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# Effects of Coronavirus on Food Systems in Ikwerre Local Government Area of Rivers State, Nigeria

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**Abstract:** The coronavirus pandemic is putting diets, food systems, and agricultural production in jeopardy globally, with agricultural trade and value chains out of reach for the masses. Therefore, this study examines the impact of coronavirus on food systems in Ikwerre LGA of Rivers State, Nigeria. Data were analyzed using descriptive statistics. The result of the socio-economic descriptions shows that a majority (78.9%) of the farmers were married, and 71.9% indicated no interest in any farmers' association. Also, the result shows that a majority (96.5%) of the farmers were aware of the coronavirus pandemic, and 52.6% agreed that farmers were vulnerable to coronavirus. Market closures and farmers' vulnerability to coronavirus were statistically significant with food systems sustainability. The study recommended that farming inputs should be subsidized and agricultural produce markets reorganized. Also, storage facilities should be made available in rural areas.

**Keywords:** Coronavirus, Food systems, Distributions, Vulnerability, Sustainability
**Jel Classification:** Q1, Q12, Q18, C25

## INTRODUCTION

Food is indispensable and essential for human growth and well-being. Crop planting, hunting, fishing, and other agricultural-related activities have always been occupations that provide livelihood for the majority of the rural populace. With job diversification and urbanization on the rise, agricultural activities have also become important sources of income, alongside food processing and marketing that have improved to feed cities (Dury, Bendjebbar, Hainzelin, Giordano & Bricas, 2019). Food systems mean the chains of market and non-market operations and actors relating to food production, aggregation, transportation and storage, processing and catering, distribution, preparation and consumption, waste and resource management, agro-input suppliers (seeds, fertilizers, improved livestock), and the associated regulatory activities (Food and Agriculture Organization FAO, 2018). Abundant food alone does not guarantee food security as food availability is influenced by food supply and demand, food accessibility, and affordability which are key drivers of food security. As a result, food systems are strategic in contributing to food security and social impacts (Dury *et al.*, 2019). FAO (2017), classified food systems into three focus areas which objectively address global food concerns in keeping with social implications. They are: food security and improved nutrition; inclusive development; creation of a sustainable environment and the fight against climate change.

Socio-economic trends are key drivers of the Nigerian food system. Nigeria is facing major challenges with high population growth, the high number of people living in extreme poverty, rapid urbanization, and stagnating agricultural productivity. Public investments in the agricultural sector are

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low, resulting in underdeveloped (especially in rural areas) infrastructure (roads, storage, and processing facilities) as well as insufficient agricultural services such as advisory services, access to inputs, and finance (Posthumus, Dengerink, Dhamankar, Plaisier & Baltissen, 2020). Due to the inadequate investment which resulted in low productivity, Nigeria is deficient in food production. The high urban demand is met through cheap food imports, which further lowers the incentives for investments in Nigerian agriculture. As such, the shortfalls in food supply at many levels seem to be enabling poverty by reinforcing increased demand for food. Environmental trends, such as soil degradation, climate change, water scarcity, deforestation, and decreasing biodiversity pose further threats to the food system, as well as the current pandemic of coronavirus. The novel coronavirus increasingly illuminates a serious underlying instability that goes beyond health. This instability stems from the fact that health, energy, finance, and food systems are all inextricably linked.

The spread of COVID-19 globally will compound pressures on food systems. Consumer access to food and producer access to markets could be impacted significantly. In Nigeria, especially Ikwerre Local Government Area of Rivers State Nigeria, the virus could take a significant toll on food production should it affect the aging agricultural workforce which is more vulnerable to it, and/or prevent women and rural dwellers (who produce almost 70% of Nigeria's food) from farming. To this end, this study examined the impacts of coronavirus on food systems in Ikwerre Local Government Area of Rivers State, Nigeria. The specific objectives of the study were to: describe the socio-economic characteristics of farmers in the study area; ascertain the influence of coronavirus on food production and distribution channels in the study area; and determine the factors affecting food systems sustainability in the study area.

## MATERIALS and METHODS

### Study area and sampling techniques

The study was conducted in Ikwerre LGA in Rivers State, Nigeria and it is located between latitudes 4º58′10″N and 5º14′30″N, and longitudes 6º49′0″E and 7º0′0″E on the geographic coordinate system. It covers an area of about 655 sq. km with a projected population of 265,400 by 2021 (National Bureau of Statistics NBS, 2022). The Ikwerre LGA has ten (10) districts. Namely Aluu, Elele, Igwurita, Isiokpor, Omogwa, Omadema, Omerelu, Ozuoba, Ubima, and Umuanwa.

A multistage sampling procedure was used to select the farmers for the study. Stage one was a random selection of four (4) districts. Stage two involves random selection of three (3) communities from each district, making twelve (12) communities. Lastly, nine (9) farmers were purposively selected from each community; this purposive selection was due to restrictions on the movement during the period of data collection making a total of one hundred and eight (108) farmers of which eighty (80) were retrieved for the study. The data for the study were collected from primary sources with the aid of a questionnaire and interview schedule. Secondary sources include articles, journals, the internet, and reviews of books to provide the needed theoretical background for this study. Data were analyzed using descriptive statistics, and the Probit Regression model. The above model is estimated using the Probit Regression estimation procedure.

### Model specification

A probit regression model was used to determine the effects of coronavirus on food systems in Ikwerre Local Government Area of Rivers State, Nigeria**.** The model used by Aroyehun (2023) and states the implicit model as;

$$y_i = \beta_0 + \sum_{i=1}^{K} \beta_i X_i + \varepsilon_i \quad (1)$$

Probability expression as;

$$P\left(Y = {}^{1}/_{X_1, X_2, X_3, \ldots X_n}\right) = \theta(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \quad (2)$$

Where;

P = Probability of awareness of coronavirus
Y = 1 means yes and 0 otherwise
$\theta$ = Cumulative distribution function of the standard normal distribution
$\beta$ = Parameter estimates

The explicit model is specified as;

$$y_i = \beta_0 + \sum_{i=1}^{7} \beta_i X_i + \epsilon_i \quad (3)$$

Where;

$Y_i$ = Probability of awareness of coronavirus (1 means yes and 0 otherwise)
$\beta_0$ = Constant
$\beta_1 - \beta_7$ = Coefficients of the parameter estimates
$X_1 - X_7$ = Independent variables
$\epsilon_i$ = Error term

The a priori expectations of the independent variables are shown in Table 1 below:

***Table 1:*** *The a priori expectations of the independent variables used to determine the effects of coronavirus on food systems in the study area*

| Key | Variables | Description | Measurement | Expected sign |
|---|---|---|---|---|
| $X_1$ | Age | Continuous | Years | - |
| $X_2$ | Farmers vulnerable to coronavirus | Categorical | 1 if yes, 0 otherwise | +/- |
| $X_3$ | Increase in cost of farming inputs | Categorical | 1 if yes, 0 otherwise | +/- |
| $X_4$ | Labour shortage/supply | Categorical | 1 if yes, 0 otherwise | +/- |
| $X_5$ | Markets closures | Categorical | 1 if yes, 0 otherwise | + |
| $X_6$ | Trade restrictions imposed on exporters | Categorical | 1 if yes, 0 otherwise | /- |
| $X_7$ | Insufficient access to capital due to restrictions in banks and crowd | Categorical | 1 if yes, 0 otherwise | + |

## RESULTS and DISCUSSION

The socio-economic characteristics of the farmers is presented in Table 2.

***Table 2:*** *Socio-economic characteristics of the farmers*

| Variables | Mean | Minimum | Maximum |
|---|---|---|---|
| Age (Years) | 41.61 | 17.0 | 65.0 |
| Years spent in formal education | 11.26 | 0.0 | 22.0 |
| Household size | 6.00 | 1.0 | 15.0 |
| Farmers' household distance to the farm (km) | 1.60 | 0.0 | 10.0 |
| Farming experience | 15.14 | 2.0 | 50.0 |
| Crop farm size (ha) | 0.85 | 0.1 | 3.0 |
| Livestock size (number) | 400 | 2 | 2500 |

Table 2 shows the socio-economic characteristics of the farmers. The result shows a mean age of 42 years, which implies that the farmers were within productive age. The farmers indicated the sufficient number of years spent in formal education (11 years); which implies that they could read and write and are capable of keeping farm records. The farmers have adequate farming experience (15 years); crops and livestock were being produced at subsistence scale which could be made worse by the COVID-19 pandemic. Awareness of coronavirus by the farmers in the study area indicated that the majority (96.3%) of the farmers were aware of coronavirus while about 60% attested to the vulnerability to coronavirus. This presupposes that the farmers could mitigate the effect of coronavirus in their production system.

***Table 3:*** *Effect of coronavirus on food production and distribution channel*

| **Effect of coronavirus** | **SA** | | **A** | | **D** | | **SD** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | $\bar{X}$ | **Rank** |
| Insufficient access to capital due to restrictions in banks and crowd | 26 | 32.5 | 29 | 36.3 | 13 | 16.3 | 12 | 15 | 2.1 | 1st |
| Border closures due to inter-state transportation | 27 | 33.8 | 27 | 33.8 | 14 | 17.5 | 12 | 15 | 2.1 | 1st |
| Perishability of most agricultural produce | 31 | 38.8 | 25 | 31.3 | 13 | 16.3 | 11 | 13.8 | 2.1 | 1st |
| Increase in cost of farming inputs | 26 | 32.5 | 29 | 36.3 | 9 | 11.2 | 16 | 20.0 | 2.2 | 2nd |
| Markets closures | 26 | 32.5 | 26 | 32.5 | 14 | 17.5 | 14 | 17.5 | 2.2 | 2nd |
| Trade restrictions imposed on exporters | 28 | 35.0 | 21 | 26.3 | 17 | 21.3 | 14 | 17.5 | 2.2 | 2nd |
| Reduction in incomes of the farmers | 28 | 35.0 | 27 | 33.8 | 10 | 12.5 | 15 | 18.8 | 2.2 | 2nd |
| Poor access to Medicare even after being infected | 25 | 31.3 | 28 | 35.0 | 15 | 18.8 | 12 | 15.0 | 2.2 | 2nd |
| Unable to purchase at the farm gate | 19 | 23.8 | 29 | 36.3 | 21 | 26.3 | 11 | 13.8 | 2.3 | 3rd |
| Spoilage of food as a result of prolonged storage | 25 | 31.3 | 25 | 31.3 | 15 | 18.7 | 15 | 18.7 | 2.3 | 3rd |
| Less diversity of food options available | 19 | 23.8 | 30 | 37.5 | 17 | 21.3 | 14 | 17.5 | 2.3 | 3rd |
| Labour shortage/supply | 21 | 26.3 | 27 | 33.8 | 16 | 20.0 | 16 | 20.0 | 2.3 | 3rd |
| Insufficient access to information on coronavirus | 21 | 26.3 | 26 | 32.5 | 15 | 18.8 | 18 | 22.5 | 2.4 | 4th |
| Farmers' vulnerability to coronavirus due to age and other ailments | 17 | 21.3 | 28 | 35.0 | 17 | 21.2 | 18 | 22.5 | 2.4 | 4th |
| Inability to hire farm labour due to social distancing | 19 | 32.5 | 26 | 36.3 | 13 | 16.3 | 12 | 15.0 | 2.4 | 4th |
| Poor Government response to the coronavirus pandemic | 21 | 26.3 | 22 | 27.5 | 18 | 22.5 | 19 | 23.8 | 2.4 | 4th |
| Volatile staple food price | 14 | 17.5 | 30 | 37.5 | 24 | 30.0 | 12 | 15.0 | 2.4 | 4th |
| Unavailability of food | 17 | 21.3 | 29 | 36.3 | 19 | 23.8 | 15 | 18.8 | 2.4 | 4th |
| Forced displacement/migration of people | 21 | 26.3 | 25 | 31.3 | 17 | 21.3 | 17 | 21.3 | 2.4 | 4th |
| Supply chain restrictions due to quarantines | 14 | 17.5 | 28 | 35.0 | 24 | 30.0 | 14 | 17.5 | 2.5 | 5th |
| Reduced food security | 19 | 23.8 | 22 | 27.5 | 21 | 26.3 | 18 | 22.5 | 2.5 | 5th |
| Unsafe foods | 13 | 16.3 | 27 | 33.8 | 21 | 26.3 | 19 | 23.8 | 2.6 | 6th |
| Threat to improved food nutrition | 11 | 13.8 | 30 | 37.5 | 23 | 28.8 | 16 | 20.0 | 2.6 | 6th |

Note: $\bar{X}$ = mean; F = frequency; SA = strongly agree; A = agree; D = disagree; and SD = strongly disagree.

Table 3 shows the effects of coronavirus on food production and distribution channels. Insufficient access to capital due to restrictions in banks and crowds, border closures due to inter-state transportation, perishability of most agricultural produce, increase in cost of farming inputs, trade restrictions imposed on exporters, reduction in incomes of the farmers and poor access to Medicare even after been infected were rated highest among the factors that affect food production and distribution. While threat to

improved food nutrition, unsafe foods, reduced food security, and supply chain restrictions due to quarantines were ranked lowest among the factors that affect food production and distribution. This implies that coronavirus could compound the pressures on food systems, as all the actors along the food value chain could be affected in different ways. This finding agrees with FAO (2019) which stated that the coronavirus pandemic is capable of disrupting the global food system. This finding agrees with the report by the International Food Policy Research Institute IFPRI (2020) confirms that logistical delays during COVID-19 led to high levels of spoilage for perishable goods, particularly in regions with limited storage facilities. IFPRI further found that farmer income dropped sharply during the pandemic, particularly in regions where markets were closed, and price volatility was high.

***Table 4:*** *Control measures adopted in the community against the coronavirus pandemic in the study area*

| Variables | Frequency | Percentage |
|---|---|---|
| **Road blockage** | | |
| Adopted | 48 | 60.0 |
| Not adopted | 32 | 40.0 |
| **Quarantine** | | |
| Adopted | 53 | 66.3 |
| Not adopted | 27 | 33.7 |
| **Disruption and closure of the market** | | |
| Adopted | 59 | 73.8 |
| Not adopted | 21 | 26.2 |
| **Washing of hands** | | |
| Adopted | 71 | 88.8 |
| Not adopted | 9 | 11.2 |
| **Use of face/nose mask** | | |
| Adopted | 71 | 88.8 |
| Not adopted | 9 | 11.2 |
| **Community sensitization and campaign** | | |
| Adopted | 38 | 47.5 |
| Not adopted | 42 | 52.5 |
| Total | 80 | 100.0 |

Table 4 shows the control measures adopted during the pandemic of coronavirus. The strategies adopted for improving the food system amidst the coronavirus pandemic include; relocation of the market (51.3%); mobile buying and selling (40%); use of mobile money transfer (40%); house-to-house selling (61.3%) and online platforms (social media) (47.5%) of the farmers.

***Table 5:*** *Factors affecting food systems sustainability in the study area*

| Variables | Coefficient | Std. Error | z | p-value |
|---|---|---|---|---|
| **Constant** | 0.55769 | 1.28121 | 0.435 | 0.6634 |
| **$X_1$** | 0.01076 | 0.01334 | 0.807 | 0.4197 |
| **$X_2$** | −5.04284 | 0.85253 | −5.915 | 0.0001*** |
| **$X_3$** | 0.67292 | 0.44859 | 1.500 | 0.1336 |
| **$X_4$** | −0.09482 | 0.26121 | −0.363 | 0.7166 |
| **$X_5$** | 5.01634 | 0.94217 | 5.324 | 0.0001*** |
| **$X_6$** | 0.41364 | 0.42957 | 0.963 | 0.3356 |
| **$X_7$** | 0.06578 | 0.34688 | 0.190 | 0.8496 |

Note: McFadden R-squared = 0.152; Adjusted R-squared = 0.743; Log-likelihood = -7.568; ***, ** and * significant at 1%, 5% and 10% respectively; Number of cases 'correctly predicted' = 63 (96.9%); f(beta'x) at mean of independent vars = 0.174.

Table 5 shows the Probit regression results of the factors affecting food systems sustainability in the study area. A McFadden R-squared value of about 0.2 was obtained, which shows that the regression model is a good fit for the data, with 96.9% number of cases correctly predicted in the model as well as 0.174 mean of independent variables captured in the model.

Market closures ($X_5$) are statistically significant influencing food systems sustainability at 1% in the area. The coefficient (5.0163) of market closures is positively related to food sustainability. This implies that the public market closures are liable to withstand the food crisis emanating from the incidence of coronavirus as the farmers were able to sell their farm produce to houses, through online marketing, and special delivery procedures that get food on the table of the final consumers.

On the other hand, the coefficient of farmers vulnerable to coronavirus (X2) is significant at a 1% level of significance. Farmers vulnerable to coronavirus show inverse functions of food sustainability with a coefficient of −5.0428. In other words, an increase in farmers vulnerable to coronavirus reduces the tendency to attain food sustainability.

## CONCLUSION and RECOMMENDATİONS

The effects of coronavirus on food systems in Ikwerre LGA of Rivers State, Nigeria induced serious threats to food systems, especially in the area of security, stability, accessibility, and distribution. Coronavirus with its hampering effects is capable of slipping Nigeria into a deeper crisis of food insecurity and resource scarcity, thereby reducing the chances of being food-sufficient as a nation. Market closures ($X_5$) and farmers vulnerable to coronavirus (X2) were statistically significant about food systems sustainability. The study, therefore, recommended that: storage facilities should be made available even in rural areas where most of the foods are coming from to reduce the incidence of food spoilage; farming inputs should be subsidized for the farmers, and agricultural produce markets for each commodity should be reorganized; there should be policies along the food supply chain which include: production, storage, processing, transportation, and purchasing activities to minimize food insecurity, malnutrition, and famine; research should be developed and funded to undertake potential impacts on food system actors and their interconnecting risks; food processing machinery and equipment should be made available to counter the labour problems.

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## AUTHOR CONTRIBUTIONS

The authors contributed equally to this study.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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