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Aquaculture Agribusiness Clusters Operations around Natural Water Sources: Implications for Economic Progress in Delta State, Nigeria

Kültür Balıkçılığı Yapan İşletme Kümelerinin Doğal Su Kaynakları Çevresindeki Faaliyetleri: Nijerya'nın Delta Eyaletinde Ekonomik Gelişmeye Etkileri

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Abstract

Objective: In the study, the primary, secondary and induced economic effects of aquaculture clusters operations around natural water sources were evaluated in Delta state, Nigeria.

Material and Methods: Primary data collected with questionnaire from purposively selected 150 cluster operators, were analyzed with descriptive and inferential statistics.

Results: The findings indicated that aquaculture agribusinesses that cluster around natural water sources generated significant and positive primary, secondary and induced economic effects. The income of principal operators of clustered aquaculture, the consumption expenditures of aquaculture inputs suppliers and taxes harvested from aquaculture agribusiness operators by government contributed significantly ($p<0.05$) to the total amount of money in circulation (economic buoyancy).

Conclusion: The operators of agribusiness clusters earned more income than their counterparts that operated in isolation in the hinterland, indicating the importance natural water source as a requirement for aquaculture cluster location. The finding shows that agribusiness clusters indirectly impacted economic buoyancy through the income of laborers and input suppliers. Tax Taxes paid by all agribusiness participants had an induced positive effect on the economy. Considering the evidence of prospects for development derivable from aquaculture agribusiness clusters, it is imperative to expand its frontier in Delta State, Nigeria.

ÖZ

Amaç: Bu çalışmada, Nijerya'nın Delta eyaletinde doğal su kaynakları etrafında kümelenen kültür balıkçılığı faaliyetlerinin birincil, ikincil ve uyarılmış ekonomik etkileri incelenmiştir.

Materyal ve Metot: Gayeli olarak seçilen 150 kümelenmiş işletmeciden anket yoluyla toplanan birincil veriler tanımlayıcı ve çıkarımsal istatistikler kullanarak analiz edilmiştir.

Bulgular: Bulgular, doğal su kaynakları etrafında kümelenmiş kültür balıkçılığı yapan tarım işletmelerinin anlamlı ve pozitif birincil, ikincil ve uyarılmış ekonomik etkileri olduğunu göstermiştir. Kümelenmiş kültür balıkçılığı yapan işletmelerin gelirleri, kültür balıkçılığı girdi tedarikçilerinin tüketim harcamaları ve hükümetler tarafından su ürünleri yetiştiriciliği işletmecilerinden toplanan vergiler, dolaşımdaki toplam para miktarına (ekonomik canlılığa) önemli ($p<0.05$) katkı yapmıştır.

Sonuç: Kümelenen kültür balıkçılığı işletmelerinin iç bölgelerde izole olarak çalışan meslektaşlarından daha fazla gelir elde etmeleri, kültür balıkçılığı kümelenmesinde lokasyon olarak doğal su kaynağının önemini göstermektedir. Bulgular, kümelenen tarım işletmelerinin, girdi tedarikçilerinin ve işçilerin gelirleri yoluyla ekonomik canlılığı dolaylı olarak etkilediğini göstermektedir. Tüm tarım işletmecileri tarafından ödenen vergiler ekonomi üzerinde uyarılmış pozitif etkiye sahiptir. Kültür balıkçılığı işletme kümelerinin sağladığı ekonomik gelişme gözönüne alındığında, Nijerya'nın Delta Eyaletinde bu oluşumunun sınırının genişletilmesi gerektiği ifade edilebilir.

INTRODUCTION

Origin of fish farming dates back to 2000 B.C., in China. The invention of culture methods in natural waters with the supply of brood fish, fingerlings, is one of the significant developments in aquaculture sub sector. Aquaculture has to do with the propagation, cultivation, and marketing of aquatic animals and plants in a confined and controlled aquatic environment. This gave rise to commercial fish culture. The catfish industry has the potential for satisfying the increased demands for catfish and other aquaculture products. Water supply source and quality are the most important factor in selecting the proper location for an aquaculture business. The most widely recognized type of aquaculture is the catfish industry (Swann, LaDon, 1992).

The concept of clusters refers to a geographical concentration of interconnected companies and institutions in a particular field (Porter, 1998). The concept of Agribusiness cluster can be extended to aquaculture sub-sector due to its relevance in economic development through its contribution to national GDP (Porter 2009). Aquaculture agribusiness involves input supplies, production process / culturing or farming of aquatic organisms such as fish. It involves practicing production techniques that are capable of increasing the production of fish more than the natural water environment (FAO, 2015). Culturing/farming fish refers to the rearing up to their market or table size under confined water bodies. As it stands, aquaculture agribusiness involves stake holders such as individual, corporate or government. Some of the stake holders in aquaculture clusters are input suppliers, producers, processors, transporters and marketers.

Aquaculture agribusiness cluster is therefore crucial to job creation, poverty reduction, food security and wealth creation, all leading to rural transformation. Aquaculture agribusiness cluster is strategically designed to boost Nigeria future economic development. Aquaculture agribusiness cluster also creates important linkages and encourages investment in such a way that it can have a strong multiplier effects on economic growth at the grass root level.

Agribusiness clusters and related business activities have been recognized as a vital force in the growth of developed nations such as USA (South Carolina), and also in some African countries such as Ethiopia, but aquaculture cluster concept has received little research attention in Nigeria. Although there is a wealth of research and initiatives relating to clusters in general, remarkably little attention has been paid to aquaculture clusters and its impact on economic development in Nigeria.

Faced with constant productivity and market pressures, the modern aquaculture needs new approaches that can enhance its competitiveness and innovation capacity. One of these approaches is the formation of aquaculture agribusiness clusters as a valuable tool to stimulate economic development at strategic locations and help them link to international agricultural value chains in a more productive and sustainable fashion.

As it stands, the realities of the mono economic system in Nigeria has called for alternative approaches. Nigeria is

considering aquaculture as a form of agribusiness to diversify the economy. Aquaculture agribusiness cluster is expected to be an important driver of the economic bouyancy programmes in Nigeria. Yet aquaculture cluster is weak in data needed to assess its social impact and its contribution to economic bouyancy in Nigeria.

Economic bouyancy is the ability or tendency of an economic system to float financially. The bouyancy force of an economy is measured by amount of money in circulation. Aquaculture agribusiness formation, particularly, the urban centres, is expected to boost the amount of money in circulation through aggregate employment, income, expenditure and taxes generated by all the direct and indirect participants (stakeholders) in the aquaculture value chain in the Nigeria.

To assess the extent of impact of aquaculture clusters, previous studies have been conducted to estimate the direct, indirect and induced effects of all agribusiness activities (Carlos, 2008). Following the methodology of Carlos, (2008), the sum of these three measures can be used to gauge the total effect of aquaculture agribusiness clusters in Delta State. Investigating the formation and distribution pattern of aquaculture agribusiness clusters, their features, its direct, indirect and induced effects on economic bouyancy of Delta State, Nigeria is an important research puzzle.

The broad objective of the study was to examine aquaculture agribusiness cluster formation and implications for economic progress in Delta State, Nigeria. The specific objectives of the study were to;

- i) evaluate the income differential between operators aquaculture agribusiness in clusters around natural water sources and those that operated in isolated units in the hinterland;
- ii. examine the relationship between aquaculture cluster formation and demand diversity;
- iii. determine the direct (primary) effect of aquaculture cluster;
- iv. assess the indirect (secondary) effect of aquaculture clusters in Delta State.
- iv) examine the induced effect of aquaculture clusters on the economy of Delta State.

MATERIAL and METHODS

This study was conducted in Delta State of Nigeria. This location was chosen for the study due to the effort of the Government to transform the aquaculture sub-sector and step up economic development using agribusiness-cluster approach. The selection of the sample involved a purposive sampling methods. This technique was considered appropriate because the clusters have similar characteristics. Eight (8) local government areas where aquaculture clusters were located were selected purposively for the study. The local governments were; Ika South, Uvwie, Oshimili South, Isoko North and South, Ukwuani, Warri South and Ethiope East local government areas. Two (2) aquaculture clusters were identified in Delta South agricultural Zone, two (2) were identified in Delta Central agricultural Zone and five (5) were identified in Delta North agricultural zone. One hundred (100)

principal operators in aquaculture (Cat Fish) clusters located at the bank of natural water sources (rivers and lakes) were examined while fifty (50) operators in isolated units were included in the study as a control group. The reason for this selection was because Delta North Agricultural Zone (5) had more cluster operations than Delta South (2) and Delta Central Agricultural Zone (2) as a result, more aquaculture agribusiness clusters were selected and examined in Delta North Agricultural Zone.

Primary data were used for this study. The data were collected through the use of questionnaire (open ended) from 150 aquaculture (cat fish) farmers. The sample was divided into 2 categories (operators of agribusinesses around natural water sources and those in isolated locations). The questionnaire was structured according to the specific objectives of the study. The questionnaire consist of information on the socio economic characteristics of respondents, structures and distribution of some selected agribusiness clusters, features of agribusiness clusters, direct, indirect and induced effect of agribusiness clusters in the study area.

Collected data were analyzed using a combination of descriptive and inferential statistics. Specifically, descriptive statistics such as mean, percentages and frequency distribution table were used in describing the socio economic characteristics of respondents of agribusiness clusters. Tools such as multiple regression model, T-test and chi square analysis were used to test the stated hypotheses.

Direct (primary) effect of aquaculture agribusiness clusters in Delta State was analyzed using multiple regression model and T-test.

Indirect (secondary) effect of aquaculture agribusiness clusters in the study area was achieved using multiple regression model and T-test.

Induced (tertiary) effect of agribusiness clusters was analyzed by the amount of taxes paid to the government by the operators in the aquaculture clusters. This was estimated by 10% of income realized by all participants in the clusters and those in isolated units.

T- test of significant difference in mean income operators of cat fish-based aquaculture clusters and isolated aquaculture units:

$$t = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}} \dots\dots\dots(1)$$

Where:

X1 = mean income of cluster agribusiness operators around natural water sources, X2 = mean income of operators of isolated agribusiness units, S1= standard deviation of income of cluster agribusiness operators

S2 = standard deviation of income of , n1= total numbers values in first set, n2 = total number of values in the second set

Chi Square:

$$X^2_{cal} = \sum \left(\frac{(F_o - F_e)^2}{F_e} \right) \dots\dots\dots(2)$$

Where;

Fo= Observed frequency, Fe= Expected frequency, Σ= Summation, X2= Chi square value

Model specification

Direct, indirect and induced value added effects of aquaculture agribusiness clusters.

Implicit form of the model was specified as:

$$TEF = f(wg, Ex, Tx) \dots\dots\dots eq (3)$$

The explicit form of the model was specified as follows:

$$TEF = \beta_0 + \beta_1 INOP + \beta_2 Wg + \beta_3 CEx + \beta_4 Tx + ei \dots\dots\dots eq (4)$$

Where;

TEF=Total Effect (₦)

INOP = Income of principal operators (₦) (Direct effect),

Wg = Salaries and wages (₦) (Indirect effect)

CEx = Consumption Expenditure of input suppliers (₦) (Indirect effect), Tx = Total Taxes paid to State government (₦) (induced effect), β1 – β4 = parameter estimates, β0 = intercept term, ei = error term.

Results and Discussion

Testing of Hypothesis

H₀: There is no significant difference between the income of principal operators in aquaculture agribusiness clusters and those that operated in isolated units.

Table 1. Test of significant difference between the income of principal operators in Aquaculture agribusiness Clusters and those operating as Isolated Units

Çizelge 1. Kümeler halinde kültür balıkçılığı yapan tarım işletmelerinin gelirleri ile izole edilen birimler olarak faaliyet gösterenler işletmelerin gelirleri arasında anlamlı farklılık testi

Variable	Mean	DF	SD	T.stat.
Income of isolated operators	₦60,300	49	677.67	5.25
Income of cluster operators	₦279,000	99	655.25	

(Source Field Data 2017)

Table 1. presents the finding of null hypothesis of no significant difference between income of operators of aquaculture clusters and operators of isolated aquaculture units. The result of the T. statistics indicates that there is a significant difference (P<0.05) between the income of the principal operators of aquaculture around natural water bodies and those operating in isolated units using artificial water sources. This is because the principal operators had a mean income of ₦279,000 while their counterparts in the hinterland had a mean income of ₦60,300. This shows that

the mean income of the principal operators of aquaculture established around natural water bodies, is greater than that of operators in isolated units using artificial sources of water. As a result, the null hypothesis was rejected and the alternate hypothesis which states that there is significant income differential between cluster and isolated aquaculture operators, was accepted. This finding could be attributed to the fact that the cost of water as purchased input must have increased total cost of aquaculture agribusiness in the hinterland. Also ready markets for the cluster operators must have enhanced their economic advantage over their counter parts in isolated units. This findings agrees with the work of Porter (2014), who reported that operating within a cluster has help to boost the income of principal operators and by

extension, the economy because the more money they make, the more their expenditure, which in turn has a ripple effect on volume of money flow in the economy.

The result of the indirect or secondary effect of aquaculture agribusiness clusters and those in isolation is presented in Table 2. The secondary or indirect effect of aquaculture agribusiness clusters refers to the spillover benefits enjoyed by people of that area as a result of the aquaculture cluster location and how these spillover benefits contributed to the larger society (economy) of Delta State. Some of the benefits of aquaculture agribusiness clusters are; employment creation, salaries and wages derivable and consumption expenditures of input suppliers.

Table 2: Result of the Indirect (Secondary) Effects (Salaries and expenditures) of Aquaculture Clusters and those in Isolated Units.
Çizelge 2. Kümelenirilmiş Kültür Balıkçılığı ve İzole Birimlerdekilerin Dolaylı (İkincil) Etkileri (Ücretler ve Harcamalar)

Impact indicators	N	Mean	Std. Dev.
Consumption expenditures of inputs suppliers in clusters	5	₦52,220.00	44885.92
Consumption expenditure of input supplier in isolated units	2	₦1,308.00	2055.81
Salaries and wages of workers at the clusters	5	₦183,980.00	216156.54
Salaries and wages of workers in isolated units	1	₦968.00	11394.79

Source (field survey 2017)

Consumption Expenditure of Input suppliers:

The result shows that consumption expenditure of input suppliers in agribusiness clusters was of ₦52,220.00 and the consumption expenditure of input suppliers in isolated unit was ₦1,308.00. The consumption expenditures is the amount of money spent on household by input suppliers in agribusiness clusters, the amount of money spent by the supplier of inputs, flows back into the economy and this in turn has a positive ripple effect on the economy.

Salaries and Wages Derivable:

The result of the research work shows that aquaculture clusters create more job opportunities for the people in the study area. The result Table 2 indicated a mean income of ₦183,980.00 for operators and a mean income of ₦968.00 for those in isolated units. The income of respondents was measured by the amount of money they received as salaries at the end of the month. Salaries and wages is the amount of money earned by the number of people who were employed as a result of the cluster location. This implies that aquaculture agribusiness clusters has the capacity to transform the area where it is located and operated. With effective financing of

their operations, cluster approach of industrialization can provide job opportunities for youths in the study area.

Tax harvested by Government.

The result of the research study shows that the total tax paid to government by principal operators of aquaculture agribusiness clusters around natural water sources is higher than the tax paid by those operating in isolated units. The tax paid by aquaculture cluster operators was ₦29,728.00 with a standard deviation 29199.49 while the tax paid to the government by isolated operators was ₦4,901.00. The tax paid to the government is a compulsory levy that the government imposes on taxable persons to generate revenue for public purposes or government activities in the state. By implication, the total tax paid to the government by operators of aquaculture clusters around natural water sources was higher than those operating in isolated units in the hinter land. The operators paid 10% of their income as tax to the government. This implies that aquaculture agribusiness clusters around natural water sources can be used as a tool for economic and social development.

Table 3. Regression Results on Effects of Agribusiness Clusters indicators on Economic Progress in Delta State, Nigeria.
Çizelge 3. Nijerya'nın Delta Eyaletinde Tarımsal İşletme Kümeleri Göstergelerinin Ekonomik Gelişme Üzerine Etkilerinin Regresyon Sonuçları.

Model	R	R ²	Adjusted R ²	Std Error	
Linear	0.956	0.914	0.904	0.14064	
Double log	0.517	0.267	0.199	0.40668	
Semi log	0.956	0.814	0.904	0.14064	
ANOVA					
Semi log	SS	DF	MS	F	P
Regression	8.873	5	1.775	89.719	0.000
Residual	0.831	42	0.020		
Total	9.704	47			
Variable in the	Equation				
Semi log	Unstandardized	coefficient	Standardized	coefficient	P
	B	Std. Error	Beta	t-Ratio	
(Constant)	4.758	0.072		66.157	0.000
Income of operators	1.723E-006	0.000	0.895	19.059	0.000
Employment	-0.001	0.001	-0.42	-0.894	0.376
Salaries and wages	1.003E-007	0.000	0.048	0.951	0.347
Consumption expenditure of input suppliers	2.688E-006	0.000	0.266	5.364	0.000
Total tax paid to government	4.109E-008	0.000	0.011	0.227	0.821

Independent variables: Income of operators, employment, salaries and wages, consumption expenditure of input suppliers and total tax paid to government

Source (Field survey 2017)

The result of the direct, indirect and induced effect of agribusiness clusters in the study area is presented in Table 3. The linear function outperformed the semi log and double log function on the basis of R² value of (0.914) 91%. Testing the regression model, the Table 4. shows that the income of principal operators of agribusiness clusters (direct effect) had a positive and significant relationship with the total effect. This implies that the income level of operators operating within the cluster had increased tremendously, as a result their standard of living had improved and also improve the economy. The result is an indications that agribusiness clusters has contributed immensely to individual operators, those in the study area (indirect) and to the economy of Delta state. The amount of money generated by agribusiness clusters has increased and has been added to economy of Delta State.

This findings agrees with the work done by Bentley (2014) in South Carolina, he examined and found out that the income earned by participant in cotton production clusters was \$1.45billion with a total effect of \$22.924 billion. This implies that agribusiness clusters can be used as a tool for economic development and poverty eradication.

The secondary or indirect effect of agribusiness clusters as depicted in the table here refers to the benefits enjoyed by people of that area as a result of the cluster location. Some of the benefits of agribusiness clusters had improved the standard of living of the people in that area such benefits are; employment, salaries and wages and consumption expenditures of input suppliers.

Employment:

The result of the study shows that the number of people employed by the clusters had a negative relationship with the total effect of agribusiness clusters at 1% level of significance. This is due to the fact that the concept of cluster is still very

young in the study area, to create any significant effect and some of the operators prefer to do the work themselves in order to save cost, but in the near future, the cluster concept will be highly appreciated and significant especially when the government will give its best for the formation of cluster. The research work is similar with the work done by Duru (2012) where agro based clusters were unable to finance its activities, until the government of the country formulated a cluster development strategy for micro and small scale enterprises in 2011 to support the development of clusters. This implies that agribusiness cluster in Delta State and the country at large need specialized support services and monitoring in order to function more effectively.

Salaries and Wages:

The result of the research work shows that salaries and wages had a positive relationship with the total effect of agribusiness clusters in the study area. Salaries and wages is the amount of money earned by the few number of people who were employed as a result of the cluster location. This implies that agribusiness clusters has the capacity to transform the area where it is located, if the government can finance their activities and operations, so that it can provide job opportunities for youths in that area and beyond.

Consumption Expenditure of Input suppliers:

The result shows that consumption expenditure of input suppliers had a positive and significant relationship with the total effect of agribusiness clusters. The consumption expenditures is the amount of money spent on household by input suppliers in agribusiness clusters, the amount of money spent by the supplier of input, flows back to the economy of Delta State, Nigeria. The existence of aquaculture clusters provide a source of livelihood for the suppliers of input as a result, they were able to fend for themselves and their families and their standard of living had improved tremendously. A similar research work was carried out by Palmetto (2013) in his study, he discovered that agribusiness clusters, consisting of production, fisheries and vegetable clusters were able to provide a total effect of about \$16.3billion to input suppliers in the cluster.

Relationship between Aquaculture Cluster Formation/ Location and Demand Diversity (size of market).

Equation 2. presents the findings of demand diversity of aquaculture agribusiness cluster in the three agricultural zones of the study area.

H₀: There is no significant relationship between aquaculture cluster formation and demand diversity in city markets close to natural water sources.

The result of the chi square indicated a significant relationship between cluster location and demand diversity. This is because the ($X^2_{cal} = 6.35$) calculated chi square value was 6.35 which was significantly higher ($P < 0.05$) than the tabulated chi square value ($X^2_{tab.} = 5.99$). As a result, the null hypothesis was rejected and the alternate hypothesis was accepted. This implies that the location of clusters were

influenced by diverse demand orientation of consumers in the cities/urban areas where clusters are located. More investors tend to venture into agribusiness clusters to satisfy the diverse demand of urban dwellers for such agribusiness commodities. This result also implies that formation of agribusiness clusters is often associated with urban centres possibly due to high population of consumers and the resultant large market. Therefore, agribusiness clusters located in remote villages are likely to fail.

CONCLUSION

Total effects (direct, indirect and induced effects) aquaculture agribusiness clusters around natural water sources on the economic progress of Delta State, Nigeria was investigated in this study. Income of principal operators of agribusiness was used as proxy for direct effect of agribusiness clusters on the economy. Consumption expenditure of input suppliers and employees. Wages as well as taxes paid by all participants were used as proxies for indirect and induced effects respectively. These formed the total finance that flows into circulation from aquaculture agribusiness clusters. The operators of agribusiness clusters earned more income than their counterparts that operated in isolation in the hinterland, indicating the importance natural water source as a requirement for aquaculture cluster location. The finding also shows that agribusiness clusters indirectly impacted the economic buoyancy through the income of laborers and input suppliers. Taxes paid by all agribusiness participants had an induced positive effect on the economy. Considering the developmental benefits derivable from aquaculture agribusiness clusters, it is imperative to expand its frontier in Delta State, Nigeria. The study has demonstrated the collective action advantages and joint economies by creating an enabling environment for inter firms' cooperation. The study has established the centrality of aquaculture agribusiness clusters in the realization of industrial and economic development plan of Delta State, Nigeria. The study also highlighted and justified the complimentary role played by government and private sector in the development of agricultural clusters. The study provided empirical information on the catalytic capacity of agribusiness clusters in economic development and poverty reduction in Delta State.

Based on the research findings, the following recommendations were made;

1. Aquaculture agribusiness cluster acceleration infrastructures should be put in place by the government in order to enhance the growth and sustenance of the clusters.

2. Government should put measures in place to develop the aquaculture agribusiness value chains since this will enhance the viability of the clusters in the study area.

3. The importance of operating within a cluster should be emphasized so that individual aquaculture agribusiness owners will come together to form a cluster, by so doing small and medium scale business owners will have advantage of economy of scale.

4. The government should make soft loan available to operators of aquaculture agribusiness clusters to enable them operate effectively without any itches.

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