UNVEILING SUSTAINABILITY DIMENSIONS IN AGRIBUSINESSES SUPPORTED BY AGRO PROCESSING, PRODUCTIVITY ENHANCEMENT AND LIVELIHOOD IMPROVEMENT SUPPORT PROJECT IN CROSS RIVER STATE, NIGERIA

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Abstract

This study assessed the sustainable dimensions of agribusinesses supported by Agro Processing, Productivity Enhancement and Livelihood improvement Support (APPEALS) project in Cross River State, Nigeria, Using the Taro Yamane formula for sample size, 391 cooperatives were randomly selected from 710 APPEALS-supported Agribusinesses and data were collected from their managers through a 5-point Likert questionnaire and analyzed using exploratory factor analysis and descriptive mean statistics. The results yielded a "Kaiser-Meyer-Olkin (KMO)" value of 0.658 and a Bartlett's test of sphericity value of 1407.936 ($p < 0.001$), confirming the suitability of the data for factor analysis. Seven factors were extracted from an initially conceptualized twelve based on the Triple Bottom Line (TBL) theory and they accounted for 56.32% of the total variance. The extracted factors include Social Safeguards, Local Support Policies, Grievance Redress Mechanism, Production Technology, Stakeholders/Institutions, Marketing Strategies, and Production Management. These were categorized under social, environmental, and economic sustainability dimensions. Social dimension of sustainability accounted for the highest cumulative variance (25.2%), followed by environmental (18.13%) and economic sustainability (13%). Out of 86 proposed variables, 22 met the factor loading threshold of 0.5, confirming construct validity. Descriptive mean analysis of the 5-point Likert scale showed weighted mean of 4.14. Twelve of the variable mean values were above weighted mean which indicated the activities frequently undertaken by the business operators for sustainability. The study recommends that, donor initiatives should continue to strengthen stakeholder collaboration and promote structured sustainability frameworks to ensure long-term integration of sustainable practices among agribusiness enterprises.

Key Words: Agribusiness Sustainability, Exploratory Factor Analysis (EFA), APPEALS Project, Triple Bottom Line (TBL)

Introduction

The Agro Processing, Productivity Enhancement, and Livelihood Improvement Support (APPEALS) project is an initiative of the World Bank in collaboration with Federal Ministry of Agriculture and Rural Development (FMARD) aimed at enhancing the agricultural sector's productivity and sustainability in six participating States in Nigeria (Cross River, Enugu, Lagos, Kano, Kogi and Kaduna). The project seeks to address challenges related to food security, job creation, and poverty reduction through various sustainable measures. Interestingly, Exploratory Factor Analysis (EFA) is a practical statistical method employed to unveil sustainable measures, it identifies underlying relationships between measured variables, making it a pertinent tool for evaluating the factors contributing to the success and sustainability of enterprises within the APPEALS framework.

However, sustainable measures in agribusinesses encompass a range of practices designed to enhance productivity while promoting environmental stewardship and social equity. Previous studies have also identified several core focus of sustainability in agriculture to include, resource efficiency, that is effective utilization of inputs (water, fertilizers, energy etc) to minimize waste and costs and environmental protection which entails adoption of practices that reduce environmental degradation, such as biodiversity conservation and reduced reliance on chemical inputs (Reganold & Wachter, 2016). Furthermore, economic viability is another is another sustainable measure in which agribusiness enterprises are profitable and can sustain themselves financially over time (Kumar & Kalita, 2017). Also, Social equity is key as a sustainable measure which involves promoting fair access to resources and opportunities among different community members, particularly focusing on marginalized groups (Davis *et al*., 2012).

Agribusinesses in Nigeria face several challenges that can hinder the effective implementation of sustainable practices, these challenges amongst others include, inadequate infrastructure such as poor road networks, lack of adequate storage facilities which often lead to post-harvest losses, limited access to credit needed for investment in better technologies or practices, issues of continuous re-training and capacity building on modern sustainable practices and cutting-edge technologies (Ajayi & Adebayo, 2014; Ogunniyi & Olaniyan, 2017; Ogbebor *et al*., 2020).

Williams *et al*. (2010) opined that, EFA can be employed to validate the effectiveness of the sustainability measures in promoting productivity and improving the challenges the agribusiness sector faces. Moreso, several studies have employed EFA to analyze sustainability measures in agricultural practices, including, Maffi *et al*., (2019) employed EFA to determine key sustainability factors in smallholder farming systems in Africa, indicating that factors like market access and resource-sharing were significant contributors.

Also, Johnson (2021) conducted an EFA on agro-processing cooperatives in Nigeria, revealing several factors such as community collaboration and training strongly aligned

with improved sustainability outcomes. The work of Ikem *et al*. (2020) highlighted the importance of policy frameworks and institutional support as critical factors, demonstrating through EFA, how these elements influence the adoption of sustainable practices. Several literatures underscore the necessity for rigorous examination of the factors influencing the sustainability of agribusinesses.

Therefore, EFA serves as a potent analytical tool to unpack the complexities of sustainable measures in implementing agribusiness project, provide actionable insights for policymakers and stakeholders. The robust nature of the tool in handling large variable and data size makes it a better statistical tool that aids in uncovering latent constructs within a set of observed variables. Analyzing these variables, scholars will gain insights on the dimensions of sustainable measures that are most prominent in project interventions, inform policy adjustments, and contribute to the broader discourse on sustainable agricultural development in Nigeria and around the globe. This study therefore, sought to conduct an Exploratory Factor Analysis (EFA) to unveil the sustainable dimensions adopted by APPEALS supported enterprises in Cross River State and describe sustainability activities frequently undertaken by the business operators.

Materials and Methods

Study area

The research was carried out in Cross River State, located in Nigeria's south-south geopolitical zone. The state lies between latitudes 4°35'N and 7°5'N and longitudes 7°30'E and 9°45'E, and comprises 18 Local Government Areas and three Agricultural Development Programme (ADP) zones, Calabar, Ikom and Ogoja, each zone has distinct ecological and agricultural features.

Agribusiness activities in the state span across production, processing, and marketing. Under the APPEALS project, which operates across all the three zones, a total of 6,921 beneficiaries were supported and organized into 710 cooperatives. The intervention was demand-driven and tailored to the specific needs of each agricultural zone.

Sampling procedure and sample size

A list of 710 agribusiness cooperatives across the value chains supported by the APPEALS project was sourced from the project office. The appropriate sample size was determined using the Taro Yamane at a 10% confidence level. From the sample frame, 391 cooperatives were randomly selected using simple random sampling. For data collection, interviews were conducted with the Presidents or Managers of the 391 selected cooperatives, who were purposively chosen.

Data collection and analysis

The primary data for this research were obtained using 5-point Likert scale questionnaire. To unveil the sustainable dimensions of the enterprises supported by APPEALS project and describe activities undertaken by the business operators for sustainability. Exploratory Factor Analysis (EFA) and Likert 5-point mean description (1-Never, 2- Rarely, 3- Sometimes, 4 – Often, 5 – Always) were used. In the 'classical factor analysis mathematical model, P denotes the

number of variables construct ($Y_1, Y_2,\ldots,Yp$) and m denotes the number of underlying factors ($X_1, X_2,\ldots,Xm$). Yj is the variable represented as latent factor construct. Hence, this model assumes that there are 'm' underlying factors whereby each observed variables is a linear function of these factors together with a residual variate. This model intends to reproduce the maximum correlations.

$$Y_j = a_{j1}X_1 + a_{J2}X_2 + \ldots\ldots\ldots\ldots + a_{jm}X_m + e_j$$

where ; j = 1, 2, ---------- P

Yj is the variable represented in latent factors, hence, this model assumes that there are 'm' underlying factors whereby each observed variable is a linear function.

and 'm' denotes the number of underlying factors ($X_1, X_2,\ldots,Xm$)

The factor loadings are $a_{j1}, a_{j2},\ldots,a_{jm}$ which denotes that a_{j1} is the factor loading of jth variable on the 1st factor. The specific or unique factor is denoted by ej.

Implicitly, 86 variables or measures grouped into 12 latent factors construct (Enterprise own resources, Finance, Marketing Strategies, Risk Management, Social Safeguard, Local Support Policies Stakeholders/Institution, Production Management, Production Technology, People & Skills, Ecosystem Management and Grievance Redress Mechanism) derived from Project Implementation Manual (PIM) and past literatures were proposed for this study. These were categorized into the Tripple Bottom Line Theory of economic, social and environmental sustainability of business operations. The model is stated explicitly as follows.

$$Y_1 = a_{11}X_1 + a_{12}X_2 + * * *+ a_{1n}X_n$$
$$Y_2 = a_{21}X_1 + a_{22}X_2 + * * * + a_{2n}X_n$$
$$Y_3 = a_{31}X_1 + a_{32}X_2 + * * * + a_{3n}X_n$$
$$*$$
$$*$$
$$*$$
$$Y_n = a_{n1}X_1 + a_{n2}X_2 + * * + a_{nn}X_n$$

Where:

$Y_1, Y_2 \ldots Y_n$ = observed construct or component variables for sustainable agribusinesses

$a_1 - a_n$ = factor loadings or correlation coefficients for each of the construct

$X_1, X_2, \ldots X_n$ = unobserved underlying factors for sustainability of agribusiness enterprises.

Maximum Likelihood extraction method and Promax rotation at 6 iteration was used for factor loading.

Results and discussion

Identification of agribusiness sustainability factors

The results of the exploratory factor analysis unveil seven factors affecting the sustainability of agribusinesses supported by APPEALS project in Cross River State, having a Kaiser-Meyer-Olkin (KMO) = 0.658 > 0.6 and the Bartlett's test of sphericity value 1407.936, Significant at P = 0.00 <0.05 as presented in Table 1. The KMO greater than 0.6 and Bartlett's test of sphericity greater than one, significant at 1% as recommended by Nunally (1978) and Hair *et al*. (2010) suggest that factor analysis is consistent with data obtained for the study and the level of confidence for the analysis is accepted.

Table 1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.658
Bartlett's Test of Sphericity	Approx. Chi-Square	1407.936
	Df	231
	Sig.	.000

Source: Field data analysis, 2024

The Exploratory Factor Analysis (EFA) result in Table 2 also showed that, seven factors with Eigen values greater than one (least factor 1.20 > 1) as against the twelve factors initially proposed in this study were extracted. The 5 factors eliminated were ecosystem management, risk management, people & skills, finance and enterprise own resources. However, one item in finance and enterprise own resources loaded in local support policies and marketing strategies respectively. The cumulative total variance explained by the extracted factors is 56.320 percent. This means that, the extracted factors explain 56.32 percent of the observed variables included in the EFA for agribusiness sustainability. The benchmark for the factor loading of variables was 0.5, in other words, variables that loaded below 0.5 bench mark were isolated through another round of rotation. The result as presented in Table 2 showed that, each variable in the 7 extracted factors had its highest loading above 0.5 on the construct, showing that covariance validity is adequate. The factors extracted were; 1 – Social Safeguard, 2 – Local Support policies, 3 – Grievance redress mechanism, 4 – Production technology, 5 – Stakeholders/Institutions, 6 – Marketing strategies, and 7 – Production management.

However, out of the 86 variables proposed in 12 conceptualized factors, 22 variables in 7 extracted factors loaded above the acceptable benchmark of 0.5. Under Social Safeguard (SS), 5 variables loaded above 0.5 as against 7 variables, Local Support policies (LS), 4 variables loaded above 0.5, the other 3 variables below bench mark were discarded, one variable in finance loaded in LS, Grievance Redress Mechanism(GR) 4 variables loaded as against the 7 variables proposed, Production Technology (PT) 2 variables loaded while the other 2 variables below bench mark were isolated, Stakeholders/Institutions (SN) 3 variables loaded above 0.5 bench mark while 4 variables below bench mark were discarded, Marketing Strategies(MS), 3 variables loaded as against 9 variables proposed, one variable

in enterprise own resources also loaded in MS, Production Management(PM) 2 variables loaded while the other 7 variables proposed that loaded below the bench mark were removed.

The factor analysis showed satisfactory factor loadings because they are represented by items with loadings above 0.5, which suggest the quality of interpretation of each factor (Hair *et al.*, 2010). Furthermore, the result in Table 2 revealed that social safeguard in the 7 extracted factors explained more of the variance in agribusiness sustainability (12.66%), followed by local support policies (10.68%), grievance redress mechanism (8.13%), production technology (7.07%), stakeholders/institutions (6.39%), marketing strategy (5.93%), production management (5.47%). This implies that, social safeguard factor had higher variability and more influence on sustainability of agribusinesses within the context of the study as against production management identified by Nakyejwe *et al.* (2021) in sustainable entrepreneurship in Uganda.

According to the exploratory factor analysis results, it is established that seven factors unveil as the sustainability dimensions of agribusinesses supported by Cross River State APPEALS project were grouped according to the triple bottom line theory. Specifically, all variables under ecosystem management, risk management, finance, enterprise own resources, people and skills constructs were eliminated. The seven factors extracted as dimensions of agribusiness sustainability were stakeholder/institutions; local support policy and grievance redress mechanism (as Social Sustainability), production management and social safeguards (as Environmental Sustainability), production technology and marketing strategy (as Economic Sustainability). The outcome is consistent with Nakyejwe *et al.* (2021) and Soto-Acosta *et al.* (2016), who in their studies revealed that business operators use social, environmental and economic aspect to determine their business performance in terms of market share, turnover, customers satisfaction and retention. Furthermore, the results shows that social sustainability explains more cumulative variance (25.2%) in sustainable agribusinesses followed by environmental sustainability (18.12%) and economic sustainability (13%) suggesting more emphasis on social and environmental sustainability. Intuitively, that could be the reason why most of the agribusinesses lack the economic power of running their enterprises for many years, hence moving from one donor agency to another looking for grants to sustain their agribusinesses. This assertion is supported by Namagembe *et al*. (2019), who revealed that, eco-design and internal environmental management practices positively and significantly influence the ecological performance of small and medium manufacturing enterprises in Uganda. Also, Piyathanavong *et al*. (2019), in their study on adopting organization environmental protection methods in Thailand's manufacturing sector, revealed that, manufacturing firms consider the impact on the environment and benefits by creating environmental awareness, and cost saving as a policy for sustainability.

Table 2: EFA results on sustainability factors of APPEALS agribusinesses

Var Code	Variables	Factor						
		1	2	3	4	5	6	7
SS_1	Commit to the corporate social responsibility of your enterprise	.778						
SS_2	Participate in public good programs for the community	.732						
SS_4	Contribute to social activities in local	.687						
SS_3	Participate in training, capacity building, social knowledge for employees	.501						
SS_5	Focusing and paying attention to issues of environmental pollution treatment	.796						
LS_3	Find Local agribusiness associations have a lot of positive support for the economy		.724					
LS_1	Have easy access to production premises smoothly		.564					
LS_4	Have prompt information of changing policíes on environmental protection		.973					
LS_2	Experience local administrative procedures affecting the day to day running of the business		.539					
GR_1	Registered and resolve grievances from customers			.667				
GR_4	Review and develop a strategic roadmap for resolving grievances			.510				
GR_2	Registered and resolve grievances from Local			.506				
PT_1	Prioritize in investing to renew equipment annually				.742			
PT_2	Develop a branded product strategy				.656			
SN_1	Fully understand customers‟ views on environmental issues					.827		
SN_2	Promote environmental and sustainability policies to customers					.671		
SN_4	Network with other local business owners and stake holders					.712		
MS_8	Assess whether the products or services yield economic benefits to the larger community						.566	
MS_5	Assess and up-date customers database in the last 12 months						.553	
MS_4	Prioritize profit growth and not just turnover growth						.679	
PM_2	Routinely undertake sample analysis to improve the quality of products/services							.799
PM_1	Develop a management plan to support the production of quality products/services							.866
	Total Variance Explained							
	Percent	12.66	10.68	8.13	7.07	6.39	5.93	5.47
	Cum Percent	12.66	23.33	31.47	38.54	44.93	50.86	56.32
	Eigen Values	2.78	2.35	1.79	1.56	1.41	1.3	1.2

Source: Field data analysis, 2024

Frequency of sustainability activities undertaken by agribusinesses

The results of sustainability activities undertaken by agribusinesses are as presented in Table 3. The weighted mean was calculated from the cumulative mean of the five-point Likert scale of the variables as presented in Table 3. The weighted mean (4.14) used as the criterion to describe variables whose cumulative mean were greater than or equal to weighted mean as activities frequently undertaken by the enterprises for sustainability. While those variables whose cumulative mean were less than the weighted mean were regarded as activities not frequently undertaken by the enterprises for sustainability. The results for each construct of agribusiness sustainability as presented in Table 3 showed that, twelve sustainability activities were frequently undertaken by the agribusinesses. These includes, Social safeguards activities: participation in training, capacity building, social knowledge for workers ($\bar{x}_1$ = 4.30), attention to environmental pollution treatment ($\bar{x}_1$ = 4.20); Local support policies: prompt information of changing environmental protection ($\bar{x}_1$ = 4.20), experience local administrative procedures affecting day to day running of business ($\bar{x}_1$ = 4.19); Grievance redress mechanism: register and resolve grievances from the locality ($\bar{x}_1$ = 4.30); Stakeholders/Institution engagement: promote environmental and sustainability activities to customers($\bar{x}_1$ = 4.20), network with other local business owners and stakeholders($\bar{x}_1$ = 4.21); Marketing strategies: assess whether the products or services yield economic benefits to the larger society ($\bar{x}_1$ = 4.32), assess and update customers database in the last 12 months($\bar{x}_1$ = 4.30), prioritize profit growth and not just sales or turnover ($\bar{x}_1$ = 4.30); Production management activities: routinely undertake sample analysis to improve quality of products/services ($\bar{x}_1$ = 4.36), develop management plan to support the production of quality products/services ($\bar{x}_1$ = 4.23).

The results in Table 3, substantiate that, agribusiness enterprises supported by APPEALS project in Cross River State, were frequently involved in activities related to economic, social and environment sustainability. This contradicts assertions by Nakyejwe *et al.* (2021) that most of the small-scale entrepreneurs have no formal strategic management plan and as such subconsciously carryout sustainability activities. They further opined that; the entrepreneurs do not have written policies to this effect. In addition, most of the businesses have waste disposal mechanisms in place to ensure that, they do not litter their environment. According to them, sustainability activities are undertaken in a rudimentary way and when compared to formal procedures, such activities would pass as non-existent. Nakeyejwe *et al.* (2021) assertion is contrary to the findings of this study especially as this study was carried out on World Bank funded agribusinesses with implementation design. Most of the implementation design of such donor funded projects come with sustainability plans (Training, capacity building, collaboration with institutions, formation of business alliances, linkage to financial institutions, Knowledge repository centres, formation of apex groups, operation & maintenance committee, mentorship,

exchange visits, study tours, etc), which are part of the beneficiary's package. However, the findings corroborate with those of Orobia *et al.* (2020), which revealed that youths and women entrepreneurs undertake social, environmental and economic practices daily in their businesses.

Conclusion

The results of the exploratory factor analysis (EFA) successfully unveiled seven core factors influencing the sustainability of agribusinesses under the APPEALS project in Cross River State, Nigeria. These factors: social safeguard, local support policies, grievance redress mechanism, production technology, stakeholders/institutions, marketing strategies, and production management collectively accounted for 56.32% of the total variance which sufficiently explain the dimensions of agribusiness sustainability within the context. The KMO value of 0.658 and a significant Bartlett's test confirmed the appropriateness of factor analysis. The study also revealed a shift from the originally conceptualized twelve sustainability factors to seven, emphasizing the contextual relevance of social, environmental, and economic dimensions. Importantly, social sustainability factors, particularly social safeguards, explained the highest proportion of the variance (12.66%) and more influence on sustainability of agribusinesses within the context of the study, indicating their predominant role in sustaining agribusinesses. Interestingly, the relatively lower variance explained by economic sustainability factors, marketing strategy (5.9%) and production technology (7.07%) implies a lesser emphasis on profit growth and reinvestment, possibly explaining why many agribusinesses still rely on external donor support. The study also shows that APPEALS-supported agribusinesses in Cross River State actively and strategically integrate sustainability practices across economic, social, and environmental dimensions.

Recommendations

1. Given that economic sustainability dimensions accounted for the least explained variances and many enterprises still rely heavily on donor support, it is recommended that the APPEALS project and relevant stakeholders prioritize financial literacy, access to credit, and business planning training. This will help agribusiness owners improve their financial autonomy, develop long-term investment strategies, and reduce dependence on external funding sources.
2. Similar donor initiatives should continue to strengthen stakeholder collaboration and promote structured sustainability frameworks to ensure long-term integration of sustainable practices among agribusiness enterprises in Cross River State and beyond.

Table 3: Descriptive mean statistics of sustainability factors extracted

Activities	Never	Rarely	Sometimes	Often	Always	CUM	$\bar{x}_1$
	1	2	3	4	5		
social safeguards; how often do you ……							
Commit to the corporate social responsibility of your enterprise	6(6)	47(94)	16(48)	205(820)	117(585)	1553	4.00
Participate in public good programs for the community	3(3)	41(82)	50(150)	145(580)	152(760)	1575	4.00
Contribute to social activities in local	6(6)	50(100)	20(60)	155(620)	160(825)	1611	4.12
Participate in training, capacity building, social knowledge for employees	1(1)	18(36)	33(99)	162(648)	177(885)	1669	4.30
Focusing and paying attention to issues of environmental pollution treatment	11(11)	8(16)	14(42)	203(812)	155(775)	1645	4.20
Local support policies; how often do you …							
Find Local agribusiness associations have a lot of positive support for the economy	6(6)	36(72)	30(90)	172(688)	147(735)	1591	4.10
Have easy access to production premises smoothly	3(3)	30(60)	45(135)	185(555)	128(640)	1393	3.60
Have prompt information of changing policíes on environmental protection	9(9)	10(20)	30(90)	186(744)	156(780)	1643	4.20
Experience local administrative procedures affecting the day to day running of the business	1(1)	21(42)	40(120)	170(680)	159(795)	1638	4.19
Grievance redress mech; How often do you							
Register and resolve grievances from customers	2(2)	17(34)	25(75)	223(892)	123(615)	1618	4.10
Review and develop a strategic roadmap for resolving grievances	5(5)	21(42)	47(141)	160(640)	158(790)	1618	4.10
Register and resolve grievances from Local	3(3)	6(12)_	44(132)	173(692)	165(825)	1664	4.30
Production technology; How often do you …							
Prioritize in investing to renew equipment annually	13(13)	32(64)	31(93)	196(784)	120(600)	1554	3.97
Develop a branded product strategy	1(1)	27(54)	27(81)	219(876)	117(585)	1597	4.08
Stakeholders/Institutions; How often do you							
Fully understand customers‟ views on environmental issues	3(3)	41(82)	48(144)	183(732)	116(580)	1541	3.94
Promote environmental and sustainability policies to customers	1(1)	14(28)	37(111)	185(740)	154(770)	1650	4.20
Network with other local business owners and stake holders	9(9)	12(24)	23(69)	191(764)	156(780)	1646	4.21
Marketing strategy; How often do you ……							
Assess whether the products or services yield economic benefits to the larger community	11(11)	1(2)	18(54)	182(728)	179(895)	1690	4.32
Assess and up-date customers database in the last 12 months	9(9)	4(8)	26(78)	175(700)	177(885)	1680	4.30
Prioritize profit growth and not just turnover growth	5(5)	17(34)	30(90)	188(752)	151(755)	1636	4.18
Production management; How often do you							
Routinely undertake sample analysis to improve the quality of products/services	4(4)	1(2)	22(66)	188(752)	176(880)	1704	4.36
Develop a management plan to support the production of quality products/services	2(2)	3(6)	31(93)	222(888)	133(665)	1654	4.23
				Weighted Mean($\bar{x}_2$) = 4.14			

Source: Field data analysis, 2024
($\bar{x}_1 \geq 4.14$, Sustainable activities frequently undertaken by the agribusinesses)

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