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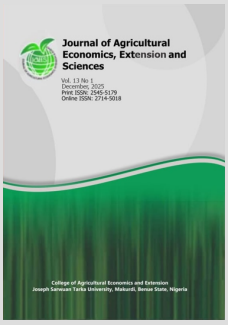
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CONSTRAINTS TO VALUE ADDITION INVESTMENTS IN COMMERCIAL AQUACULTURE IN OSUN STATE, NIGERIA

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Abstract

This study evaluated processors-related constraints to value addition investment in commercial catfish aquaculture in Osun State, Nigeria. A multi-stage sampling technique was employed in the selection of 60 fish processors. Data were analyzed using descriptive statistics and factor analysis. The incidence index pattern finding revealed that more than 60 % of the fish processors experienced lack of skilled support staff(ranking the highest most constraint) with index of 0.983. The KMO and Barlett test of sphericity result showed that the 11 constraints to fish processing identified in the study area were sufficiently tenable. The exploratory factor analysis mapped four major underlying dimensions; access to credit, poor state of processing facility, high variable cost of operation and power supply inadequacy with the percentage variance of 20.718%, 16.853%, 12.692% and 11.673% respectively. About 63.40% of processors fall within severity of constraints index range of 0.51-0.7599. The results of variability in CVAICCA index across the socio-economic characteristics of fish processors revealed that years of experience (5.186, 0.05) and education (3.446, 0.05) were statistically significant. Majority of processors were male (90%) with 45% belonging to age range of 31-40 years and 81.7% had experience of 10 years and 83.35% household size of less or equal 5 persons. Policies for promotion of capacity building, competency enhancement, better access to credit facilities and use of modern technologies in fish processing that increase value addition and wealth maximization are recommended.

Keywords: Catfish; Value addition; Constraints, Processor-Related, Potentials, Aquaculture

Introduction

Reports assert that out of 1,027,000 tonnes as national output marine catches contributed 36%, inland catches 33% and aquaculture 31% (FAO, 2017). Although the bane in fish

supply deficit may be primarily attributed to sub-optimal output performance, the non-intensive or ineffective exploitation or exploration of aquaculture value chain should be suspected as the salient impediment to supply adequacy.

Aquaculture value chain involves the inter-linkages of economic activities inherent in fisheries business venture such as; business conception, breeding, rearing/harvesting processing, marketing, transportation, financing and culminating to product delivery to the final consumer. The quest for market share dominance induces value addition concept and this has tremendously revolutionized fish market, tending towards meeting consumers expectation. Value addition in aquaculture fisheries is an initiative focused on enhancing product (fish) quality - (size, nutritional quality, prolong shelf life) for intense market penetration with a better price bargain in view. Fish processing is the value addition component in aquaculture. It is effective in mitigating post-harvest loss, preservation of nutritional quality, elongation of shelf life due to its perishable nature as food item (Agbon, Ezeri, Ikenwiewe, Alwgbleye, and Akmolade, 2002). It also, influences supply chain dynamics with relative impact on sales price in guaranteeing profit returns. Oyedrian, Omoare, Oladoyinbo, Ajagbe and Dick (2016) noted that fish processing activities commence from post-landing/harvesting and continues with handling (sorting, dressing, cutting, eviscerating, skinning, pre- cooking, blending, filleting, salting and packing) and the eventual marketing of the processed fishing in various forms; frozen, salted, smoked, dried, fillets, pre –cooked, fish oil and fish meal to consumers. Just like in other agricultural activities, women constitute the predominant resource persons in this value chain (Nauen, 1989; Ifeka, 1989).

Fish processing investment or enterprise is not devoid of constraints (FAO, 2005;, Oyedrian *et al*., (2016) and Jaji, Adegbuyi and Yusuf-Oshoala, 2014). The similarity of constraints documented in literatures could be broadly categorized as Finance- access to credit difficulty from commercial banks and its associated high cost of credit; Economic-market linkages; Technology- relevant modern technology access or usage (Eves and Brow , 1993); Technical know-how- dearth of skilled manpower (Davies, 2005); Government policy- lack of intervention programme for processors; Physical infrastructure – inadequate electricity power supply and poor storage facility (Diagne and Zeller 2001;, Clucas 2002; Shahbaz, Ali, Khan and Ahmed 2010; Ayuba and Omeji 2006; and Davies and Davies, 2009). Many processing constraints may exist (Bolorunduro and Faleye 2003; , Davies 2005, Davies, Davies, Inko-Tariah and Bekibele 2008; and Adeyeye, 2016) but its severity may vary subject to the state of economic development and ecological features,

(Oyediran *et al.,* (2016) and Jaji *et al.,* (2014). Assessing constraints severity to value addition in aquaculture is the major objective of this study, alongside the specific objectives; incidence index variability response and relative ranking of the constraints to value addition investment in commercial catfish aquaculture, dimensions of the constraints to value addition, level of severity of constraints and profile analysis of constraints to value addition. The study is a novel addition to aquaculture (fish farming). It will guide fish-farmers in identifying and addressing major constraints which could erode investment profit margin, while policy development may be recalibrated towards mitigating major constraints.

Methodology

The study was carried out in Osun State, in the Southwestern geopolitical zone of Nigeria. It lies between longitude 4 and 5° E and latitude 7 and 8 °N. The State has a population of 3,423,535 (National Population Commission, 2006) located within the tropics. Primary data were collected from fish processors. Multistage sampling technique was used to select respondents. At the first stage, proportionate sampling method was used to select 60 respondents from the lists of fish processors obtained from the zonal office of the Osun State Agricultural Development Programme (OSADEP) in Osun State as follows: Osogbo, Ife, Ijesha, and Iwo. Secondly, 15 fish processors were randomly selected in each ADP zones. In all, a sample of 60 fish processors was selected for this study. Structured questionnaire was used for the data collection. Data collected were analyzed using descriptive statistics and inferential statistics. Descriptive statistical tools such as mean, incidence index, composite index, frequency distribution and percentages while factor analysis is used to ascertain underlying dimensions of the constraints to fish processing value addition among processors in the study areas.

Results and Discussion

The response variability, incidence index and relative ranking of the constraints to Value Addition Investment in Commercial Catfish Aquaculture

The pattern of distribution of the fish processors across the measures of severity of the constraints to value addition investment in fish processing depicts the variability of constraints experienced among the fish processing entrepreneurs. Despite the variability, the incidence index of the components implies the headcount coverage of the conditions in the study area that informs the relative ranked order positioning of these constraints in the area. Thus, the incidence index represents the magnitude or proportion of those affected

adversely by the constraints with respect to the fish processing business in the study area. It could also imply the percentage of the population affected by the situation. Based on the incidence index pattern, the spread of the components of constraints vary in intensity across the population. Out of 11 component items, 7 items constituting 1st to 7th relative ranked constraints have effects that affected more than 70 percent of the fish processors. The 1st to 3rd ranked constraints affected virtually all the fish processors while 4th and 5th ranked constraints adversely influencing more than 80 percent of the population. Virtually more than 60 percent of the fish processors are experiencing adverse business condition that reduces value addition and wealth maximization in the study area.

As indicated by item 7, Table 1; lack of skilled support staff was the most ranked constraints with index of 0.983, this implies that high fish processing productivity is influenced by skilled personnel assistances where requisite practice skills would be deployed to cope with the dynamic market environment. Hence, the extensive application of staff training and competency enhancement if adopted as business management tools would enhance processors to remain competitive (Bene *et al,* 2015), such is the expectation of processors. The second most ranked constraints, item 6: lack of government support had an index of 0.967, this suggests that processors are expectant of government structured or special intervention programme in fish processing while Item 3; high cost of equipment and Item 10; high purchasing cost of preservatives were ranked third with index of 0.917 and fourth with index value of 0.850 respectively. It implies solvency and liquidity difficulties, faced by fish processing entrepreneurs. Solvency highlights the long-term financial obligations ability of aquaculture allied enterprises, while liquidity measures the ability to meet current financial obligations (Engle, 2010).

Poor storage facility was ranked fifth with incidence index of 0.817 while lack of access to training ranked sixth with index of 0.767, this highlights the challenge of inadequate coverage of extension services to aquaculture fisheries related activities, knowledge gained through years of experience in the vocation seems to substitute for training from extension service programme. It appears surprising that access to credit ranked seventh with index of 0.750, wasn't among the top 5 most ranked constraint based on the study, this could be adduced the coexistence of credit markets which they explore and patronize the one with less stringent conditionality's to obtain credit. Eighth ranked constraint was high transportation cost with index of 0.650, transportation cost is a variable cost which is recoverable, though it reduces profit margin. Also was security ranked at 0.633 as the ninth constraints- implies that there might be an effective community policing or security

arrangement which mitigate theft losses. Not enough fish available was ranked tenth, at 0.617 meaning that capture fish served as an alternative raw material for processing hence was one but last least ranked constraints and the eleventh ranked constraint being poor electricity supply at 0.317. This suggest that processors might have adopted other forms of processing such as fish smoking thus influencing it as the least ranked constraints.

Table 1: Showing the response variability, incidence index and relative ranking of the constraints to Value Addition Investment in Commercial Catfish Aquaculture

Item	Constraints	Not Serious	Moderately Serious	Serious	Very Serious	AII and RROP
1	Lack of access to credit	25.00	30.00	33.330	11.70	0.750 7th
2	Lack of access to training	23.30	60.00	16.70	0.00	0.767 6th
3	High cost of Equipment	8.30	58.30	25.00	8.30	0.917 3rd
4	Poor electricity supply	68.30	26.70	3.30	1.70	0.317 11th
5	High transportation cost	35.00	43.30	18.30	3.30	0.650 8th
6	Lack of government support	3.30	46.70	50.00	0.00	0.967 2nd
7	Lack of skilled support staff	1.70	80.00	13.30	5.00	0.983 1st
8	Security of farm facilities	36.70	48.30	15.00	0.00	0.633 9th
9	Poor storage facility	18.30	48.30	30.00	3.30	0.817 5th
10	High purchasing cost of preservatives (nitrites, sulphites, sorbates, benzoates and essential oils)	15.00	63.30	18.30	3.30	0.850 4th
11	Not enough fish available	38.30	48.30.	11.70	1.70	0.617 10th

Major dimensions of the constraints to Value Addition Investment in Commercial Catfish Aquaculture

There has been a plethora of reasons and adverse factors that reduce fish processing. Although, qualitative identification of constraints dominates the analysis of fisheries literature, a quantitative approach to generation of evidence for decision making under uncertainty become extremely necessary. Quantitatively, some of the constraints could be aligned towards a common action that can address several factors. When there is a clear-cut solution and its resultant level of change that the intervention can make, it become pertinent to engage a statistical procedure that can reproduce a set of interrelated factors into a sizeable factor without losing its original set of characteristics. Factor analysis generally is a data reduction tool that can satisfy the aim of generation of a set of

actionable factors that can serve multifunctional purpose to predict and measure the major and significant dimensions of the constraints to fish processing value addition in the study area. Amid several concerns towards enhancing value addition on the fisheries value chains, understanding the major dimensions for possible transformative policy planning and decision requires empirical procedure that crystallizes most prominent constraints into significant dimensions that can be used to mitigate the level of constraints that affects the fish processing value addition.

Table 2, analysed the underlying dimensions of the array of constrained items. These items were subjected to factor analysis using principal component approach to reduce the number of items to major and sizeable significant number of dimensions using Eigen value criterion of greater than or equal to 1 to select the underlying dimension of 11 initial items. The KMO and Barlett test of the factor analysis result showed that 11 constraints to fish processing identified was sufficiently and adequately tenable to measure respondents (processors) in the survey of fish processing constraints in the study area.

As shown on Table 2, Out of the 11 constraints in fish processing 4 mutually exclusive and major patterns were generated by factor analysis, and were as follows;

Constraints (factor 1): Access to credit with the variance of 20.718% and loaded high with these constraints' items; High cost of equipment (0.749), Lack of government support (0.783), Lack of access to credit (0.800). The implication is that access to credit difficulty still persist and often impedes productivity in agricultural or it allied activities although empirical studies shows that credit access increases productivity (Hazarika and Alwang, 2003; Diagne and Zeller, 2001)

Constraints (factor 2): Poor state of processing facility – with variance of 16.853%, and loaded high with constraints items of; High transportation cost (0.526), Security (0.615), Lack of skilled staff (0.532), poor storage facility (0.807), it indicates that lack of modern facility or technology deployment in fish processing makes value addition drudgery, aide the diminishing of market value which affects profit profile of processors due to rapid deterioration or spoilage of fish, Davies (2005) and Clucas (2002).

Constraints (factor 3): High variable cost of operation – with variance of 12.692%, and loaded high with constraints items; High purchasing cost (0.633), Not enough fish available (0.847). This shows that high cost of fish processing operation coupled with liquidity challenges strains value addition, this appears to agrees with (Oyediran ,2016) that high cost processing equipment was significant to utilization of low-cost of processing.

Constraints (factor 4): Power supply inadequacy- with variance of 11.673%, and loaded

high with constraints items; poor electricity supply (0.764), lack of access to training (0.764). This indicates that power supply inadequacy impedes the utilization of modern technologies in fish processing, like freezing option (cold rooms), drying use of oven etc. perhaps it contributes to the relatively low adoption of fisheries technology when compared with other agricultural technologies (Bolorundo and Faleye, 2003).

Table 2: Showing the Tenability and the Dimensions of the Constraints to Value Addition Investment in Commercial Catfish Aquaculture.

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	CEI
Lack of access to credit	0.800				0.764
High cost of Equipment	0.749				0.624
Lack of government support	0.783				0.663
High transportation cost		0.526			0.619
Lack of skilled staff		0.532			0.599
Security		0.615			0.552
Poor storage facility		0.807			0.717
High purchasing cost			0.633		0.431
Not enough fish available			0.847		0.738
Lack of access to training				-0.637	0.476
Poor electricity supply				0.764	0.630
Diagnostics Statistics					
Eigenvalues	2.279	1.854	1.396	1.284	
% of Variance	20.718	16.853	12.692	11.673	
Cumulative %	20.718	37.571	50.263	61.937	
KMO and Bartlett's Test					
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			.500		
Bartlett's Test of Sphericity	Approx. Chi-Square		116.953		
	df		55		
	Sig.		.000		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

The level of severity of the constraint to Value Addition Investment in Commercial Catfish Aquaculture

Aside analyzing the incidences of several constraints in the study area, the covariate magnitude of the severity across the population calls for concern in order to understand the estimated influence across the study area. As shown on Table 3, it represents the levels of severity of constraints in fish processing. Following the diverse incidence distribution of the firm's constraints to value addition investment in commercial catfish aquaculture severity index, categorization of the constraints severity index into ranges became

expedient based on; not serious, moderately serious, serious and very serious and a frequency of the population were made across the severity index ranges.

The pattern of result depict that all fish processors affirmed that there are challenges that hinders that level of value addition in fish processing in commercial catfish investment but the fish processors admitted the level influence of the constraints not very serious. Furthermore, About 63.40% of processors within severity of constraints index range of (0.51-0.7599) were majority and affirmed that constraints are serious, as 36.00% within index range of (0.24-5099) indicated that it is moderately serious. This implies that fish processing activity is inherent with inhibiting factors or reasons which impedes high productivity.

Table 3. The Level of Severity of the Constraints to Value Addition Investment in Commercial Catfish Aquaculture (SCVAICCA)

SCVAICCA index range	SCVAICCA index range implication	frequency	Percentage
0.00-0.2599	Not Serious	0	0.00
0.24-0.5099	Moderately Serious	22	36.60
0.51-0.7599	Serious	38	63.40
0.75-1.00	Very Serious	0	0.00
Total		60	100.00

Profile analysis of Constraints to Value Addition Investment in Commercial Catfish Aquaculture (CVAICCA) Index

It is common knowledge that constraints and liquidity risk affect business firms differently. It became necessary to decompose severity of the constraints to provide broader insight for development of advisory services which would support idiosyncratic and covariate transformative planning and action that would enhance and sustain value addition processes. Table 4 is on analysis of socio-economic profiles of fish processors taking cognizance of their age, household size, years of experience, gender, marital status, highest level of education, access to credit facility and member of association.

With Item 1, the age distribution showed an inverse pattern on the CVAICCA mean index. As age increases the mean index decrease. Processors within the age range of 31-40years were majority (45.00%) followed by 21.67% of 41-50years, 20.00% of less or equal

30years and 13.33% of above 50 years. This suggest that majority age range of processors falls within the active labour age with the advantage of physical and mental vigor to withstand the rigor associated with fish processing since old processing technologies is much prevalent. The severity of constraints was much felt on the lowest age range. Despite the variability in CVAICCA mean index, both 31-40 age range and 41-50 age range were statistically not different from either the lowest or upper most age range. However, there was considerable gab in mean CVAICCA index lowest and uppermost age range group. Generally, the exposure to the severity was virtually the same as the variability of the CVAICCA mean index was not statistically significant. This buttress the assertion by Bolorunduro and Faleye (2003) that adoption of fisheries technologies is relatively low.

With regards to Item 2, Table 4, Household size is a variable that contribute meaningfully to effectiveness of division of labour in fish processing especially in the fishing settlement, labour of older household members are usually engaged, Inyang and Udong (2013). The involvement of household members in cultured fishing might not be too different. The size compositions influence the extent of CVAICCA mean index. As shown Item 2, Table 4, the distribution of results suggests that household size influenced the severity of CVAICCA index across the two categories of household size. Despite the CVAICCA mean index variation, the extent of the CVAICCA where virtually the same as household within 1 and 5 persons experienced most impact of CVAICCA. Household size of less or equal 5 persons were majority (83.35%) as against 16.65% constituting age range of 6-10 persons. This suggests that family planning awareness may have influenced majority of processors reproductive preference in having fewer (smaller) household sizes implying that the proceeds from fish processing would enhance their family standard of welfare or living, Bene *et al* (2015).

There are plethora of literature on the fish farming that the business in sub-Saharan Africa is characterized by mass entry and virtual abandonment if not total withdrawal FAO (1996). Item 3, Table 4; years of experience is susceptible to such trends since fish processing would also depend in availability of fish for processing. There was a drastic decline in the population of the fish processors as year of experience increases beyond there about 4 to 10 years. The result further revealed that there are more constraints to value addition of newly experienced fish processor than who has survived beyond 10 years. The difference in CVAICCA mean index between the groups was statistically significant which implies there could be technical capacity competency that the business has adjusted to over the years. The result showed processors of less than 10years of

experience being majority (81.68%), as 18.32% represented those with 11-20years of experience in fish processing. This is rather contrary to the a priori expectation that associate years of experience number of years spend in fish processing vocation, this suggest that processors with less than 10years might have leverage on extension services to be informed, as this may have influenced adoption efficient technologies to stay in business.

In terms of sex of the manager or entrepreneur, Item 4 revealed that about 90% of male in processing as against 10% of women, has challenged the hitherto perception of women comprising the majority labour force supply in agricultural activities (Tanko 1994). This may be adduce to the fact that source of supply is from aqua-farms not marine or inland waters, which often require more men to relocate from their communities to fishing settlements for fish captures, but the proximity of supply source makes men readily available for fish processing. The sex of the managers did not influence the statistical significance of the CVAICCA mean index despite indicating marked variability index. It was surprising that female experienced less CVAICCA index than the male fish processor.

As shown on Item 5, table 4, the distribution of fish processors indicated utmost involvement by heads of families. Of course, maintaining family demands expenditures on needs and fish processing contribute to alternative income and food security generation sources Bene *et al* (2015). About 80% constituting the majority of processors indicated that they are married, this showed that dwellers in the study area holds the societal norms of marriage in high esteem, they enjoyed the support of their spouses as they undertake the business. Marital status did not affect the exposure to the extent of CVAICCA although the never married category had relatively higher CVAICCA index than the married fish processor.

Similar to the year of experience significance difference in mean CVAICCA index, the level of formal education also led to significant difference in mean CVAICCA index of fish processors. The pattern of variation in mean CVAICCA index did not follow a priori expectation that the higher of education, the lesser the CVAICCA index. Those with secondary education experienced the CVAICCA than all others as shown on Item 6, Table 4, Since similar awareness level is common to fish processor in the study area, there could be some peculiarities that could influence the pattern of variation as shown on Item 6. About 56.66% of processors making up the majority had experienced tertiary education, this places them in a vintage advantage for better information seeking disposition which would deepen their technical know-how about fish processing.

The result on Item 7 suggests accessibility to credit did not lead to reduction in the CVAICCA mean index of the fish processors and thus their mean CVAICCA index difference revealed that both groups were faced with virtually the same covariate CVAICCA index. About 63.33% have access to credit facility for business expansion or investment in machinery. The spike in access to credit may be adduce to the structure of credit markets system in developing economies there is the coexistence of informal/ formal credit markets (Hoff and Stiglitz, 1990; Kochar, 1997; Bell *et al*,1997; Mohieldin and Wright, 2000).

According to Item 8, Table 4, leveraging on membership of association did not influence the extent of CVAICCA index as both groups were faced with virtually the extent of CVAICCA index. It is worthy to observe the membership of association did not supposed to assist in technical assistance and support to firm processing efficiency but rather tilted to social economic concerns. About 60.00% belong to social organization this afford them the opportunity to build marketing networks, and exchange of ideas as it relates to the business of fish processing.

Table 4: Profile analysis of constraints to Value Addition Investment in Commercial Catfish Aquaculture (CVAICCA) Index across the Socio-Economic Characteristic of Fish Processors

Item	Socioeconomic Profile	Category	Percentage	CVAICCA Means Index	Fvalue (sign=0.05)
1	**Age (years)**	Less or equal 30	20.00	0.5530 ^{b}	1.679 ^{NS}
		31-40	45.00	0.5362 ^{ab}	
		41-50	21.67	0.5280 ^{ab}	
		Above 50	13.33	0.4830 ^{a}	
2	**Household size**	Less or equal 5	83.35	0.5323 ^{a}	0.145 ^{NS}
		6-10	16.65	0.5227 ^{a}	
3	**Years of experience**	Less than 10	81.68	0.5404 ^{a}	5.186 ^{S}
		11-20	18.32	0.4876 ^{b}	
4	**Sex**	Male	90.00	0.5358 ^{a}	2.795 ^{NS}
		Female	10.00	0.4848 ^{a}	
5	**Marital status**	Never married	20.00	0.5398 ^{a}	0.237 ^{NS}
		Married	80.00	0.5284 ^{a}	
6	**Highest level of Education**	Primary	10.00	0.4735 ^{a}	3.446 ^{S}
		Secondary	33.34	0.5557 ^{b}	
		Tertiary	56.66	0.5261 ^{ab}	
7	**Access to credit facility**	Yes	63.35	0.5329 ^{a}	0.097 ^{NS}
		No	36.65	0.5269 ^{a}	
8	**Member of Association**	Yes	60.00	0.5372 ^{a}	0.748 ^{NS}
		No	40.00	0.5208 ^{a}	

Conclusion and Recommendations:

The variability of constraints experienced and incidence index pattern among the fish processors vary in intensity across the population. Seven items out of eleven constituting 1st

to 7th relative ranked constraints that affected more than 70 percent of the fish processors. More than 60 percent of the fish processors are experiencing adverse business condition that reduces value addition and wealth maximization in the study area. Four mutually exclusive and major patterns were generated by factor analysis out of the 11 constraints in fish processing. Majority of processors were within the severity of constraints index range of 0.51-0.7599 and affirmed that constraints are serious, as 36.00% within index range of 0.24-5099 indicated that it is moderately serious. The results further revealed that a high proportion of sampled fish farmers and fish processors were married and are in their active and productive years with relatively large household size. Two variables of processors socio-economic profile; years of experience at (5.186, 0.05) and highest level of education (3.446, 0.05) showed statistically significant variation of mean index of constraints value addition investment across their independent factors. Insights of the socioeconomic context of fish processors in Osun State provided understanding as basis for re-directing pattern of other revenue generating value addition to fish products in the study area. Therefore, it is very important that policy development be recalibrated towards mitigating major constraints affecting fish processing value addition.

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