

# Production Innovation and Food Security in South Eastern Nigeria

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## Abstract

Expansion of food supply apparently offers the opportunity of increasing nutrition, health, wellness and stampeding hunger. This study offers the insight on ensuring food security through production innovation using South Eastern Nigeria as a case study. The population of this study was quoted food manufacturing firms in South-Eastern Nigeria which are members of the Manufacturing Association of Nigeria (MAN). It also included non registered members of MAN whose amount of capital exceeded Ten million Naira. The sample size consists of five hundred and forty two respondents. The responses from the participants were measured using 5-liket scale and Cronbah's Alpha was used in determining the extent of consistency of the reliability. The hypothesis was tested using multiple regression analysis of the Ordinary Least Square technique. The results showed that production innovation as shown by the statistics have significantly and positively influenced the level of food security hence production innovation is imperative to keep food supply afloat.

**Keywords;** *Production innovation; Food security; Nutrition; Hunger; Manufacturing firms*

## I. INTRODUCTION

Persistent competitions in the present day business environment appear to place firm(s) and industries on constant challenges of seeking innovative means to ensure efficient production in order to maximize market opportunities. This becomes imperative as product variations multiplies to accommodate the societal needs, as noted by Ong, Yaun and Nee (2008) since products are becoming more versatile, inherently complicated, and intricate. Production innovation is referred to as a concept relating ongoing restructuring processes and a core-organizational culture in itself. It entails transformation of products through enhanced production process from common trends to continuous improvement in order to retain and

widen competitive advantages. Furthermore, it involves constant monitoring and evaluation of the advances in research and technology advancement in the areas of production management system and related technology and working methods. The adopted working methods are expected to bring about significant improvements in technical specifications, components and materials, healthy customer relationship and other functional characteristics.

Production innovation implies to develop new or improve existing production competences in firms based on the convergence of appropriate readiness levels of technology, workforce skills and knowledge, and financial resources to invest. Twenty-first century is widely accepted as the

advent of the fourth industrial revolution in which rapid development and fusions of technologies are blurring divisions between physical, digital, and biological domains (Agbarakwe, Anowor, &Ikue, 2018; Schwab, 2017). In the current highly competitive business environment, the manufacturing industry is facing constant challenges of producing innovative products at précised time-to-market (Anowor, Ukwani, Ezekwem&Ibiam, 2013). In the case of product innovation, the price-cost margin increases because buyers are willing to pay higher for new product features and the firm yields monopoly rents until these new features are imitated (see: Onodugo, Anowor,Ifediora, &Aliyu, 2019; Peters, 2015; Anowor, Ukwani&Ikeme, 2013). To improve returns to product innovation investments, organization need to effectively govern and measure their new product development processes from end to end, from strategic road mapping to idea development to innovation execution (Tohidi&Jabbari, 2012).

Food security has evolved significantly in theory and practice through sequences of definitions and paradigms during the last decades (see also: Weingärtner, 2000). The concept of ‘Food for Development’ was introduced and institutionalized in the 1960s when it was obvious that food-aid could hinder self-sufficient development; hence the World Food Program in 1963 (WFP). Food assurance was borne out of the food crisis of 1972/1974; this era marked a dramatic turning point from food abundance of donor countries to highly unstable food supplies and prices in the world market. Consequently, food security insurance schemes were introduced to assure international access to physical food supplies through experienced coordination among donor organizations and agencies and competent food surveillance in recipient countries. In the 1980s, following the success of Green Revolution (GR) which helped to increased food production, it was established that food emergencies and even famines were not caused as much by disastrous shortfalls in food production as by

declines in the purchasing power of specific social groups. Therefore food security was broadened to include both physical and economic access to food supply. Concrete plans were defined to eradicate or at least reduce hunger and malnutrition drastically in the 1990s. Additionally, the human right to adequate food and nutrition was reaffirmed and committed to a more proactive role. Decreasing hunger and malnutrition have increasingly come to become a principal context, as advanced by Anowor, Ukwani and Ezekwem (2013), of the Millennium Development Goals (MDGs) of 2000-2015 and Sustainable Development Goals (SDGs) of 2015-2030. The internationally accepted targets are to ensure adequate food and nutrition for the entire members of the society.

From the above, food security entails availability, access, utilization and stability of food. Food is mostly accepted as any substance that people eat and drink to gain energy in order to maintain life and growth. Food security according to Food and Agricultural Organization (FAO, 2018) is achieved when it is ensured that all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Therefore food security is achieved if adequate food (quantity, quality safety, socio-cultural acceptability) is available and accessible for and satisfactorily used and utilizes by all individuals at all times to live a healthy and active life.

More than one billion people since 2010 are estimated according to Food and Agricultural Organization to be undernourished. The disturbing fact about this FAO statistics is that this figure is almost the population of Africa. Malnourished persons are unable to consume adequate amounts of nutrients for productive activities. Approximately 3.5 million deaths occur per year in children under five in Africa, Asia, the Western Pacific and the Middle East; and the deaths are attributed to illnesses related to malnourishment/under-nutrition

(Horton, 2008; Black et al., 2008). The World Health Organization (WHO) map for Children under-five years stunted 2000-2008 (WHO, 2010) indicates that countries where greater than 40% of their children experience nutrition-related growth stunting are concentrated in Africa, South Asia and the South Pacific islands.

In Nigeria, food accounts for a large and increasing share of family budgets for poor and urban families. If prices of staple foods soar, poor people are most likely the ones to bear the brunt. The Food and Agricultural Organization warned that Nigeria, Morocco and Bangladesh are at the imminent danger of food crisis (Eme, Onyishi, Uche and Uche, 2014). A number of studies have shown that there is a looming scarcity of food in Nigeria especially within the South Eastern states of Nigeria hence concerted attentions are required to avert the imminent danger (Chigbu&Onukaogu, 2012). They further reiterated that some of the most profound and direct impacts of climate change over the next few decades will be on agricultural and food systems and also adduced that increasing temperature and declining precipitation over semi-arid region are likely to reduce crop yield and other agricultural produce.

It is against these backdrops that this study aims to ascertain the extent to which production innovation influence the level of food security in the South Eastern Nigeria using the quoted food manufacturing firms as a case study.

## II. LITERATURE REVIEW

Production process can be defined as a set up procedure used to create a commodity usually repeated to create multiple units of the same item. The production process generally involves the use of raw materials, machinery and manpower to create a product by combining various material and immaterial inputs in order to craft something for consumption (Craig and Harris, 2003).

The main resources and stages that are involved to make up the production process are shown in figure 1 below:

**Figure 1: Production process**



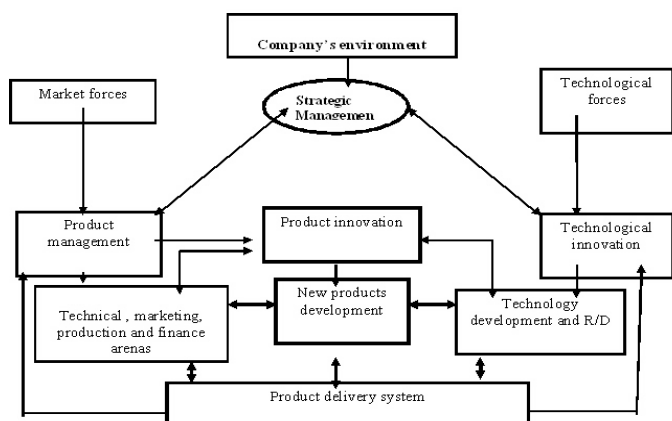
The Production Process (With Diagram) retrieved from <http://www.economicdiscussion.net/theory-of-production/the-production-process-with-diagram/19900>)

The level of success of any firm is ultimately determined by how well-organized it is at performing this transformation process. This level is known as productive efficiency of a firm and reason being that a firm needs to be as efficient as possible thus gaining an advantage over other competitive firms supplying the same product or service (John, 2017). Firms are working within an environment characterized by the rapid changes: social, political, economic, organizational, technological and marketing changes. Under this new environment, firms become obliged to adopt themselves with these changes to ensure its continuance. At same time, these changes and variables are considered as opportunities and threats which push firms to create new methods adopted with these environment needs.

The stable political environment and the support given by authorities for innovation encourages both companies and individuals to innovate whether in production field or other fields through establishing Research and Development centers and providing the necessary financial and human resources to them. All these forces represent opportunities to companies for solving their problems through innovating new products or making modifications in

the existing ones. Figure 2 denotes the main elements that influence product innovation.

**Figure 2: Product innovation**



David L.R. (2006). Product innovation: Leading Change through Integrated Product Development. Cambridge University Press

### III. FOOD SECURITY

Food security is a situation of limited or uncertain availability of nutritionally adequate and safe food or limited or uncertain ability to acquire acceptable foods in socially acceptable ways. Household food security exists when all members, at all times, have access to enough food for an active, healthy life. Individuals who are food secure do not live in hunger or fear of starvation. The Food and Agriculture Organization (FAO) of the United Nations identified the four pillars of food security as availability, access, utilization, and stability (Boeing, 2016). The United Nations (UN) recognized the Right to Food in the Declaration of Human Rights in 1948, and has since noted that it is vital for the enjoyment of all other rights.

The major factors militating against food security in the twenty century include:

- i. Global Water Crisis - Water table reserves are falling in many countries (including Northern China, the US, and India) due to widespread over-pumping and irrigation.
- ii. Climate Change - Rising global temperatures are beginning to have a ripple effect on crop yields,

forest resources, water supplies and altering the balance of nature.

- iii. Land Degradation - Intensive farming leads to a vicious cycle of exhaustion of soil fertility and decline of agricultural yields.
- v. Greedy Land Deals - Corporations and Governments buying rights to millions of acres of agricultural land in developing countries to secure their own long-term food supplies (Disabled World, 2015).

### IV. DIFFUSION OF INNOVATION THEORY

Diffusion of innovations is a theory, which varied and spans multiple disciplines, seeks to explain how, why, and at what rate new ideas and technology spread. Everett Rogers, a professor of communication studies, popularized the theory in his book Diffusion of Innovations; the book was first published in 1962. Rogers argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behaviour, or product. Adoption means that a person does something differently than what they had previously (i.e., purchase or use a new product, acquire and perform a new behaviour, etc.). The key to adoption is that the person must perceive the idea, behaviour, or product as new or innovative. It is through this that diffusion is possible.

Rogers proposes that four main elements influence the spread of a new idea: the innovation itself, communication channels, time, and a social system. The innovation must be widely adopted in order to self-sustain. Within the rate of adoption, there is a point at which an innovation reaches critical mass. Diffusion manifests itself in different ways and is highly subject to the type of adopters and innovation-decision process. The criterion for the

adopter categorization is innovativeness, defined as the degree to which an individual adopts a new idea.

There are five main factors that influence adoption of an innovation, and each of these factors is at play to a different extent in the five adopter categories.

i. Relative Advantage - The degree to which an innovation is seen as better than the idea, program, or product it replaces.

ii. Compatibility - How consistent the innovation is with the values, experiences, and needs of the potential adopters.

iii. Complexity - How difficult the innovation is to understand and/or use.

iv. Triability - The extent to which the innovation can be tested or experimented with before a commitment to adopt is made.

v. Observability - The extent to which the innovation provides tangible results.

Diffusion occurs through a combination of (a) the need for individuals to reduce personal uncertainty when presented with new information, and (b) the need for individuals to respond to their perceptions of what specific credible others are thinking and doing, and (c) to general felt social pressure to do as others have done.

## V. EMPIRICAL REVIEW

Towobola, Luqman, Kolade, Ogunwale and Olakojo (2014) examined entrepreneurship as a vehicle for Sustainable Food Production in Nigeria with Oyo State as case study. The study adopted narrative-textual case study (NTCS) as methodology to conclude that when an agricultural practice in Nigeria is approached from entrepreneurial angle, it would help solve the problems of unemployment, food scarcity and malnutrition, and poverty among the rural dwellers in Nigeria and will consequently increase per capita income and standard of living.

Eme, Uche, Uche and Onyishi, (2014) conducted a study, adopting survey sampling, on challenges of

food security in Nigeria using Abia State as a sample; concluded by positing that the task of feeding the populace adequately constituted an increasing challenge, requiring the coordinated efforts and interaction of food producers, transporters, market operators and a myriad of retailers.

Agbogo, Udouso, and Tiku (2013) randomly selected Two hundred and forty (240) rice consumers from twelve (12) chosen purposively Local Government Areas in Cross River State to evaluate the factors affecting rice consumption in the Cross River State of Nigeria. Survey research design was used for the study and it was discovered that the socio-economic variables that affect rice consumers in the study area were age, marital status, household size, religion, and educational level. The study concluded that price naturally has an inverse relationship with consumption expenditure, where an increase in income results in less of the commodity consumed. They recommended that farmers should be encouraged to produce more of the brand of rice available in the area.

Egbetokun and Omonona (2012) accessed the determinants of farmers' participation in a food market in Odeda L.G.A. of Ogun state of Nigeria. The study used simple random sampling technique to gather information on the determinants of farmers' participation in a food market. Descriptive statistics and Probit regression analysis used to analyze the information gathered. Probit analysis shows that the major determining factors influencing farmers participation in the market were age, marital status, the source of labor, farming experience and farm size. It is therefore recommended that government should intensify efforts through the extension agents in organizing programs which will promote farmers' participation in the market through training, disseminating market information and better utilization of farmland.

Ajao, Ojofeitimi, Adebayo, Fatusi and Afolabi (2010) examined the influence of family size,

household food security status, and child care practices on the nutritional status of under-five children in Ile-Ife, Nigeria. Fertility pattern and reproductive behaviours affect infant death in Nigeria. The study discovered that children with less educated mothers were significantly more likely to be stunted.

Babatunde and Oyatoye (2005) examined the problems of food marketing and security in Nigeria, using maize marketing in Kwara State as a case study. The data collected were analyzed using descriptive and inferential statistics. Responses of the selected respondents show that the significant problems of food marketing are; transportation problem, inadequate market infrastructure, low funding, shortage of processing facilities and seasonality and perishability of food produce. The study recommended that the government should provide adequate transportation facilities, regarding good roads and functional vehicles, private individuals and cooperative groups.

## VI. MATERIAL AND METHOD

### Area of the Study

The area of study includes a political or geographical area including its history, geography, language, and general culture. The area of the present study was quoted food manufacturing firms in South-Eastern, Nigeria; South East of Nigeria is one of the six geopolitical zones in the country. The region consists of the following states; Abia, Anambra, Ebonyi, Enugu, and Imo which houses the selected manufacturing firms in study. Enugu spreads south wards to the borders with Abia and north wards to Kogi state. Imo spreads its boundary to Rivers, and Cross-Rivers. Anambra spreads to Delta states and Benue States. Ebonyi spreads to Cross River and Bayelsa States, while Abia also with Rivers and Cross-Rivers states.

### Population of the Study

The population of this study was quoted food manufacturing firms in South-Eastern Nigeria which

are bonafide members of the Manufacturing Association of Nigeria (MAN). It also included non registered members of MAN whose amount of capital exceeded ten million (10M). This was done to accommodate manufacturing firms from Ebonyi State their registered with MAN. Their inability to get registered with MAN in the various state chapters was attributed to lack of adequate sensitization and public enlightenment on the imperative of belonging to such an umbrella body. The population of this study was made up of management, senior and junior staff of ten quoted food manufacturing firms in South-Eastern, Nigeria which gave a total of five thousand, five hundred and eighty four employees (5,584) as shown below.

**Table 1: Population Distribution**

S / N	Manufacturing firms	Mgt	Senior	Junior	Total
1	Chitis Ltd	43	253	314	610
2	Aqua Rapha Investment Nigeria Limited	12	322	482	816
3	I. RICE MILL COMPANY NIGERIA LIMITED	21	125	274	420
4	Tummy-Tummy Foods Industries Limited	28	215	412	655
5	Camela Vegetable Oil Company	38	147	354	539
6	M.O. Nnaji Bakery	15	150	257	422
7	Vegas Bakery Limited	13	67	127	209
8	Envoy Oil Industries Limited	37	217	327	581
9	Rapido Foods	74	312	443	829
10	Golden Oil Industries Limited	24	169	312	502
<b>Total</b>		<b>305</b>	<b>1977</b>	<b>330</b>	<b>5584</b>

Source: Field Survey, 2019

Table 1 above shows that ten firms were selected from five states in Southeast which the researcher deemed to be representative of the food manufacturing firms.

### Sample Size Determination

The study sample size was five hundred and forty two (542) respondents. This sample size is justified because the population was huge and such a sample

would be sufficient to address the research problem. The actual population would be five thousand, five hundred and eighty four employees (5,584) employees. The population of the study will be drawn from the three levels of employees in these organizations under study using stratified sampling method. In calculating the sample size for this study, the researchers applied the statistical formula for selecting a sample from a finite population by Bill (2004).

$$SS = \frac{Z^2 p(1-p)}{C^2}$$

Where SS = Sample Size

Z = Z-Value (e.g. 1.96 for a 95percent confidence level)

P= Percentage of the population Picking a choice expressed as decimal

C= Confidence interval expressed as (+4percent)

Substituting SS =

$$\frac{(1.96)^2 \times 0.5 \times 0.5}{(0.04)^2}$$

$$SS = \frac{3.846 \times .25}{0.0016} = 0.9604$$

$$SS = 600.25$$

$$\text{New SS} = \frac{SS}{\frac{1+(SS-1)}{POP}}$$

Where POP = Population (5584)

$$SS = 600$$

$$\text{New SS} = \frac{600}{\frac{1+(600-1)}{5584}}$$

$$\text{New SS} = \frac{600}{1+0.1074}$$

$$\text{New SS} = \frac{600}{1.1074}$$

$$= 541.8$$

$$\approx 542.$$

**Table 2: Proportionate Allocation of Questionnaire**

Thus:

S/N	Manufacturing firms		Senior	Junior	Total
1	Chitis Ltd	Mgt	$\frac{43 \times 542}{5584}$	4	60
		Senior	$\frac{253 \times 542}{5584}$	25	
		Junior	$\frac{314 \times 542}{5584}$	31	
2	Vegas Bakery Limited	Mgt	$\frac{13 \times 542}{5584}$	1	20
		Senior	$\frac{67 \times 542}{5584}$	7	
		Junior	$\frac{127 \times 542}{5584}$	12	
3	Rice Mill Company Nigeria Limited	Mgt	$\frac{21 \times 542}{5584}$	2	41
		Senior	$\frac{125 \times 542}{5584}$	12	
		Junior	$\frac{274 \times 542}{5584}$	27	
4	Tummy-Tummy Foods Industries Limited	Mgt	$\frac{28 \times 542}{5584}$	3	64
		Senior	$\frac{215 \times 542}{5584}$	21	
		Junior	$\frac{412 \times 542}{5584}$	40	
5	Camela Vegetable Oil Company	Mgt	$\frac{38 \times 542}{5584}$	4	52
		Senior	$\frac{147 \times 542}{5584}$	14	
		Junior	$\frac{354 \times 542}{5584}$	34	

6	Aqua Rapha Investment Nigeria Limited	Mgt	$\frac{12 \times 542}{5584}$	1	79
		Senior	$\frac{322 \times 542}{542}$	31	
		Junior	$\frac{482 \times 542}{542}$	47	
7	Rapido Foods	Mgt	$\frac{74 \times 542}{5584}$	7	80
		Senior	$\frac{312 \times 542}{542}$	30	
		Junior	$\frac{443 \times 542}{542}$	43	
8	Camela Vegetable Oil Company	Mgt	$\frac{37 \times 542}{5584}$	4	57
		Senior	$\frac{217 \times 542}{5584}$	21	
		Junior	$\frac{327 \times 542}{5584}$	32	
9	M.O. Nnaji Bakery	Mgt	$\frac{15 \times 542}{5584}$	1	41
		Senior	$\frac{150 \times 542}{5584}$	15	
		Junior	$\frac{257 \times 542}{5584}$	25	
10	Golden Oil Industries Limited	Mgt	$\frac{24 \times 542}{5584}$	2	48
		Senior	$\frac{169 \times 542}{5584}$	16	
		Junior	$\frac{312 \times 542}{5584}$	30	
<b>Total</b>					<b>542</b>

interview. Copies of the questionnaire were administered to management, senior and junior of the organizations studied. The questionnaire was divided in two sections, section A is designed to gather information about the participant characteristics like gender, demographic information, qualification, age and work experience. While, section B is designed to gather responses of employees on the extent the independent variable affects the dependent variable. The responses generated were used for data analysis. The responses from the participants were measured using 5-liket scale as follows: Strongly Agree [SA] –5 points, Agree A – 4 points, Undecided UN – 3 Points, Disagree [D] – 2 points and strongly Disagree SD – 1 point.

A test-retest method was used to test the reliability of the instrument. This was done by administering 20 copies of the prepared questionnaire to the sample of the study, after a period of time, the same questionnaire was re-administered on the respondents at the end of the exercise the response of the group was consistent. Cronbah's Alpha was used in determining the extent of consistency of the reliability.

The formula is as follows:

$$= \frac{K (\text{Cov}/\text{Var})}{1 - (k-1)(\text{Cov}/\text{Var})}$$

Where

K = number of items on the survey.

Cov = Average inter item covariance.

Var = Average item variance.

I = Constant.

A Cronbach's alpha value (  $\infty$  ) of greater 0.966 indicated very strong reliability.

**Scale: ALL VARIABLES**

**Source:** Field Survey, 2019

The main instrument for data collection was structured questionnaire; the study made use of oral

**Table 3: Case Processing Summary**

		N	%
Cases	Valid	30	100.0
	Excluded <sup>a</sup>	0	.0
	<b>Total</b>	<b>30</b>	<b>100.0</b>

a. Listwise deletion based on all variables in the procedure.

**Table 4: Reliability Statistics**

Cronbach's Alpha	No. of Items
.76	6

Scale reliabilities were calculated using Cronbach's Alpha; the result obtained was 0.766. This shows that the internal consistency of the scale is good for the purpose of this study, because it is greater than 0.7 which is the standard. Cronbach's Alpha is considered the most appropriate statistics test for reliability. Given the nature of responses used to construct the scale. For this kind of data, this is equivalent to the Kuder-Richardson formula 20 (KR20) coefficient.

## VII. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

**Table 5: Distribution and Return of the Questionnaire**

	Distributed	No Returned	Percent	No not Returned	Percent
Chitis Ltd	60	58	10	2	.4
Aqua Rapha Investment	20	20	4	0	0
<b>II. RICE MILL COMPANY</b>	41	40	8	1	.2
Tummy-Tummy Foods	64	59	11	5	.9
Camela Vegetable oil	52	50	9	2	.4
M.O. Nnaji Bakery	79	75	13	4	.8
Vegas Bakery Limited	80	77	14	3	.6
Envoy Oil Industries	57	57	10	0	0
Rapido Foods	41	40	8	1	.2
Golden Oil Industries	48	48	9	0	0
<b>Total</b>	<b>542</b>	<b>524</b>	<b>96.0</b>	<b>18</b>	<b>4.0</b>

Source: Field Survey, 2019.

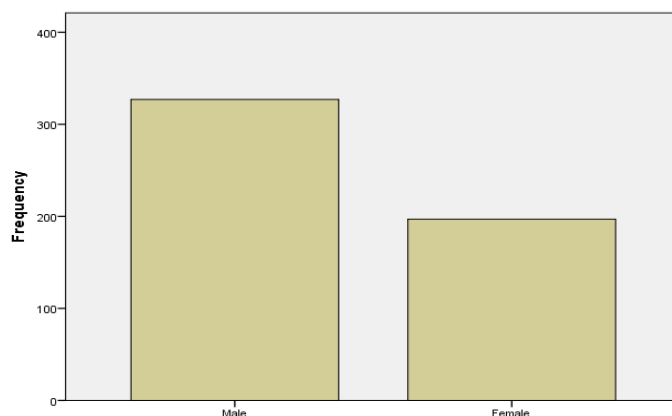
Table 4.1 shows that five hundred and twenty four (524) copies representing 96 percent were returned while eighteen (18) copies representing 4 percent were not returned.

### Bio Data

**Table 6: Sex of Respondents**

	Frequency	Percent	Mean	Std Deviation
Male	327	62.4	3.7992	.87109
Female	197	37.6	4.2386	.54063
Total	524	100.0	3.9644	.79240

Source: Field Survey, 2019.



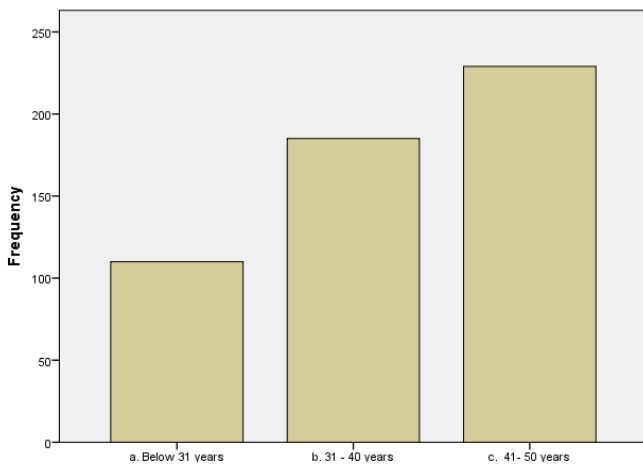
**Figure 3: Sex of respondents**

From table 6, represented in the bar chart of figure 3, it was observed that 524 respondents out of 327 representing 62.4 percent were males whereas 197 respondents representing 37.6 percent were females. This indicated that male were more than the females.

**Table 7: Age of the respondent**

	Frequency	Percent	Mean	Std. Deviation
a. Below 31 years	110	21.0	3.5197	1.10778
b. 31 - 40 years	185	35.3	3.9000	.71774
c. 41- 50 years	229	43.7	4.2300	.51795
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.9644</b>	<b>.79240</b>

Source: Field Survey, 2019.



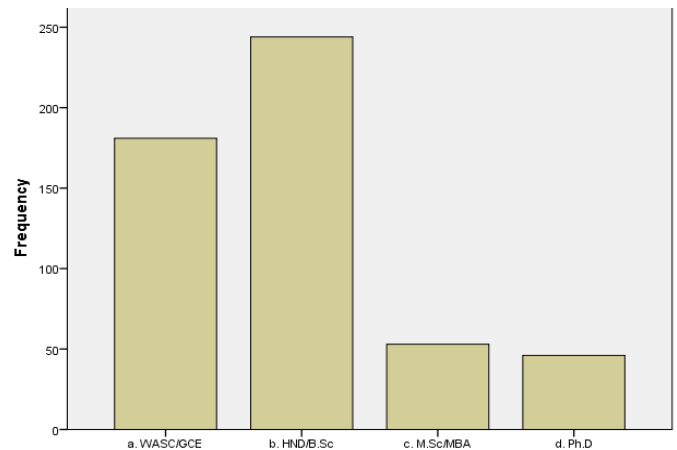
**Figure 4: Age of the respondents**

Table 7 represented in the Bar chart figure 4, 110 respondents out of 524 representing 21.0 percent were below 31years, 185 respondents with 35.3 percent were within the age bracket of 31-40, 229 respondents representing 43.7 percent were within the age bracket of 41-50years. This implies that greater proportion of the respondents fall within the ages of 31-40 years.

**Table 8: Highest Educational Qualification**

	Frequency	Percent	Mean	Std. Deviation
a. WASC/GCE	181	34.5	3.6722	.94492
b. HND/B.Sc	244	46.6	4.0786	.67762
c. M.Sc/MBA	53	10.1	4.0975	.61882
d. Ph.D	46	8.8	4.3551	.46162
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.9644</b>	<b>.79240</b>

Source: Field Survey, 2019.



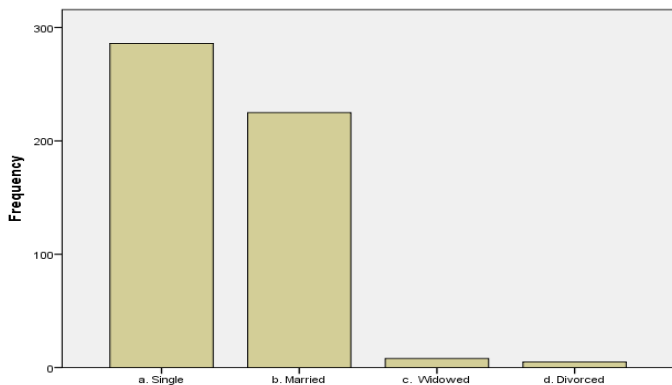
**Figure 5: Educational qualifications of the respondents**

Table 8 represented in the bar chart figure 5, reveals that 181 respondents out of representing 34.5 percent were holders of WASC/GCE, 244 respondents representing 46.6 percent were holders of HND/B.Sc, 53 respondents representing 10.1 percent were holders of M.Sc/MBA and 46 respondents representing 8.8 percent were holders of Ph.D.

**Table 9: Marital status**

	Frequency	Percent	Mean	Std deviation
a. Single	286	54.6	3.7500	.90889
b. Married	225	42.9	4.2096	.51935
c. Widowed	8	1.5	4.6667	.00000
d. Divorced	5	1.0	4.0667	.68313
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.9644</b>	<b>.79240</b>

Source: Field Survey, 2019.



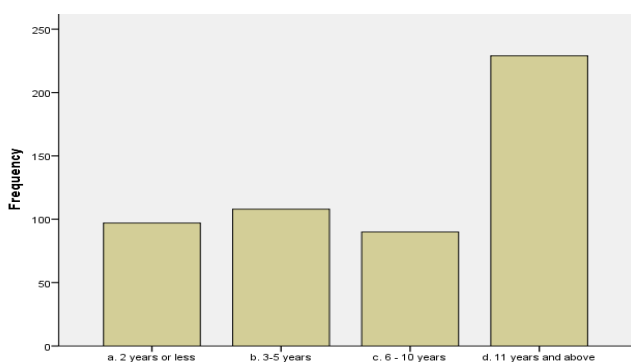
**Figure 6: Marital status of respondents**

Table 9 represented in the bar chart figure 6, reveals that 286 respondents out of 524 representing 54.6 percent were single, 225 respondents representing 42.9 percent were married. 8 respondents representing 1.5 percent were widowed, 5 respondents representing 1.0 percent were divorced.

**Table 10: Years of experience**

	Frequency	Percent	Mean	Std Deviation
a. 2 years or less	97	18.5	3.4725	1.15987
b. 3-5 years	108	20.6	4.0216	.51815
c. 6 - 10 years	90	17.2	3.7500	.85615
d. 11 years and above	229	43.7	4.2300	.51795
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.9644</b>	<b>.79240</b>

Source: Field Survey, 2019.



**Figure 7: Years of experience**

Table 10 represented in the bar chart figure 7, shows that 97 respondents out of 524 representing 18.5 percent were 2 years or less, 108 respondents with 20.6 percent were within 3-5 years, 90 respondents representing 17.2 percent were within the years

establishment bracket of 6-10years, 229 respondents representing 43.7 percent were within the years establishment bracket of 11 and above. This implies that greater proportion of the respondents fall within the year's establishment bracket of 6-10 years.

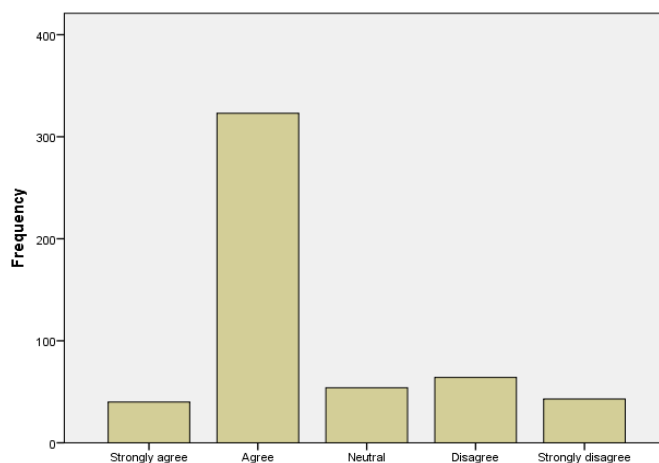
## VIII. DATA ANALYSIS

**Research Question:** To what extent does production innovation influence the level of food security of the quoted food manufacturing firms, South-East, Nigeria?

**Table 11: My organisation has innovated a new method of packaging.**

	Frequency	Percent	Mean t	Std deviation
Strongly agree	40	7.6	4.5583	.61504
Agree	323	61.6	4.1115	.40224
Neutral	54	10.3	2.9660	.41256
Disagree	64	12.2	2.3958	.75505
Strongly disagree	43	8.2	1.6357	.52737
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.6148</b>	<b>1.00192</b>

Source: Field Survey, 2019



**Figure 8: My organization has innovated a new method of packaging**

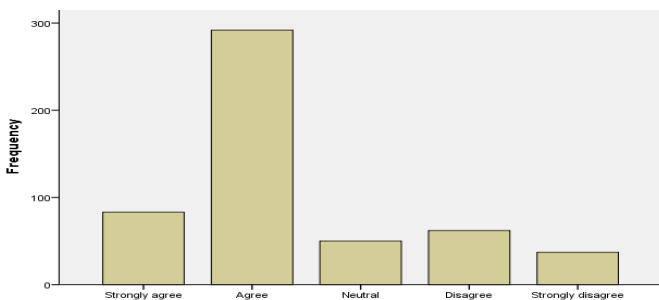
Table 11, and represented in the bar chart figure 8, indicates that 40 respondents out of 524 representing 7.6 percent strongly agree that my organisation has innovated a new method of packaging with mean score of (4.5583) and standard deviation (.61504). 323 respondents representing 61.6 percent agree with mean score of (4.1115) and

standard deviation (.40224), 54 were neutral respondents representing 10.3 percent that my organisation has innovated a new method of packaging with mean score of (2.9660) and standard deviation (.41256), 64 respondents representing 12.2 percent disagree with mean score of (2.3958) and standard deviation of (.75505). 43 respondents representing 8.2 percent strongly disagree that my organisation has innovated a new method of packaging with mean score of (1.6357) and standard deviation of (1.00192).

**Table 12: Production innovation in my organization has reduced the costs of the production.**

	Frequency	Percent	Mean	Std deviation
Strongly agree	83	15.8	4.4839	.40959
Agree	292	55.7	4.0245	.49440
Neutral	50	9.5	2.9767	.35953
Disagree	62	11.8	2.2581	.60559
Strongly disagree	37	7.1	1.5676	.53063
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.6148</b>	<b>1.00192</b>

Source: Field Survey, 2019



**Figure 9: The production innovation in my organization has reduced the costs of the production**

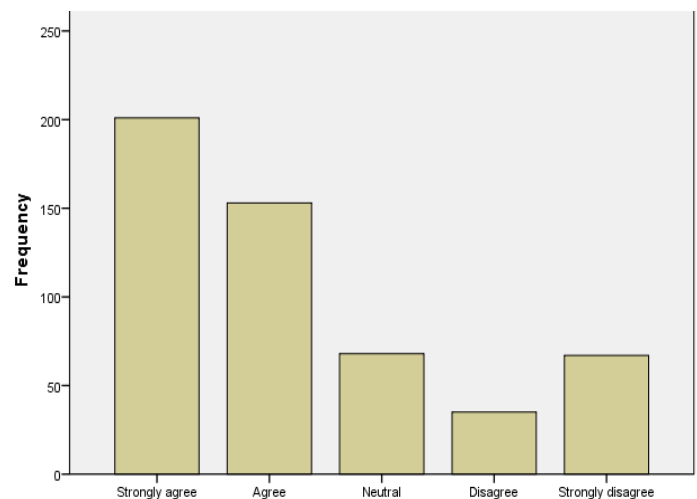
Table 12, and represented in the bar chart figure 9, indicates that 83 respondents out of 524 representing 15.8 percent strongly agree that the production innovation in my organization has reduced the costs of the production with mean score of (4.4839) and standard deviation (.40959). 292 respondents representing 55.7 percent agree with mean score of (4.0245) and standard deviation

(.49440), 50 were neutral respondents representing 9.5 percent that the production innovation in my organization has reduced the costs of the production with mean score of (2.9767) and standard deviation (.3595), 62 respondents representing 11.8 percent disagree with mean score of (2.2581) and standard deviation of (.60559). 37 respondents representing 7.1 percent strongly disagree that the production innovation in my organization has reduced the costs of the production with mean score of (1.5676) and standard deviation of (.53063).

**Table 13: There is better distribution arrangements due to new production innovation in my organisation**

	Frequency	Percent	Mean	Std Deviation
Strongly agree	201	38.4	4.3964	.27519
Agree	153	29.2	3.9390	.37984
Neutral	68	13.0	3.0809	.38793
Disagree	35	6.7	2.3143	.50934
Strongly disagree	67	12.8	1.7512	.53527
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.6148</b>	<b>1.00192</b>

Source: Field Survey, 2019



**Figure 10: There is better distribution arrangement due to new production innovation in my organization**

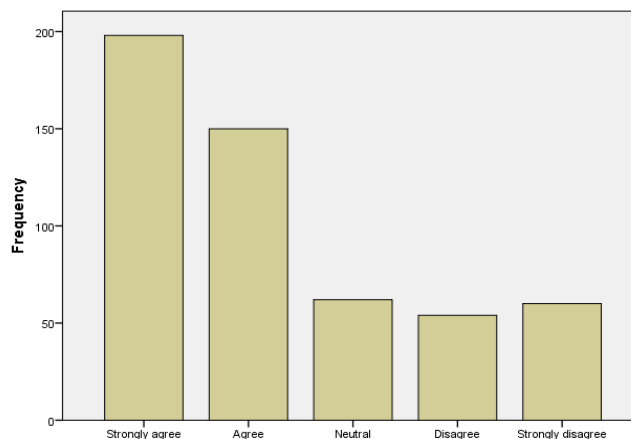
Table 13, and represented in the bar chart figure 10, indicates that 201 respondents out of 524 representing 38.4 percent strongly agree that there is better distribution arrangements due to new production innovation in my organisation with mean

score of (4.3964) and standard deviation (.27519). 153 respondents representing 29.2 percent agree with mean score of (3.9390) and standard deviation (.37984), 68 were neutral respondents representing 13.0 percent that there is better distribution arrangements due to new production innovation in my organisation with mean score of (3.0809) and standard deviation (.38793), 35 respondents representing 6.7 percent disagree with mean score of (2.3143) and standard deviation of (.50934). 67 respondents representing 12.8 percent strongly disagree that there is better distribution arrangements due to new production innovation in my organisation with mean score of (1.7512) and standard deviation of (.53527).

**Table 14: Production innovation in my organization has led to increased efficiency.**

	Frequency	Percent	Mean	Std Deviation
Strongly agree	198	37.8	4.3165	.31236
Agree	150	28.6	4.0667	.46823
Neutral	62	11.8	3.1344	.34783
Disagree	54	10.3	2.1389	.49605
Strongly disagree	60	11.5	1.9944	.77141
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.6148</b>	<b>1.00192</b>

Source: Field Survey, 2019



**Figure 11: Production innovation in my organization has led to increased efficiency**

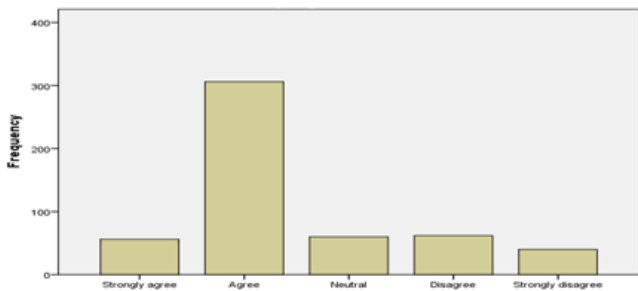
Table 10, and represented in the bar chart figure 4.9, shows that 198 respondents out of 524 representing 37.8 percent strongly agree that production innovation in my organization has led to increased efficiency with mean score of (4.3165) and standard deviation (.31236). 150 respondents representing 28.6 percent agree with mean score of (4.0667) and standard deviation (.46823), 62 were neutral respondents representing 11.8 percent that production innovation in my organization has led to increased efficiency with mean score of (3.1344) and standard deviation (.34783), 54 respondents representing 10.3 percent disagree with mean score of (1.389) and standard deviation of (.34789). 60 respondents representing 11.5 percent strongly disagree that production innovation in my organization has led to increased efficiency with mean score of (1.9944) and standard deviation of (.77141).

**Table 15: Better support for a given product has been enhanced by production innovation in my organisation**

	Frequency	Percent	Mean	Std Deviation
Strongly agree	56	10.7	4.3720	.69412
Agree	306	58.4	4.0398	.56181
Neutral	60	11.5	3.1694	.61868
Disagree	62	11.8	2.5134	.74064
Strongly disagree	40	7.6	1.6792	.74859
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.6148</b>	<b>1.00192</b>

Source: Field Survey, 2019

Disagree	61	11.6	2.4481	.61730
Strongly disagree	37	7.1	1.5631	.66243
<b>Total</b>	<b>524</b>	<b>100.0</b>	<b>3.6148</b>	<b>1.00192</b>



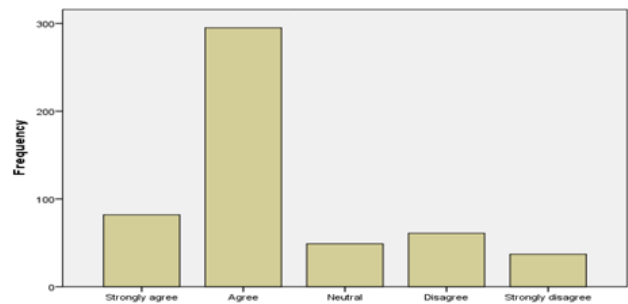
**Figure12: Better support for a given product been enhanced by production innovation in my organization**

Table 15, and represented in the bar chart figure 12, indicated that 56 respondents out of 524 representing 10.7 percent strongly agree that better support for a given product has been enhanced by production innovation in my organization with mean score of (4.3720) and standard deviation (.69412). 306 respondents representing 58.4 percent agree with mean score of (4.0398) and standard deviation (.56181), 60 were neutral respondents representing 11.5 percent that better support for a given product has been enhanced by production innovation in my organization with mean score of (3.1694) and standard deviation (.61868), 62 respondents representing 11.8 percent disagree with mean score of (2.5134) and standard deviation of (.74064). 40 respondents representing 11.8 percent strongly disagree that better support for a given product has been enhanced by production innovation in my organization with mean score of (1.6792) and standard deviation of (.74859).

**Table 16: Production innovation in my organization has provided a substitute of a cheaper material.**

	Freque ncy	Perce nt	Mean	Std Deviation
Strongly agree	82	15.6	4.3496	.55531
Agree	295	56.3	3.9746	.64741
Neutral	49	9.4	3.2211	.44015

Source: Field Survey, 2019



**Figure 13: Production innovation in my organization**

Table 16, and represented in the bar chart figure 13, indicates that 82 respondents out of 524 representing 15.7 percent strongly agree that production innovation in my organization has provided a substituted of a cheaper material with mean score of (4.3496) and standard deviation (.55531). 295 respondents representing 56.3 percent agree with mean score of (3.9746) and standard deviation (.64741), 49 were neutral respondents representing 9.4 percent that Production innovation in my organization has provided a substituted of a cheaper material with mean score of (3.2211) and standard deviation (.44015), 61 respondents representing 11.6 percent disagree with mean score of (2.4481) and standard deviation of (.61730). 37 respondents representing 7.1 percent strongly disagree that production innovation in my organization has provided a substituted of a cheaper material with mean score of (1.5631) and standard deviation of (.66243).

### Test of Hypotheses

**Hypothesis:** Production innovation has significantly positively influence the level of food security of the quoted food manufacturing firms, South-East, Nigeria

**Table 17: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.896 <sup>a</sup>	.892	.892	.09149

a. Predictors: (Constant), MOH, TPI, TIB, PII, BEP, PNN.

**Table 18: ANOVA<sup>a</sup>**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	520.681	7	86.780	103.67	.000 <sup>b</sup>
	Residual	4.327	517	.008		
	Total	525.008	524			

a. Dependent Variable: TEOP

b. Predictors: (Constant), MOH, TPI, TIB, PII, BEP, PNN.

**Table 19: Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.087	.016		5.410	.000
MOH	.237	.006	.261	38.017	.000
TPI	.208	.007	.283	31.054	.000
TIB	.188	.006	.256	33.673	.000
PII	.194	.007	.208	26.608	.000
BEP	.146	.007	.160	19.783	.000
PNN	-.004	.005	-.005	-.738	.461

a. Dependent Variable: TEOP

**Where**

TEOP = Production innovation influence the level of food security

MOH = My organisation has innovated a new method of packaging.

TPI = The production innovation in my organization has reduced the costs of the production

TIB = There is better distribution arrangements due to new production innovation in my organisation.

PII = Production innovation in my organization has led to increased efficiency.

BEP = Better support for a given product has been enhanced by production innovation in my organisation.

PNN = Production innovation in my organization has provided a substituted of a cheaper material.

Level of significance:  $\alpha$  at 5%

Degree of freedom:  $\frac{N-1}{N-K} = \frac{7-1}{542-7} = (535, 6) = 2.7858$

F - tabulated value = 2.7858

#### Decision Rule:

If the f-calculated is greater than the f-tabulated {F-cal > F-tab} reject the null hypothesis {H<sub>0</sub>} that the overall estimate is not significant and if otherwise conclude that the overall estimate is statistically significant.

#### Decision

The R<sup>2</sup> (R-Squared) which measures the overall goodness of fit of the entire regression, shows the value as .892 and adjusted to .892. This means that R<sup>2</sup> suggests that Product differentiation strategy variables accounted for 89.2 percent approximately 89 percent of variation of the number of the output of the manufacturing firms. This indicated that the independent variables explained about 89 percent of the variation in the dependent variable. It showed goodness of fit. We then concluded from the analysis that production innovation has significantly positively influence the level of food security of the quoted food manufacturing firms, South-East, Nigeria.

From the result, f-calculated {103.67} is greater than the f-tabulated {2.7858}, that is, Fcal > F-tab. Hence, we reject the null hypothesis {H<sub>0</sub>} and accept

Alternative hypothesis which means that the overall estimate has a good fit which also implies that our independent variables are simultaneously significant. We now conclude from the analysis that production innovation has significantly positively influence the level of food security of the quoted food manufacturing firms, South-East, Nigeria

### IX. DISCUSSION OF RESULT

From the result, f-calculated {103.67} is greater than the f-tabulated {2.7858}, that is, Fcal > F-tab. Hence, we reject the null hypothesis {H<sub>0</sub>} and accept Alternative hypothesis which means that the overall estimate has a good fit which also implies that our independent variables are simultaneously significant. We now conclude from the analysis that production innovation has significantly and positively influenced the level of food security in South Eastern Nigeria.

### X. SUMMARY OF THE FINDINGS AND RECOMMENDATIONS

Production innovation as shown by the statistics [F (95, n =542) = 103.67, p < 0.05.] have significantly and positively influenced the level of food security in the South Eastern Nigeria.

The study confirmed the theoretical position that innovation is a prime factor in achieving organizational target and success, especially those related to the difficult and broad process involved in becoming competitive on the global market. A strong innovation process is required for improving food security; food quality; time-space compression; new product development and food waste. The influence of the overall innovation of the Nigeria food manufacturing industries on the level of competition was confirmed by the statistical analysis of the data, revealing that the higher the overall innovativeness, the higher the level of competitiveness of the companies.

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