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On the Challenges Faced by Female Members of Agricultural Cooperatives in Southeast Nigeria

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This study uses structural equation modelling (SEM) and path diagram techniques to examine challenges faced by women in the agricultural sector cooperatives in Southeast Nigeria. The data are from a cross-section survey of randomly selected women cooperative members. Results suggest that women with poor economic status are less likely to have access to improved technology, labour, off-farm employment, and improved infrastructure. We found that cultural factors increase women's failure to own land, farm inputs, and agricultural credit. Additionally, the results show that compared to men, institutional factors increase women's unequal access to extension training as well as their domestic workload. We also found that older women face fewer challenges in the agricultural sector cooperatives than younger ones while more educated ones face more challenges. This study provides useful policy insights to mitigate the challenges women face in agricultural cooperatives. Most importantly, we argue that economic freedom among women in cooperatives may not be achieved unless they are emancipated from existing cultural, economic, institutional, and management constraints.

Key words: confirmatory factor analysis, path diagram, structural equation model, Nigeria

INTRODUCTION

Agriculture is paramount to the economic development of rural societies. Development of rural sources parallels job creation, market infrastructure, and road infrastructural development among others. To quicken the development of the sector, the integration of women in the development process would go a long way to improve the sectorial contribution to productivity and food security. Women's contribution to rural agriculture is often swept under the carpet even though research (e.g., Basavaraj and Babus, 2018) have shown that women contribute about 43% of agricultural labour globally. This statistic varies across countries especially in Sub-Sahara Africa (SSA) where agriculture is more of a subsistent – farming practice. Throughout human history, traditional gender roles have often defined and limited women's activities and opportunities. Many religious doctrines stipulate certain rules for obligatory women. For example, Obianefo et al. (2019) suggest that women are more or

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less considered vulnerable in the agricultural sector.

To improve food security especially during the coronavirus disease 2019 (COVID-19) pandemic, women in agriculture have taken a centre stage in economic planning in most developing countries. This suggests that for their important roles, women have been in the forefront overseeing the agriculture sector even if their roles are not quite recognized. Women are the key developmental actors. They play a significant role in domestic and socioeconomic dynamics of rural societies. These roles include but not limited to land preparation, planting of crops, harvesting, transporting, processing, storing, and marketing of farm and non-farm produce. Adenugba and Raji-Mustapha (2013) suggest that women's activities are typically numerous. Adenugba and Raji-Mustapha (2013) further contend that women's roles in rural societies include tending to animals, food processing and preparation, working for agricultural and non-agricultural enterprises to generate income and improved livelihoods, engaging in trade and marketing and caring for their families. The involvement of women in the sector should attract attention to developing suitable extension services that are gender-specific and tailored to women farmers (Olorunnishola et al, 2016; Ng'ombe et al., 2017). The need for this should not be looked down as extension has often been seen as the best tool to disseminating agricultural research results and technologies (Ng'ombe et al., 2014; Mensah and Brümmer, 2016).

As in other countries, despite the realization of the importance of women in agriculture, their contributions to agriculture remain neglected in Nigeria. Nwankwo and Onyishi (2012) and Lone et al. (2020) reiterate that Nigerian women in agriculture have continued to face such challenges as rural poverty, yet programs are not tailored to addressing them. Systemic gender biases exist in the form of (a) customs, beliefs and attitudes that confine women mostly to the domestic sphere, (b) women's economic and domestic workloads that impose severe time burdens on them, and (c) laws and customs that impede women's access to credit, production inputs, employment, education, or medical care (Baba et al., 2015). Ogunlela and Mukhtar (2009) contend that women contribute immensely to agricultural output, however, they have recently, benefited from agricultural incentives and innovation due to economic suppression, social and traditional practices which weaken the constitutional provisions on gender equality. Ogunlela and Mukhtar (2009) suggest that gender discrimination, rather than ignorance, is the justification for the lack of female participation in agricultural programs and projects.

In Nigeria, women are often marginalized to have limited access to economic, political and social resources compared to men, rendering them relatively poorer than their male counterparts (Adebayo, 2019). With little or no access to modern improved technologies, generally, women may not secure reasonable investments in. capital, inputs and labour (Baba et al., 2015). These challenges are seen to cut across other world countries Niranjan et al. (2020) and Honsberger (2015) suggest that male members of the society get more opportunities for education, access to information and exposure, as well as more access to off-farm work for income generation. The challenges faced by women in the sector have been identified by many scholars since they seem to have reduced women's farm productivity in the food supply chain. Thus, Azih (2008) and Sule and Yusuf (2019) note that agricultural productivity has remained a very complex concept and most difficult to interpret due to the diversity of capital utilized in agricultural production.

Obianefo et al. (2020) and Pandit (1965) argue that productivity is the art of securing an increase in output from the same input or getting the same output from smaller input. In the same line of thought, Adams (2017) suggests that the challenges facing women and what reduces their productivity are constraints resulting from unified extension systems, socio-cultural barriers. Mugede (2013) affirms that women experience limited access to productive resources. Drafor-Amenya and Puplampu (2013) suggest that women have limited access to land ownership and that this must be tackled through accelerated land development.

Salma and Pushkar (2010) equally reiterate that women are less educated than their male counterparts and that more domestic workload restricts women's participatory ability in agricultural projects. Lack of training on extension services and mechanization was reported by Dave (2020) and Ng'ombe et al. (2020) as a serious challenge that women face in the sector. Drafor and Puplampu (2013) identify limited access to finance and farm inputs as the major challenges women face. The Sahel Capital and Advisory Limited (SCA) (2014) that women receive less than 10% of credit offered to small scale farmers in Nigeria due to limited access to collateral.

While many empirical studies exist on the subject of women's challenges in the agricultural sector which cut across many SSA countries, many of the challenges faced in one region may not apply to another region. Some may have not been addressed. It is still necessary to draw the attention of policymakers to this important area because of the importance of women to agricultural productivity and food security. Since Nigeria is a country with six geopolitical zones and with about three hundred ethnic groups, adding to literature about the challenges women face in agricultural cooperatives is necessary. Thus, the objective of this study is to determine the challenges women face in agricultural sector cooperatives in Southeast Nigeria. As observed by Mulungu and Mudege (2020), development agencies often implement interventions through collective-action groups that include farmer cooperatives. This suggests there is still great need to understand the

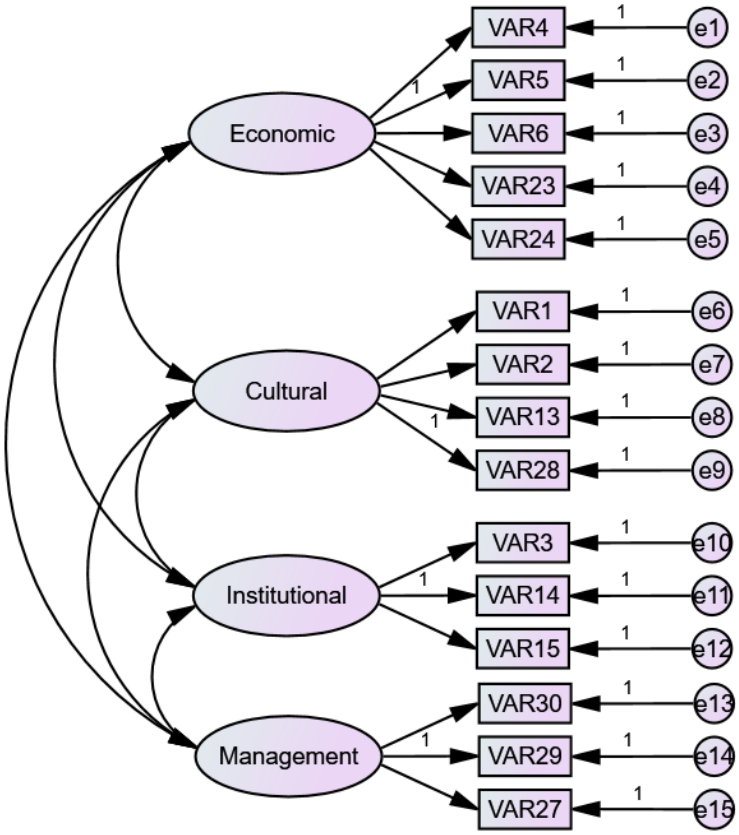

Figure 1. Confirmatory path diagram of women's agricultural challenges in Southeast, Nigeria.

challenges women face in agricultural sector co-operatives. This study could provide policymakers with insights about the challenges women face in agricultural cooperatves and ways in which they can be mitigated.

We adopt a confirmatory factor analysis (CFA) approach by drawing a path diagram to validate the hypotheses of those agricultural challenges peculiar to Southeastern part of the country for policy implication. The choice of this approach affords them the opportunity for structural modification till they arrive at those challenges. This is because the aim is to make policymakers prioritize and channel attention to solving problems that are consistent with the research area. Newsom (2017) note that CFA is part of a larger analysis framework, called structural equation modelling (SEM) that combines CFA with path analysis (regression slopes). Amy et al. (1997) suggest that before proceeding with CFA, researchers need to understand the theory underlying variable measurement before its analysis. We therefore, adopt CFA to examine the causal connections between the challenges identified, to help us reject or fail to reject one or more hypotheses about the factor structure based on the sampled data. We further looked at how the socioeconomic profile of the women interacts with the challenges they face in the sector.

Subsequent sections of the article are organized as follows.

The next section presents data and their description. Section 3 presents the methodology while section 4 provides empirical results and discussion. Section 5 concludes.

Data

This study was carried out in Southeastern Nigeria. The five states that make up the area include Anambra, Imo, Enugu, Abia, and Ebonyi, covering 101 Local Government Areas (LGAs) that split into 346 communities. About 60% of the residents live in rural areas and over 70% of rural dwellers depend on farming for their survival (Okechukwu, 2014). The area is renowned for commerce, adventure, and dexterity. The last official census (NPC, 2006) reported that the area had 28,415,006 people where 51% of the population were female. Women form cooperatives to have access to market opportunities, credit, inputs, processing of farm produce, and marketing. The area (shown in Figure 1) is located on latitude 6°26′59′′ N and 6°44′99′′N and longitude 7°29′59′′E and 7°49′99′′E, with 41440 km^2.

Table 1. Distribution of Women according to State and LGAs.

State	No. of cooperatives	No. of members	Stratum
Anambra			
Ayamelum	9	145	65
Awka North	10	172	77
Imo			
Orlu West	8	138	62
Owerri West	9	153	68
Enugu			
Aninri	10	197	88
Udenu	8	129	58
Ebonyi			
Ivo	7	111	49
Izzi	8	125	56
Abia			
Bende	6	84	37
Isiala Ngwa	7	112	50
Total	82	1366	610

We initially carried out a pilot survey to estimate the standard deviation to be use for determining the sample size of the main survey. We sent 25 pre-test (5 per State) questionnaires were sent to research assistants. With a 90% return rate from the pilot survey, they used Binomial-based method to calculate the standard deviation (σ) as:

$$\sigma = npq \quad (1)$$

where n is number of pilot questionnaire (25), p is return rate (success), and q is failure. Thus, σ = 25*0.9*0.1 = 2.25.

Furthermore, a mean sample size determination method was used which was stated as:

$$n_i = \frac{Z^2\sigma}{e^2} \quad (2)$$

where: n_i is sample size, Z^2 is Z score (1.64), σ is standard deviation (2.25), and e^2 is marginal error at 10% significance level (0.10). Thus the sample size was

$$n_i = \frac{1.64^2 * 2.25}{0.1^2} \quad (3)$$

n_i = 605.16 = 610 to the nearest ten.

From the list of women cooperative provided by the Cooperative Department from the five States, there are 133,841 registered women cooperative for farmers in Southeast. Two agrarian LGAs were randomly selected from each State. The authors employed the Kumaison (1997) stratum method (also used in Ekwere and Edem, 2014) to allocate the study strata per State as defined by Equation 4 and presented in supplementary Table 1.

$$i\text{th} = \frac{n_h \times n}{N} \quad (4)$$

where n is the total sample size, n_h is number of items in each stratum in the population, N is the new population size in the strata, and ith is sample allocation (Table 1). shows the population distribution of female cooperatives as well as their membership representation per state, it equally shows how the sample size was proportionately allocated per state.

Eventually, (10) research assistants were employed (two per state) and they spent two weeks in the field to collect high quality data for the study.

Table 2 presents descriptive statistics of the women in the sample. Descriptive statistics show that the average age, level of education (years), farming experience (years), household size (people), monthly income (USD), and farm size (ha) for the sample are 43.03, 11.81, 14.87, 6.02, 87.04, and 0.37, respectively.

METHODS

Analytical framework

Following Newsom et al. (2016) and Williams (1995), the first thing to do while conducting CFA is to run a default principal factor analysis (PFA). This is necessary before estimating the causal effects between the variables. They conducted the default PFA to prepare the data for CFA convergence. One distinguishing feature

Table 2. Descriptive statistics of women in the sample (N=610).

S/N	Variable	Mean	Standard deviation
1	Age (year)	43.03	13.958
2	Education (year)	11.81	3.913
3	Farming experience (year)	14.87	7.290
4	Household size (No)	6.02	2.701
5	Monthly income (USD)	87.04	26.35
6	Farm size (ha)	0.37	0.120

Source: Field survey data, 2019. 1 USD = NGN 380 (accessed 20 October 2020 from www.xe.com).

of CFA from the explanatory factor analysis (EFA) is that the variables can be structurally modified to achieve a model with good fit. This singular act of modification can introduce a type 1 error. It is important to note that CFA is an SEM tool that combines factor loading with path analysis. To cope with the complications and problem of SEM, experts have tried to devise other indices of "goodness of fit" or "approximate fit" using maximum likelihood estimation (MLE). These should express the degree of approximation plus estimation discrepancy, and provide an additional basis for the acceptance or rejection of a model. Therefore, CFA allowed us to test and modify their path diagram until it was consistent with SEM's model fit. All but one of these goodness-of-fit indices (GFI) are based on Chi-square (χ^2) and degree of freedom as defined by Hu and Bentler (1998, 1999) in Equation (5)

$$GFI = 1 - \hat{F}/\hat{F}_b \quad (5)$$

where $\hat{F}$ is the minimum value of the discrepancy function $\hat{F}_b$, is the baseline discrepancy function defined in Bollen (1989b) as 0.95. The second model fitness called Turker-Lewis coefficient or index (TLI) as defined by Bentler and Bonett (1980) is

$$\rho^2 = \frac{C_b}{d_b} - \frac{\bar{C}}{d}/\frac{C_b}{d_b} - 1 \quad (6)$$

where $\hat{C}$ and d are the discrepancy and the degrees of freedom for the model being evaluated respectively, $\hat{C}_b$, and d_b are respectively the discrepancy and the degrees of freedom for the baseline model. The typical range for TLI lies between zero and one, but it is not limited to that range, the value close to one indicates a very good fit. The third model indices they obeyed was comparative fit indexes (CFI) defined by Bentler (1990) as:

$$CFI = 1 - Max(\hat{C} - d, 0)/Max(\hat{C}_b - d_b, 0) = 1 - NCP/NCP_b \quad (7)$$

where $\hat{C}$ is the discrepancy, NCP is the non-centrality estimate for the model being evaluated,

$\hat{C}_b$, NCP_b and d_b are the discrepancy, non-centrality and degree of freedom for the baseline model respectively. This CFI model is identical to McDonald and Marsh (1990) relative non-centrality index (RNI) defined as:

$$RNI = 1 - \hat{C} - d/\hat{C}_b - d_b \quad (8)$$

The only distinguishing feature of CFI and RNI is that CFI is truncated to fall in the range between zero and one (Bentler, 1990). Thus, a CFI value close to 1 indicates a very good fit model. Finally, they also consider the root mean square error approximation (RMSEA) which has an indirect relationship with the residuals since it is based on Chi-square (χ^2), degree of freedom (*df*) and sample size (N). Following Hu and Bentler (1998, 1999), this RMSEA mathematically expressed as:

$$RMSEA = \sqrt{x^2 - df/df\,(N-1)} \quad (9)$$

Several suggestions exist regarding the critical cutoff values to determine the acceptance or rejection of a model, among which those of Hu and Bentler (1998, 1999) have been widely used. According to Kenny (2012), goodness of fit model indices often reported in CFA studies include RMSEA of less or equal to 0.06, comparative fit index (CFI $\geq$ 0.95), and Tucker-Lewis index (TLI $\geq$ 0.95) among others. All these suffice to determine the point of rejection or acceptance of the SEM.

To achieve the above mentioned thresholds, data collected from the respondents were subjected to a series of test for internal consistency such as Kaiser-Meyer-Olkin measure of sampling adequacy and their value was 0.656 (Supplementary Table 2), commonalities, and discriminant analysis test. By the rule of thumb, as in Obianefo et al. (2020), a KMO value greater than 0.5 meant that the data were adequate for analysis. The variables with a communalities-value less than 0.5 (Supplementary Table 3) were otherwise dropped. The data equally had a positive Eigen-value which helped them to achieve 73.86% total variance that meant that it was adequate to further the study (Supplementary Table 4). They also adopted a discriminant analysis approach to ensure no variable was loaded in more than one factor (Supplementary Table 5) as this would go a long way to ease the CFA convergence using MLE. All the challenges identified from the empirical reviews were presented in (Supplementary Table 6).

Empirical model specification

The basic model of the default PFA stated in Joreskog (1977) is stated as:

$$Z_i = \delta_{i0} + \delta_{i1}F_1 + \delta_{i2}F_2 \ldots + \delta_{im}F_m + e_i \quad (10)$$

where $\boldsymbol{Z}_i$ is the $p \times 1$ vector of measurements or observations, $\boldsymbol{\delta}_{i0}$ is the $p \times 1$ vector of means, $\boldsymbol{\delta}_{i1}$ - δ_{im} is the $p \times$ m matrix of factor loading (regression weight), F_1-F_m is the m x 1 vector of factors, $\boldsymbol{e}_i$ is the m x 1 vector of residual varaibles or unobserved stochastic error term with zero mean and finite variance. For the vectors, p is the number of measurement on a subject, and m is the number of common factor. After estimating of equation (10), they then applied

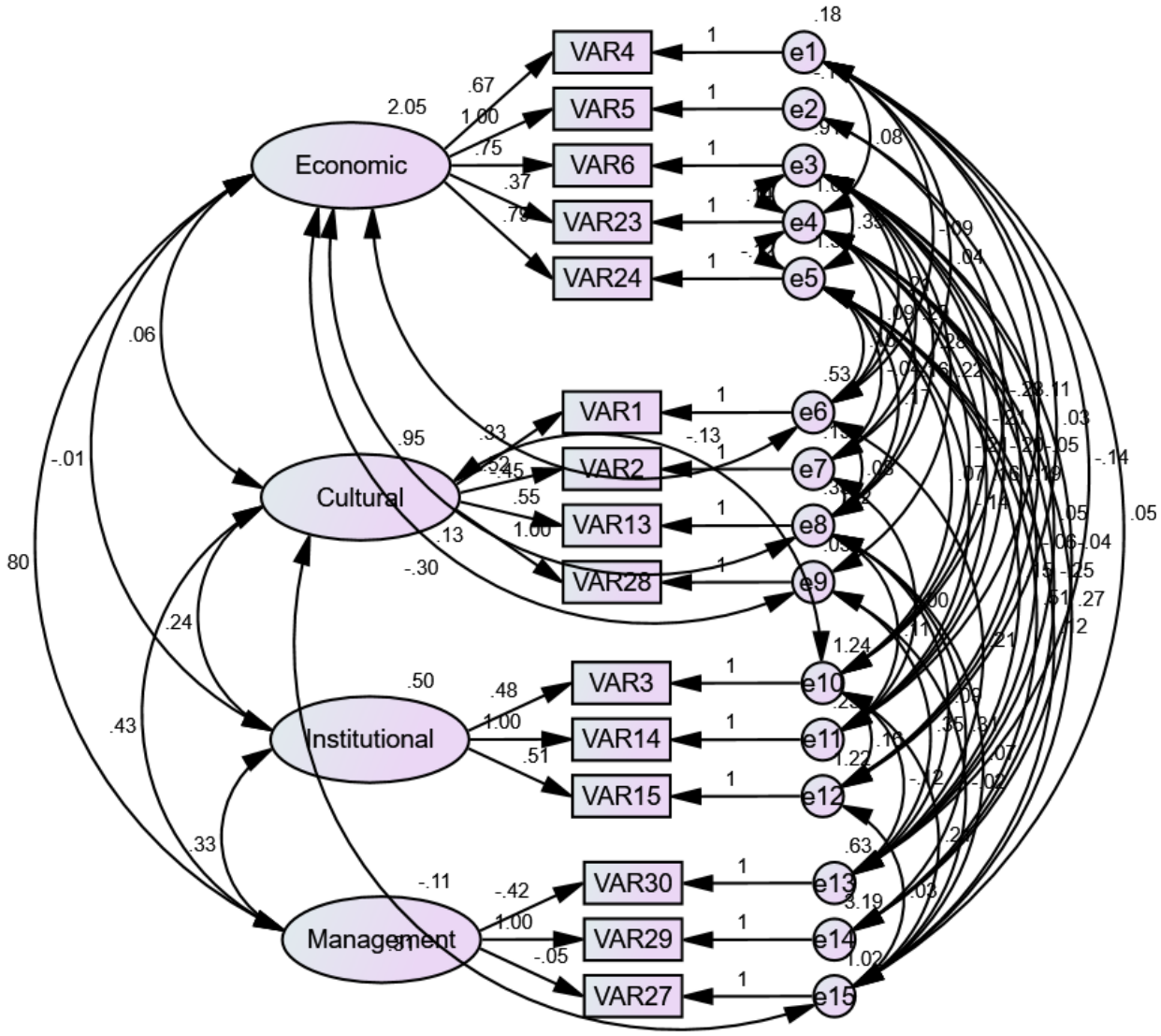

Figure 2. Output of the modified path diagram of women's challenges.

the associated assumptions (KMO ≥ 0.5, Cronbach's alpha ≥ 0.7, communalities ≥ 0.5, variance explained factor ≥ 53%, and discriminant analysis that suggest no variable should load in more than one factor) accordingly and a suitable number of factors were subjectively selected using a Promax rotation factor matrix from SPSS software version 23.0, after which they drew a CFA path diagram as in Supplementary Figure 1:

Next, the relationship between the women's socioeconomic characteristics and agricultural challenges faced in the area was estimated using a two-limit Tobit regression model. The following model was estimated

$$Y^* = \beta_0 + \beta_1 X_1 + \dots \beta_8 X_8 + u_i \quad (11)$$

where Y^* is the latent variable for threshold of women's agricultural challenges from 5 points Likert scale, β_1- β_8 is estimated parameters, X_1 is age measured in years, X_2 is marital status (1 = married, 0 = otherwise), X_3 is level of education measured in years, X_4 is farming experience measured in years, X_5 is household size, X_6 is monthly income measured in USD, X_7 is the number of extension contacts recorded during the previous farming season, and X_8 is land area in hectares (Ha), μ_i is error term and is normally distributed with zero mean and constant variance. The latent variable (Y^*) below 3.0 is left censored.

RESULTS AND DISCUSSION

Confirmatory factor analysis of the agricultural challenges faced by the women

Figure 2 shows the output from the CFA approach. We took advantage of the flexibility of CFA over the EFA to modify the path diagram as suggested by the analytical tools in Amos version 23 to obtain a model with good fit. The low values of Chi-square distribution (χ^2) (99.498),

Table 3. Confirmatory factor analysis of the agricultural challenges faced by the women.

Variable ID			Component factors	Estimate	S.E.	C.R.	P
VAR4	Inadequate access to improved technology	<---	Economic	0.668	0.011	59.053	***
VAR5	Inadequate access to capital	<---	Economic	1.000			
VAR6	High cost of labour	<---	Economic	0.748	0.026	28.905	***
VAR23	Inadequate access to off-farm employment	<---	Economic	0.373	0.027	13.655	***
VAR24	Infrastructural decay	<---	Economic	0.786	0.033	23.494	***
VAR1	Limited access to land ownership	<---	Cultural	0.327	0.034	9.517	***
VAR2	High cost of farm inputs and agro chemical	<---	Cultural	0.518	0.037	13.932	***
VAR13	Women receive lesser credit offered to the sector	<---	Cultural	0.554	0.041	13.452	***
VAR28	Personal health	<---	Cultural	1.000			
VAR3	Unequal access to extension training with the men	<---	Institutional	0.481	0.111	4.327	***
VAR14	High rural poverty among women	<---	Institutional	1.000			
VAR15	Domestic workload	<---	Institutional	0.512	0.114	4.503	***
VAR30	Herders-farmers clash	<---	Management	-0.420	0.057	-7.426	***
VAR29	Climate change issues	<---	Management	1.000			
VAR27	Child bearing and house chores	<---	Management	-0.053	0.045	-1.187	0.235
Model fit summary							
DF				29			
GFI				0.979			
TLI				0.960			
CFI				0.989			
RMSEA				0.063			

Source: field survey data, 2019. (*) significant at 10%, (**) significant at 5%, (***) significant at 1%. *S.E* is the standard error, *C.R* is covariance which is the same as *Z*-ratio in a multiple regression, and *P* is probability

the GFI (0.979), TLI (0.960), CFI (0.989) and RMSEA (0.063) suggested that we had an appropriate model following the path modification. These values were in agreement with Hu and Bentler (1998, 1999) whose suggestion confirmed the above values to be within the appropriate thresholds. The regression weight of CFA represents the casual effect of the latent observation on the observed challenges (Table 3).

The default PFA saw the rotation of those challenges that passed through the data treatment into four (4) components named as economic (factor 1), cultural (factor 2), institutional (factor 3), and managerial (factor 4). The relationship between the measurement of observed variables and the unobserved variables (constructs) was significant at 1% significance level. Inadequate access to capital, personal health, high rural poverty among women, and climate change issues were the challenges (measurement variables) assumed to have a constant relationship with the latent loading.

We found out that economic factors have a positive relationship and casual effect on the observe challenges. This is with respect to inadequate access to improved technology (0.668), high cost of labour (0.748), inadequate access to off-farm employment (0.373), and infrastructural decay (0.786). If the above economic variables in the agricultural sector are not properly addressed, their marginal impact to women will be exactly the value of the causal effect. These findings are in agreement with those found in Mugede (2013); Baba et al. (2015); Honsberger (2015).

The study results also showed that cultural factors have a positive and significant relationship with the identified challgens and causal effect with respect to limited access to land ownership (0.327), high cost of farm inputs and agrochemical (0.518), and women's receipt of less credit offered to the cooperatives (0.554). These results are statistically significant at 1% significance level. Thus, we suggest that policymakers should consider addressing the limitations that arise as a result of culture that restrict women from active involvement in the agricultural sector cooperatives. These challenges identified also appeared in studies by Drafor-Amenya and Puplampu (2013), and SCA (2014). Moreover, the institutional factor has a positive and significant relationship with the identified challenges and a causal effect with respect to unequal access to extension training with the men (0.481), and domestic workload (0.512). The magnitude of the aforementioned institutional challenges can be reduced

Table 4. relationship between the women's socioeconomic profile and the challenges they faced.

Variable	Symbol	Marginal effects	S.E	Z
Age	α_1	-0.201*	0.010	-1.86
Marital status	α_2	0.274	0.172	1.59
Level of education	α_3	0.178*	0.095	1.88
Farming experience	α_4	-0.022	0.028	-0.8
Household size	α_5	0.237	0.151	1.57
Monthly income	α_6	-0.000*	0.000	-1.75
Extension contact	α_7	0.197	0.279	0.71
Farm size	α_8	-0.043	0.223	-0.19
Constant	α_0	-4.777	3.746	-1.28
Diagnostics				
Log-likelihood		-62.887		
LR		9.19		
Obs.		600		

by more education and changing the systemic structures that promote restriction of women representation by including such values that encourage inclusion of every gender. These results are consistent with the work by Olorunnishola et al. (2016); Dave (2020), and Salma and Pushkar (2010).

Finally, the management factor has a negative and significant relationship at 1% significance level, as well as a causal effect with respect to herders-farmers clash (0.420). This is an indication that the issues between the women and herders can be addressed if the cooperative management that encourages inclusion is put in place to negotiate for each parties right. Therefore, when other factors are held constant, 1% improvement in the managerial ability of the women will reduce the clash by 42%. This is plausible and calls for policymakers' intervention to address conflicts most importantly through training communities involved about conflict management.

Relationship between the women's socioeconomic profile and the challenges they faced

The average marginal effects from Tobit regression model are presented in Table 4. The dependent variable is the extent of women's agricultural challenges which is censored from below at 3.0 on a five point Likert scale. Down of (Supplementary Table 4) are log-likelihood value of -62.887 and a likelihood ratio test statistic (against a null model) of 9.19. The likelihood ratio test result is statistically significant at 1% significance level which implies that the general model is more appropriate.

The study results suggest that age, level of education and monthly income of respondents significantly affect the extent of challenges faced by women in agricultural sector cooperatives in Southeast Nigeria. The coefficient of age was negative and significant at 10% significance level. This finding implies that a marginal increase in the age of women farmers is associated with a reduction in the challenges they faced by 0.20 units, *ceteris paribus*. This is somehow an indication that older women are less vulnerable in cooperatives than their younger counterparts. Against our *a priori* expectations, the coefficient of the level of education was positive and significant at 10% significance level, a result which implies that a year's increase in the level of education among women is associated with increased agricultural challenges faced by 0.17 units, all other factors held fixed. The possible implication here could be that their men counterparts may hold stronger cultural beliefs and may perceive more educated women as a threat, resulting in more challenges for women. Finally, the coefficient of monthly income was negative and significant, implying that a unit increase in women's monthly income status is associated with lower challenges faced though not with an appreciable value.

Conclusion

This study used structural equation modelling (SEM) and path diagram techniques to examine existing challenges faced by women in the agricultural sector cooperatives in Southeast Nigeria. Data were collected from randomly selected women in agricultural cooperatives in Southeastern Nigeria. Methodologically, we initially ran a default principal factor analysis (PFA) to rotate the structural challenges into four components (economic, cultural, institutional and management) factors. We ensured no variable was loaded in more than one factor to ease the SEM convergence in Amos software. We adopted a confirmatory factor analysis (CFA) approach in place of explanatory factor analysis (EFA) as the study intention was not to empirically identify

the general challenges women face in the agricultural sector.

This was in preference to a CFA in order to modify the path diagram till an appropriate model was achieved. They ensured that Hu and Bentler's (1998, 1999) recommended values for goodness of fit (GFI), comparative fit index (CFI), Turkey-Lewis index (TLI) and root mean square error of approximation (RMSEA) were achieved to assure us more credible results. for policy and novel contribution to literature.

The study results suggest that women in agricultural sector cooperatives with poor economic status are more likely to have inadequate access to improved technology, face higher cost of labour, inadequate access to off-farm employment, and infrastructural decay. These results call for increased inclusion of women in social-economic programs as well as education to limit their economic status from making them more vulnerable to failure of access to improved agricultural technology, inputs and employment in Southeast Nigeria We found that cultural factors increase women's failure to own land, farm inputs and agrochemicals as well as credit. Thus, we suggest suggest that policymakers should consider addressing the limitations that arise as a result of culture and restrict women from active involvement in the agricultural sector. Increasing women's access to subsidized inputs, increased education against cultural believes that limit women ownership of essential agricultural inputs and other services is encouraged. As Mulungu and Mudege (2020) and Kiwanuka-Lubinda et al. (2021) put it, designing collective action groups that encourage gender equity outcomes, as well as gender composition of groups, is another option to mitigate the challenges women face in most agricultural institutions.

Our results further showed that institutional factors increase women's unequal access to extension training relative to men, increased domestic workload. We suggested that more education among communities should be encouraged to ensure that even men participate in domestic chores to help women. Extension training should as well include women, especially that their contribution to global agricultural labour is considerably high (Basavaraj and Babus, 2018).

In terms of women's socioeconomic profile and the number of challenges they face, we found that older women are less vulnerable in the agricultural sector cooperatives than younger ones while more educated ones face more challenges, against their prior expectations. It was also found that the increase in women's monthly income is associated with fewer challenges they face in the agricultural sector. These results suggest that the need for increased education and inclusion of women in social-economic sectors to help curb the existing bias against women. As Mandela (2013) puts it, "freedom cannot be achieved unless women have been emancipated from all forms of oppression." Our study argues that even economic freedom among women in cooperatives may not be achieved unless they are emancipated from existing economic, institutional, cultural,and management factors.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interest.

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Supplementary materials

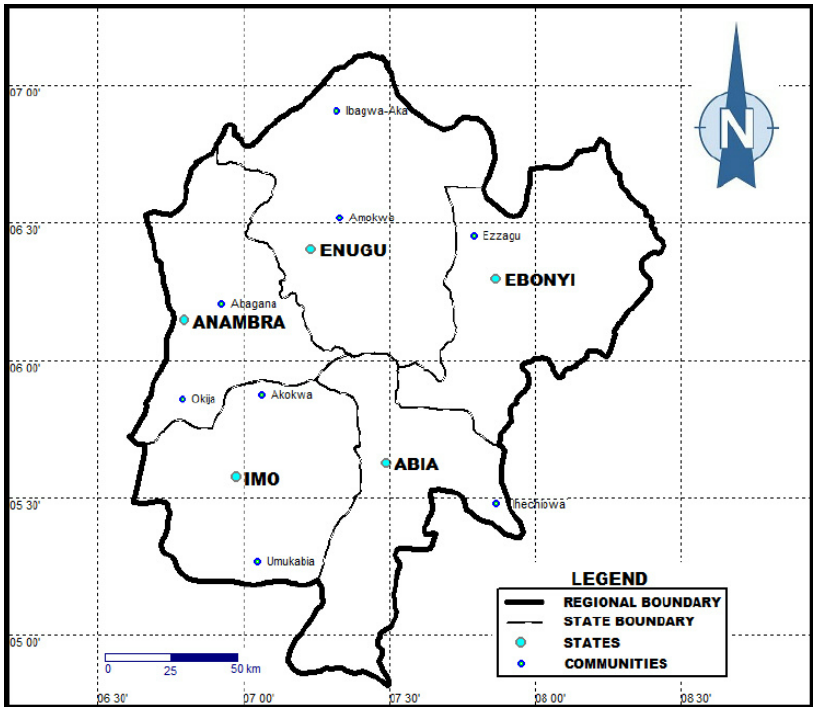

Figure SM1. Map of Southeastern Nigeria with its States.

Table SM1. Reliability Statistics.

Cronbach's Alpha	No of Items
0.709	16

Table SM2. KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.656**
Bartlett's Test of Sphericity	Approximate Chi-Square	6829.528
	df	120
	Sig.	.000

Table SM3. Communalities.

	Initial	Extraction
VAR1	1.000	0.591
VAR2	1.000	0.748
VAR3	1.000	0.637
VAR4	1.000	0.913
VAR5	1.000	0.933
VAR6	1.000	0.809
VAR13	1.000	0.887
VAR14	1.000	0.710

Table SM3. Contd.

VAR15	1.000	0.452
VAR19	1.000	0.712
VAR23	1.000	0.619
VAR24	1.000	0.621
VAR26	1.000	0.885
VAR27	1.000	0.827
VAR28	1.000	0.795
VAR29	1.000	0.678

Extraction method: principal component analysis.

Table SM4. Total Variance Explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.067	25.419	25.419	4.067	25.419	25.419	3.999
2	3.349	20.930	46.348	3.349	20.930	46.348	3.211
3	1.755	10.966	57.314	1.755	10.966	57.314	2.012
4	1.536	9.603	66.917	1.536	9.603	66.917	1.617
5	1.110	6.940	73.857	1.110	6.940	73.857	1.547
6	.954	5.960	79.817				
7	.759	4.745	84.563				
8	.694	4.340	88.903				
9	.536	3.353	92.255				
10	.351	2.192	94.448				
11	.262	1.637	96.084				
12	.209	1.307	97.392				
13	.166	1.040	98.431				
14	.120	.751	99.182				
15	.103	.646	99.828				
16	.028	.172	100.000				

Extraction Method: Principal Component Analysis. [a] When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table SM5. Pattern Matrix[a].

	Component				
	1	2	3	4	5
VAR5	0.944				
VAR4	0.940				
VAR6	0.820				
VAR24	0.761				
VAR23	0.682				
VAR13		0.888			
VAR28		0.851			
VAR2		0.834			
VAR1		0.663			
VAR27			0.894		

Table SM5. Contd.

VAR26	-0.851		
VAR14		0.831	
VAR15		0.662	
VAR3		0.524	
VAR19			0.880
VAR29			

Table SM6. Definition of the selected challenges.

Variable ID	Challenges
1	Limited access to land ownership
2	High cost of farm inputs and agrochemical
3	Unequal access to extension training with the men
4	Inadequate access to improved technology
5	Inadequate access to capital
6	The high cost of labour
7	Lack of collateral
8	Inadequate access to agricultural information
9	Low research in women dominated crop and livestock
10	Receive lower policymakers attention in the sector
11	Low investment in agricultural capital and inputs
12	Inadequate access to infrastructure
13	Receive lesser credit offered to the sector
14	High rural poverty among women
15	Domestic workload
16	Drudgery
17	Gender inequality and discrimination
18	High illiteracy among women
19	Marginalization on access to economic, political and social resources
20	Poor managerial skills due to lower attention to women education
21	Cultural influence and restriction
22	Economic suppression by the men
23	Inadequate access to off-farm employment
24	infrastructural decay
25	Inadequate access to market infrastructure
26	Low knowledge of value addition
27	Childbearing and house chores
28	Personal health
29	Climate change issues
30	Herders-farmers clash