces women's time for productive work, leadership, and social participation—key components of empowerment captured in the A-WEAI time and leadership domains. This aligns with African time-use studies that

identify unpaid care work as a major structural barrier to women's empowerment (Blackden & Wodon, 2006; Adeyeye & Fischer, 2024). Norms that restrict domestic and reproductive care to women limit their mobility; therefore, reducing their capacities to attend training, access extension services, or explore opportunities in distant but profitable markets for farm produce (Pierotti *et al*., 2022; Adebayo *et al*., 2025; John-Abebe, 2025).

Conversely, the proportion of chronically ill household members is positively associated with empowerment ($\beta = 0.006$; $p < 0.01$). While seemingly counterintuitive, this may reflect a reconfiguration of household roles in response to illness, whereby women assume greater responsibility for farm management and decision-making. Similar patterns have been observed in contexts affected by health shocks, where women exercise power due to necessity rather than normative change (Adhvaryu & Beegle, 2012), becoming de facto leaders (Kabeer, 1999).

Among resource variables, total labour availability has a positive and highly significant effect on women's empowerment ($\beta = 0.000$; $p < 0.01$). Greater access to labour reduces women's work burden and enables more active participation in farm and non-farm decision-making. While men typically cultivate larger farm areas, women depend more on hired, family, and exchange labour. Among married Hausa women, whose mobility is often constrained, hired labour is commonly used, relying on male labour for physically demanding tasks such as ridge making (Baba & van der Horst, 2018). The use of household labour as a productive resource is also evident in the Middle Belt, where large households support farming activities and exchange labour arrangements are widespread (Yinusa, 1999). In Tiv farming households, gendered labour roles and reciprocal obligations remain entrenched: men provide women with grains in return for labour on their farms, while women are expected to supply yams upon request (Surma, 2024). Across these contexts, men predominantly perform physically intensive tasks such as bush clearing, ridge making, and planting, while women are more involved in weeding and harvesting.

Asset value shows a weak but positive association with women's empowerment ($\beta = 0.000$; $p < 0.10$), suggesting that assets matter, though their effects are conditional. Consistent with Agarwal's (1994) bargaining framework, empowerment gains arise primarily from ownership rights rather than access through male household heads. In rural Northern Nigeria, this distinction is exemplified by asymmetry in livestock ownership. While men and women own goats, sheep and poultry, women dominate the rearing of poultry as an accessible but low-value asset while men retain control over large livestock such as cattle and donkeys, which function as key stores of wealth (Baba & van der Horst, 2018). This gendered asset distribution reinforces men's economic dominance and limits women's capacity to leverage assets for income generation, risk management, and bargaining power, thereby dampening the empowerment effects of asset accumulation.

Table 4: Determinants of empowerment among women agrifood system actors

Individual empowerment in 5DE	Coef.	St. Err.	z-value
Individual characteristics			
Marital status	-1.054	0.462**	-2.28
Income from livestock	0.000	0.000	-0.87

Individual empowerment in 5DE	Coef.	St. Err.	z-value
Income from crop	0.000	0.000	-0.30
Farm area	-0.003	0.005	-0.66
Household factors			
Household type	3.177	1.271**	2.50
Household members	0.015	0.010	1.46
Proportion of household members not of working age	-0.007	0.002***	-3.41
Household members chronically ill	0.006	0.001***	5.30
Resources			
Access to cell phone	0.001	0.001	1.11
Access to electricity	0.001	0.001	0.96
Total labour	0.000	0.000***	3.49
Value of assets	0.000	0.000*	-1.68
Distance to agro-dealers	0.000	0.000	-0.91
/cut1	-5.315	0.741	.b
#Mean dependent var	0.754		
Pseudo r-squared	0.011		
Chi-square	70.063		
Akaike crit. (AIC)	6589.451		

*significant at 10%, **significant at 5%, ***significant at 1%

CONCLUSION

This study provides empirical evidence on the determinants of women's empowerment among rural women engaged in agriculture in Northern Nigeria using the empowerment index in the five domains of the A-WEAI. Findings indicate heterogeneity in the empowerment across the five A-WEAI domains. Rural women in Northern Nigeria demonstrate relatively high adequacy in production and income, moderate empowerment in leadership and time, and significant deprivation in access to credit within the resource domain. These underscore the multidimensional nature of empowerment and highlight the importance of examining domain-specific constraints rather than relying solely on aggregate empowerment scores. The high level of deprivation in credit confirms that limited access to credit is a key factor constraining women's empowerment in the study area and restricts their full and equitable participation in agricultural activities. When women lack access to credit, it has significant implications for their agricultural productivity and may further widen the existing productivity and income gaps between men and women.

The findings reaffirm that women's empowerment in agriculture is not driven solely by productive engagement or income generation, but is deeply embedded in household structures, demographic pressures, and gendered social relations (Kabeer, 1999; Doss, 2013). Household-level factors particularly household type, dependency ratios, health shocks, and labour availability emerged as the most significant drivers of empowerment. These findings reinforce the argument that empowerment requires not only access to resources but also agency, control, and supportive social norms.

From a policy perspective, the results suggest that efforts to empower women in Northern Nigerian agriculture must move beyond narrow productivity-enhancing interventions. Interventions aimed at improving women's empowerment in credit should adopt a comprehensive approach that addresses the multiple drivers of inequality, including less visible underlying constraints such as gender norms that influence women's access to and control over financial resources. Gender-responsive policies should integrate labour-saving technologies, childcare and social protection measures, women's asset ownership, and norm-transformative approaches that address intra-household power imbalances. Embedding empowerment objectives within agricultural, health, and rural development programmes is essential for achieving inclusive and sustainable agricultural transformation.

REFERENCES

Adam, R. I., Sufian, F. D., & Njogu, L. (2024). The status of women's empowerment in the aquaculture sector in Kenya. *International Journal of Development Issues*, *23*(1): 142-165.

Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (2025). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States. http://dx.doi.org/10.2139/ssrn.5414938 .

Adeyeye, O., & Fischer, G. (2024). Empowerment and gender norms among Yoruba women and men cassava producers. *Heliyon,* 10(21).

Adeyeye, O., & Fabusoro, E. (2019). What capability matters for household food security? Insight from rural women in Southwest Nigeria. *Ibadan Journal of Agricultural Research,* 15(1): 15 – 29

Adeyeye, O., Ogunleye, A. S., Wineman, A., Reed, H., Alia, D., Akinola, A. A. Bamire A.S., Abdoulaye T., Oni, T.O. & Ogundele, O. (2019). Does women's empowerment influence agricultural productivity? Evidence from rural households in Northern Nigeria. Sixth International Conference African Association of Agricultural Economists (AAAE), September 23-26, 2019, Abuja, Nigeria. https://ideas.repec.org/p/ags/aaae19/295940.html

Adhvaryu, A. R., & Beegle, K. (2012). The long-run impacts of adult deaths on older household members in Tanzania. *Economic Development and Cultural Change*, *60*(2): 245-277.

Agarwal, B. (1994). *A field of one's own: Gender and land rights in South Asia*. Cambridge University Press.

Agarwal, B. (1997). "Bargaining" and gender relations: Within and beyond the household. *Feminist Economics*, 3(1): 1–51.

Aiyetan, I., Aremo, A., & Olomola, P. (2021). Assessing the impact of electricity production on industrial and agricultural output growth in Nigeria. *International Journal of Business and Economic Sciences Applied Research*. https://doi:10.25103/ijbesar.133.07

Ajewole, O., Ayinde, E. O., Ojehomon, V., Agboh-Noameshie, R., & Diagne, A. (2015). Gender analysis of agricultural innovation and decision

making among rice farming household in Nigeria. *AGRÁRINFORMATIKA/Journal of Agricultural Informatics*, *6*(2): 72-82.

Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa. *Journal of Economic Perspectives*, 24(3): 207–232.

Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G., & Vaz, A. (2013). The women's empowerment in agriculture index. *World Development*, 52: 71–91.

Arora, D., & Rada, C. (2017). A gendered model of the peasant household: Time poverty and farm production in rural Mozambique. *Feminist Economics*, *23*(2): 93-119.

Ayevbuomwan, O. S., Popoola, O. A., & Adeoti, A. I. (2016). Analysis of women empowerment in rural Nigeria: A multidimensional approach. *Global Journal of Human Science: C. Sociology and Culture*, *16*(6): 35-48.

Baba, U. S., & Van der Horst, D. (2018). Intrahousehold relations and environmental entitlements of land and livestock for women in rural Kano, northern Nigeria. *Environments*, *5*(2): 26.

Blackden, C. M., & Wodon, Q. (Eds.). (2006). *Gender, time use, and poverty in sub-Saharan Africa* (Vol. 73). World Bank Publications.

Butterworth, R., Abdulsalam-Saghir, P., & Martin, A. (2008). CAVA: Gender and Diversity report Nigeria, National Resources Institute. https://gatesopenresearch.org/documents/3-238

Chiaka, J. C., Zhen, L., Xiao, Y., Hu, Y., Wen, X., & Muhirwa, F. (2024). Spatial assessment of land suitability potential for agriculture in Nigeria. *Foods*, 13(4): 568. https://doi.org/10.3390/foods13040568

Doss, C. (2013). Intrahousehold bargaining and resource allocation in developing countries. *The World Bank Research Observer*, *28*(1): 52-78.

Doss, C., Meinzen-Dick, R., Quisumbing, A., & Theis, S. (2018). Women in agriculture: Four myths. *Global Food Security*, 16: 69–74.

FAO. (2023). *The status of women in agrifood systems – Overview.* Rome. https://doi.org/10.4060/cc5060en

Forsythe, L., Martin, A., & Posthumus, H. (2015). Cassava market development: a path to women's empowerment or business as usual?. *Food Chain (2046-1887)*, *5*.

Hilhorst, T., Van Liere, M. J., Ode, A. V., & De Koning, K. (2006). Impact of AIDS on rural livelihoods in Benue State, Nigeria. *Sahara: Journal of Social Aspects of HIV/AIDS Research Alliance*, *3*(1): 382-393.

Ingutia, R. & Sumelius J. (2024). Does cooperative membership facilitate access to credit for women farmers in rural Kenya? *Journal of Agriculture and Food Research,* 18: 01425. https://doi.org/10.1016/j.jafr.2024.101425

John-Abebe, R. O. (2025). Gender norms and agro-pastoral women's participation in economic activities in North-Eastern Nigeria. *Ghana Journal of Geography*, *17*(2): 18-28.

Kabeer, N. (1999). Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and Change*, 30(3): 435–464.

Liverpool-Tasie, L. S. O., Omonona, B. T., Sanou, A., & Ogunleye, W. O. (2017). Is increasing inorganic fertilizer use for maize production in SSA a profitable proposition? Evidence from Nigeria. *Food Policy*, *67*: 41-51.

Lundberg, S., & Pollak, R. A. (1993). Separate spheres bargaining and the marriage market. *Journal of Political Economy*, 101(6): 988-1010.

Malapit, H. J. L., Kadiyala, S., Quisumbing, A. R., Cunningham, K., & Tyagi, P. (2015). Women's empowerment mitigates the negative effects of low production diversity on maternal and child nutrition in Nepal. *The Journal of Development Studies, 51*(8): 1097–1123.

Malapit, H. J. L., Kovarik, C., Sproule, K., Meinzen-Dick, R., & Quisumbing, A. R. (2015). Instructional guide on the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI). *IFPRI Discussion Paper* No. 01487. International Food Policy Research Institute.

Meysonnat, A., Wineman A., Anderssen C.L., Adegbite, O., de Hoop T (2022). Participation in informal savings groups and women's empowerment in agriculture in Nigeria. ECWG Working Paper 09. https://womensgroupevidence.org/sites/default/files/2022-07/Paper-Informal-Savings-Groups.pdf

Mwambi, M., Bijman J., & Galie A. (2021). The effect of membership in producer organizations on women's empowerment: Evidence from Kenya. *Women's Studies International Forum* 87: 102492. https://doi.org/10.1016/j.wsif.2021.102492

Obayelu, O. A., & Chime, A. C. (2020). Dimensions and drivers of women's empowerment in rural Nigeria. *International Journal of Social Economics*, *47*(3): 315-333.

Obayelu, O., Jimmy, M., & Ojo, A. O. (2024). Women's empowerment in agriculture and household food insecurity in Nigeria. *Malaysian Journal of Agricultural Economics*, *31*(1): a0000541. https://doi.org/10.36877/mjae.a0000541

Obisesan, A. A., & Akinola, M. O. (2021). Women's involvement in intra-household decision making on agricultural production: what factors matter? *Periodicity: Semestral*, *10* (2). https://doi.org/10.5281/zenodo.5562354

Ogunlela, Y. I., & Mukhtar, A. A. (2009). Gender issues in agriculture and rural development in Nigeria: The role of women. *Humanity & Social Sciences Journal*, 4(1): 19–30.

Ogunnaike, M. G., Shittu, A. M., & Kehinde, M. O. (2019). Effect of gender empowerment in agriculture on food

security of farming households in Ogun state, Nigeria. *Ife Journal of Agriculture*, *31*(2): 59-71.

Olayide, O. E., Obisesan, D., Nitturkar, H., Adesida, A., Alegieunu, B., & Obisesan, O. (2021). Cassava seedpreneurship, determinants of varietal adoption, profitability, and women empowerment in Nigeria. *Resources, Environment and Sustainability*, *6*, 100041.

Peterman, A., Behrman, J. A., & Quisumbing, A. R. (2014). A review of empirical evidence on gender differences in nonland agricultural inputs, technology, and services in developing countries. *World Development*, 59: 183–209.

Pierce, S. (2003). Farmers and 'prostitutes': Twentieth-century problems of female inheritance in Kano emirate, Nigeria. *The Journal of African History*, *44*(3): 463-486.

Pierotti, R. S., Friedson-Ridenour, S., & Olayiwola, O. (2022). Women farm what they can manage: How time constraints affect the quantity and quality of labor for married women's agricultural production in southwestern Nigeria. *World Development*, *152*:105800. https://doi.org/10.1016/j.worlddev.2021.105800

Quisumbing, A. R., Meinzen-Dick, R., Raney, T., Croppenstedt, A., Behrman, J. A., & Peterman, A. (2014). *Gender in agriculture and food systems*. FAO.

Ragsdale, K., Read-Wahidi, M., Marinda, P., Pincus, L., Torell, E., & Kolbila, R. (2022). Adapting the WEAI to explore gender equity among fishers, processors, and sellers at Zambia's Lake Bangweulu. *World Development*, *152*: 105821.

Sen, A. (1990). Gender and cooperative conflicts. In I. Tinker (Ed.), *Persistent inequalities* (pp. 123–149). Oxford University Press.

Surma, N. (2024). *Are international agriculture projects empowering rural female farmers in sub-Saharan Africa? A case study of North Central Nigeria* (Doctoral dissertation, University of East Anglia).

World Bank, the Food and Agriculture Organization (FAO) of the United Nations, and the International Fund for Agricultural Development (IFAD) f (2009). Gender in agriculture sourcebook (English). Agriculture and Rural Development Washington, DC: World Bank. http://documents.worldbank.org/curated/en/799571468340869508.

Yunusa, M. B. (1999). Not farms alone: a study of rural livelihoods in the Middle Belt of Nigeria. *ASC* Working Paper 38. Centre for Research and Documentation (CRD), Kano