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## Lean Six Sigma Manufacturing and Performance of Brewing Firms in South-South, Nigeria

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### **Abstract:**

*The broad objective of this study is to determine the type of relationship that exists between Lean Six Sigma Manufacturing and Performance of brewing firms in South-South, Nigeria. Specifically, this study seeks to ascertain the type of relationship between employee training and product availability of brewing firms in South-South, Nigeria. The study was anchored on Socio-Technical Systems Theory postulated by Eric Trist, Ken Bamforth and Fred Emery (1951). Survey research design was adopted for the study. Primary source of data was employed by the researcher. The primary source of data employed by the researcher was the questionnaire. A total population of three hundred and eighty-three (383) was used for the study. Census sampling method was used for the study because the population is a manageable size. Regression analysis was used to analyze the collected data. Results obtained from the test of the hypothesis revealed that a significant positive relationship exists between employee training and product availability since ( $F$ -statistic = 1428.14;  $R$ -squared = 0.819;  $P < .05$ ). Based on the findings, the researchers concluded that there exists a strong significant positive relationship between Lean Six Sigma Manufacturing and Performance of brewing firms in South-South, Nigeria.*

**Keywords:** *Lean six sigma manufacturing, employee training, organizational performance, product availability*

### **1. Introduction**

Lean Production (LP) and Six Sigma Manufacturing (SSM) are two distinct operations/production management techniques that have gained popularity since they were first proposed. An integration or the merging of these two distinct tools led to the thought Lean Six Sigma Manufacturing (LSSM). The concept of Lean Six Sigma Manufacturing (LSSM) was first used around early 2000 by Wheat, Mills and Carnell through a book titled: *Leaning into Six Sigma: The Path to Integration of Lean Enterprise and Six Sigma* (George, Rowlands & Kastle 2014). The concept was used to describe the combination of Lean production (LP) and Six Sigma (SS) (Sheridan, 2010). This joining aimed to overcome the drawbacks from both methodologies and take advantage of the benefits of the two techniques. The success of LSSM, as one of the best continuous improvement methodologies, has led several manufacturing firms around the globe particularly in Europe, America and Asia to adopt it in their operations. The use of this methodology made these organizations more competitive (Cherrafi, Elfezazi, Chiarini, Mokhlis & Benhida, 2016) and made enhanced quality possible in the manufacturing process (Alhuraish, Robledo & Kobi, 2017; Chugani, Kumar, Garza-Reyes, Rochalona & Upadhyay, 2017). Despite the numerous benefits that abound from an application of LSS production technique, empirical evidence suggests that many Nigerian manufacturing firms have not started the full implementation of LSSM in their operations. This gives credence to a determination of the nexus between Lean Six Sigma Manufacturing (LSSM) and the performance of brewing firms in South-South, Nigeria.

The evolution of production systems has forced manufacturing firms across the globe to develop strategies that could ensure their sustainability. Practical and theoretical evidences suggest that Lean Six Sigma Manufacturing (LSSM) could affect the performance of manufacturing firms (Cherrafi et al., 2016; Chugani et al., 2017). Lean Six Sigma Manufacturing is defined as a methodology that improves process performance, customer satisfaction/fulfillment and organizational outcomes. Lean Six Sigma Manufacturing (LSSM) is one of the latest production improvements which integrates human and process elements into a programme that links and arranges improvement tools to an overall approach for innovation and firm growth. LSSM is a strong strategy in production management which seeks to eliminate defects and reduce variations in product manufacturing, service processes, which foster excellent business processes (Snee, 2010). Larry (2012) identified (LSS) manufacturing as a comprehensive and flexible mechanism that helps in controlling the products, improving them through ascertaining the defects and trying to remove them to reach optimum quality using the minimum resources and the shortest time. The LSSM aims to improve capabilities of organization, reduce cost of production (Chen & Lyu, 2009) and maximize value of stakeholders by improving quality (Laureani & Antony, 2012).

The principles of Lean Six Sigma Manufacturing presented by Morgan and Brenig-Jones (2009) are customer focus, employee of operational activities, employee training, continuous improvement (Just in time manufacturing, continuous flow between processes, pull system, standardized processes and work, quality input, 5s methodology, cell manufacturing, production levelling, total productive maintenance, single minute exchange of dice), removal of non-value added steps, reduction in variations and involvement of everyone. Understanding the processes of LSSM makes it possible for the firm to be able to visualize the processes and the improvements to be made and the associated risks. Lean Six Sigma Manufacturing is a technique that can greatly impact the performance of a typical manufacturing firm as experienced in a wide range of leading industries and organizations around the globe that include chemical, automotive, finance, electronics, and health sector (Snee, 2010). As a result of the above, the researcher deemed it necessary to ascertain the relationship that exists between Lean Six Sigma Manufacturing (LSSM) and performance of brewing firms in South-South, Nigeria.

The inability of some Nigerian manufacturing firms to adopt a world class manufacturing technique was observed by the researcher. These Nigerian manufacturing or production firms have failed to adopt a manufacturing methodology centered on continuous improvement and flexibility. Most Nigerian production firms have failed to measure up with their western counterparts as a result of their inability to adopt the necessary manufacturing or production methodology. The Nigerian brewing industry is not left out as the failure of the management team and specifically the production department of some Nigerian brewing firms to keep themselves abreast with recent or current production methodologies could affect the performance level of these brewing firms.

The researcher observed that a regular training or update of the skills of employees is not taken seriously by some managers of the studied brewing firms. They do not care about the development of their sub-ordinates. This negative attitude makes some employees to have a shallow knowledge of the basic tenets of the production methodology adopted by the organization. This by extension could affect the volume of products produced by these firms. Though scholars like Ariguzo, Amos, Egwakhe and Adefule (2019) who applied LSSM methodology to the Nigerian food and beverage sub-sector, Olanrewaju, Uzorh and Nnanna (2019) who applied LSSM methodology to manufacturing firms in Lagos State, Nigeria have recommended a strict implementation of LSSM to the operations of production firms, most Nigerian manufacturing firms and particularly the brewing industry have failed to inculcate LSSM methodologies in their manufacturing processes. The foregoing creates a lacuna in literature and therefore gives credence to the study of Lean Six Sigma Manufacturing (LSSM) and Performance of brewing firms in South-South, Nigeria. Specifically, this study seeks to examine the type of relationship that exists between employee training and product availability of brewing firms in South-South, Nigeria.

## 2. Literature/Theoretical Underpinning

### 2.1. Lean Six Sigma Manufacturing (LSSM)

Christopher and Lee (2014) indicated that lean Six Sigma is an administrative philosophy based on focusing on eliminating defects through improving the production processes depending on knowledge, facts, intelligence and the idea to improve quality and obtaining the required goals. Larry (2012) identified (LSS) manufacturing as a comprehensive and flexible system that help in controlling the products, refining them by determining the defects and attempting to remove them as well as striving to reach quality at minimum cost at the shortest time. Basically, Lean Six Sigma (LSS) manufacturing is a blend of two different manufacturing/production techniques. They are Lean production/manufacturing and Six Sigma production/manufacturing. Lean production was derived from Toyota's operating system in the 1930's. Lean production/manufacturing was introduced to the business world in the 90's, through James Womack's book called 'The machine that changed the world'. A reliability engineer at Motorola, Bill Smith, pioneered the statistics and formula of the Six Sigma method in a bid to improving the manufacturing processes of the organization (Morgan & Brenig-Jones, 2009; Montgomery & Woodall, 2008). This technique was officially launched at Motorola in 1986 to sustain final output quality by focusing on acquiring significantly higher compliance levels (Arnheiter & Maleyeff, 2015). The idea of Six Sigma is to remove variations from processes and strive to manufacture defect-free products. It is considered a manufacturing strategy and a technique that combines statistical and business methodologies which hinges on continuous and steady improvements to reduce production costs, improve customer satisfaction and to predictably produce or manufacture quality goods and services (Noone, Namasivayam & Tomlinson, 2010). The principles of Lean Six Sigma Manufacturing presented by Morgan and Brenig-Jones (2009) are customer focus, employee of operational activities, employee training, continuous improvement (Just in time manufacturing, continuous flow between processes, pull system, standardized processes and work, quality input, 5s methodology, cell manufacturing, production levelling, total productive maintenance, single minute exchange of dice), removal of non-value added steps, reduction in variations and involvement of everyone. The Lean Six Sigma principle used for this study is employee training.

### 2.2. Employee Training

In today's dynamic work environment, Schroeder, Linderman, Liedtke and Choo (2008) recommend that organizations establish clear roles and task before embarking on any improvement process. They believe that allocating clear roles and obligation to employees would ensure better control of activities in the organization. In this regard, various authors contend that the Lean Six Sigma infrastructure is made up of senior management employees and specialists who disseminate acquired understanding and knowledge to others (Snee, 2010; Delgado, Ferreira & Branco 2010). They suggest that each of these specialists is required to perform certain activities as part of the Lean Six Sigma improvement project. These individuals receive extensive teaching, training and learning in Lean Six Sigma application which they are to

extend to others. Thevnin (2014) believes that all employees have their own unique task to fulfill in an organization. He claims that each employee's individual effort must be recognized and appreciated so that everyone would work towards a common goal. McCarty and Fisher (2017) make a classification where employees and processes are inseparable. They suggest that poor quality of work may be as a result of the poor training of employees. To address these concerns, Mehrjerdi (2011) recommends that associations/organizations invest in new technology as a way of improving processes so that the employees can come up with a higher standard of work. The overall significance of equipping employees with the appropriate skill sets needed to carry-out their task is to ensure continuous improvement.

### 2.3. Organizational Performance

The performance of an organization is adjudged positive when the activities of an organization yield favourable consequences (Nwachukwu, 2006). Gregory (2015) contends that an organization is judged through several parameters. These parameters or indicators help managers determine how well an institution is performing and areas where improvements are needed. Continuous improved performance is the intention of any organization because only through performance, organizations are able to grow and progress. Griffin (2005) suggested that organizational performance is described as the extent to which the organization or business entity is able to meet the needs of its stakeholders and its own need for survival. Iravo (2011) is of the opinion that organizational performance level is used to ascertain how well an organization has attained its set objectives. The definitions of the concept by different researchers show that organizational performance is all about the economic well-being of an undertaking in relation to its competitors. Wishart (2019) contends that some performance parameters or indicators used for a typical manufacturing firm are product availability, sales volume, labour cost, down time, material cost, reject/scrap, quality, profitability, shareholders' dividend, organizational innovation and turn-over. Product availability is the parameter used for this study.

### 2.4. Product Availability

Jader (2019) sees product availability as not necessarily making product available 100%. It is all about making products readily available to customers at the right time and in the right quantity and quality. It is a matching game of predicting the right time when goods are needed by customers. This can be ensured by adequate production planning. Wishart (2019) opines that product availability entails making sure customers are not stranded when- ever they request the product of a manufacturing firm. It could be measured through stock-out level, demand pattern, orders delivered, delivery lag and stock level. Ravichandran&Rai, (2010) suggest that product availability is all about ensuring that the product required or appealing to consumers or buyers are available for purchase. The foregoing shows that product availability is all about ensuring that a manufacturing outfit does not go out of stock. A manufacturing undertaking ought to be ever ready to give customers quantity and quality demanded.

### 2.5. Theoretical Framework

This study is anchored on Socio-Technical Systems Theory. The theory was postulated by Eric Trist, Ken Bamforth and Fred Emery (1951) during the second world war era, based on their work with employees in English coal mines at the Tavistock Institute in London. Socio-Technical Systems Theory pertains to the social aspects of people and society and technical aspects of organizational structure and processes. Here, technical does not necessarily pertain material technology. The focus is on processes and related knowledge i.e., it refers to the ancient Greek term *techné*. Technical is a concept used to refer to structure and procedures and a broader sense of technicalities. Socio-technical refers to the interrelatedness of social and technical aspect of an organization (Long, 2013). This theory is relevant to this study because adequate training of employees would ensure an effective union of the human and technical elements which is the bane of the Socio-Technical Systems Theory. This by extension could impact the product availability of the studied brewing firms.

### 2.6. Empirical Review

Kaushik, Khanduja, Mittal and Jaglan (2012) study aimed at applying Lean Six Sigma to small-medium size manufacturing firms in India. The selected unit was motorcycle industrial unit. The study aimed at examining the effect employee training has on product availability. Questionnaire was the data collection instrument employed and a sample size of 150 was used for the study. Data analyzed using logistics regression analysis showed that a relationship exists between employee training and quality product availability.

Alkunsol, Sharabati, AlSalhi and El-Tamimi (2019) investigated the influence of Six Sigma on the performance of the Jordanian pharmaceutical product manufacturing firms. It was a survey study. Data was collected from (300) directors through questionnaire method, ordinary least square regression analysis was used to analyze the collected data. Results showed that an application of Six Sigma variables (employee training) has an effect on product availability of Jordanian pharmaceutical manufacturing firms.

Yong (2016) examined Lean Six Sigma and performance of manufacturing firms in Malaysia. The identified variables were continuous enhancement culture, Innovative Culture, management understanding of operating activities, equipping employees. The survey questionnaire of 39 structured questions were developed and sent to 88 respondents through emails. A total of 50 respondents responded answering all the 39 structured questions. Regression analysis was used to analyze the collected data. Findings from the survey revealed that a relationship exists between employee training and product availability.

Afsheen, Lash and Susan (2011) examined Lean Six Sigma and performance of selected hospitals in Malaysia. Survey design was used. Interview method was used to collect data from 250 medical practitioners. DMAIC, Cause and

effect diagram, Bar chart were used to analyze the collected data. Findings revealed a relationship between Lean Six Sigma (employee training) and performance of the studied hospitals.

Kateeb (2009) examined the effect of Six Sigma using Housing Bank for Trade and Finance in Turkey. Survey design was used for the study. The study used a structured questionnaire to randomly collect information from 120 employees working in Housing Bank for Trade and Finance and 310 customers. Regression analysis was used to analyze the collected data. The study established a significant statistical relationship between Six Sigma technique (training of employees) and service (product) delivery.

None of the empirically reviewed examined Lean Six Sigma Manufacturing as it relates to Performance of Brewing firms in South-South, Nigeria. This is the gap in knowledge that this study seeks to fill.

### 3. Methodology

Survey research design was used for the study. Survey design was used because it aids the confidentiality of data gathered from respondents and the non-manipulation of the sample elements.

The three brewing companies located in South-South, Nigeria were used for this study.

Champion Brewery Plc is located at industrial layout, Aka Offot, Uyo, Akwa-Ibom state. Its products are Champion Lager Beer and Champ Malt. Its beer brand has a production capacity of 650,000 hecto-litres per annum and its malt brand 10,000 hecto-litres per annum ([www.championbreweries.com](http://www.championbreweries.com)).

Guinness Nigeria Plc is located at industrial estate, Ikpoba-hill, Benin city, Edo state. Its products are Foreign extra stout, Harp lager beer, Guinness extra smooth, Satzenbrau, Dubic extra lager, Smirnoff-ice, Snapp, Origin, Malta Guinness and Spirit of different types. The Beer and Malt brand share a production capacity of 3 million hecto-litres per annum each and its spirit brand 0.1 million hecto-litres per annum ([www.guinness-nigeria.com](http://www.guinness-nigeria.com)).

Pabod Brewery Plc which is a subsidiary of SABMiller Plc is located at plot 186/187, Trans Amadi industrial layout, Oginigba, Port-Harcourt, River's state. Its products include Grand lager beer, Grand malt, Grand soda, Bond super lager beer, Castle milk stout, Castle lager beer and Eagle lager beer. It has a production capacity of 250,000 hecto-litres per annum ([www.ab-inbev.com](http://www.ab-inbev.com)).

Employees of the production and engineering department of the focused firms were used for this study. They were used because of the nature of the study.

Company Name	Production Dept.	Engineering Dept.	Total
Guinness Nigeria Plc.	177	44	221
Paphod Brewery	71	13	84
Champion Brewery	63	15	78
Total			383

Table 1: Study Population

Source: Human Resource Department of the Firms of Study (2021).

Census sampling was used because the study population (383) was deemed manageable by the researcher. Also, only the existing data of the three (3) brewing plants in South-South, Nigeria were used for the study.

Primary source of data through a questionnaire was used for this study. A five-point Likert scale questionnaire was used for the study. Strongly Agreed (SD), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagreed (SD).

On the spot method of data collection and observation method were the method adopted by the researcher. On the spot method was employed for the primary data. This was ensured by the researchers and two other research assistants.

Face and construct validity test were applied by the researcher. Face validity was ensured by experts in management. In other to determine the discriminant and convergent validity (construct validity), factor analysis was employed for this study. A sampling adequacy benchmark of 0.40 opined by Koh and Nam (2005) was used for this study.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.540
Bartlett's Test of Sphericity	Approx. Chi-Square	443.538
	Df	105
	Sig.	.000

Table 2: Validity Statistics of KMO and Bartlett's Test for Lean Six Sigma Manufacturing

The Kaiser-Meyer-Olin measure of sampling adequacy shows a value of 0.540, while the Barlett's test of sphericity approximation chi-square shows a value of 443.538. This proves the validity of the instrument.

<b>Component Matrix<sup>a</sup></b>					
	<b>Component</b>				
	1	2	3	4	5
Q1	.585	.668	.262	-.107	-.232
Q2	.701	.317	.053	.113	.477
Q3	.696	.202	.391	-.023	-.181
Q4	.674	-.553	.268	-.042	-.152
Q5	.626	.290	.027	-.679	.165
Extraction Method: Principal Component Analysis.					
a. 5 components extracted.					

Table 3: Validity Statistics of Component Matrix for Lean Six Sigma Manufacturing

Table 3 above reveals that question 1 is loaded in component 2, questions 2-5 are loaded in component 1.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.595
Bartlett's Test of Sphericity	Approx. Chi-Square	436.432
	Df	105
	Sig.	.000

Table 4: Validity Statistics of KMO and Bartlett's Test for Performance

The Kaiser-Meyer-Olin measure of sampling adequacy shows a value of 0.595, while the Barlett's test of sphericity approximation chi-square shows a value of 436.432. This shows the validity of the instrument.

<b>Component Matrix<sup>a</sup></b>				
	<b>Component</b>			
	1	2	3	4
Q1	.660	-.648	.087	.190
Q2	.722	-.313	.184	-.520
Q3	.677	-.428	-.089	.365
Q4	.773	.004	-.445	.102
Q5	.746	-.339	-.317	-.180
Extraction Method: Principal Component Analysis.				
a. 4 components extracted.				

Table 5: Validity Statistics of Component Matrix for Performance

Table 5 above reveals that questions 1-5 are loaded in component 1. It shows the validity of the measuring instrument.

Cronbach Alpha reliability test was used for the primary data instrument of the study. Suwannoppharat and Kaewsa's (2015) assertion of a reliability coefficient of 0.696 and above as an acceptable value was used for the study.

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
.837	5

Table 6: Reliability Statistics for Lean Six Sigma Manufacturing

Since the reliability value of  $0.84 > 0.696$ , it shows that the instrument for Lean Six Sigma Manufacturing (LSSM) is reliable.

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
.820	5

Table 7: Reliability Statistics for Performance

Since the reliability value of  $0.82 > 0.696$ , it shows that the instrument for performance is reliable.

Mean and Regression analysis were used to analyze the data. This was aided by SPSS Version 20 and E-views 10. The level of significance was 5% while a 95% confidence level was adopted.

## 4. Results and Findings

### 4.1. Data Presentation and Analysis

<b>Returned (Valid)</b>	<b>317</b>	<b>82.77%</b>
Returned (Mutilated)	22	05.74%
Unreturned	44	11.49%
<b>Total questionnaires administered</b>	<b>383</b>	<b>100%</b>

*Table 8: Returned and Unreturned Questionnaire*

*Source: Field Survey, 2021*

Table 8 reveals that out of the 383 copies of the questionnaire administered to the three (3) studied brewing firms, 317 (82.77%) valid copies were returned. Base on that 317 copies of the questionnaire were used for the analysis of data.

### 4.2. Research Question

What type of relationship exist between employee training and product availability of brewing firms in South-South, Nigeria?

<b>Descriptive Statistics</b>				
	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>
Q1	317	1.00	5.00	2.7950
Q2	317	1.00	5.00	2.8801
Q3	317	1.00	5.00	3.0757
Q4	317	1.00	5.00	3.1073
Q5	317	1.00	5.00	2.5331
Valid N (listwise)	317			

*Table 9: Descriptive Statistics for Employee Training*

The mean scores of the responses from questions relating to employee training for the studied brewing firms (Guinness Nigeria Plc, Paphod Brewery and Champion Brewery) are >2.5. This makes the responses acceptable.

<b>Descriptive Statistics</b>				
	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>
Q1	317	1.00	5.00	2.7476
Q2	317	1.00	5.00	2.8454
Q3	317	1.00	5.00	3.0063
Q4	317	1.00	5.00	3.0694
Q5	317	1.00	5.00	2.5795
Valid N (listwise)	317			

*Table 10: Descriptive Statistics for Product Availability*

The mean scores of the responses from questions relating to product availability for the studied brewing firms (Guinness Nigeria Plc, Paphod Brewery and Champion Brewery) are >2.5. This makes the responses acceptable.

### 4.3. Test of Hypothesis

- Ha: A significant relationship exists between employee training and product availability of brewing firms in South-South, Nigeria.

<b>Dependent Variable: PRO__AVA</b> <b>Method: Least Squares</b> <b>Date: 06/29/21 Time: 09:51</b> <b>Sample: 1 317</b> <b>Included observations: 317</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.123540	0.374985	8.329776	0.0000
EMP__TRA	0.914815	0.024207	37.79072	0.0000
R-squared	0.819292	Mean dependent var		16.10410
Adjusted R-squared	0.818718	S.D. dependent var		6.290832
S.E. of regression	2.678463	Akaike info criterion		4.814653
Sum squared resid	2259.862	Schwarz criterion		4.838368
Log likelihood	-761.1224	Hannan-Quinn criter.		4.824126
F-statistic	1428.139	Durbin-Watson stat		1.977160
Prob(F-Statistic)	0.000000			

Table 11: Cumulative Regression Output for Hypothesis Three

The results obtained revealed that employee training has significant effect on product availability of the studied brewing firms (Guinness Nigeria Plc, Paphod Brewery and Champion Brewery) ( $\beta = 0.915$ ,  $t$ -statistics= 8.330,  $P < .05$ ). Also, employee training is a predictor of product availability (F-statistic = 1428.14; R-squared = 0.819;  $P < .05$ ). The predictor variable single handedly explained 81.9% of the variance in product availability, while the remaining 18.1% could be due to the effect of the extraneous variables. The Durbin Watson value of 2.0 shows that there is no first order serial correlation. This makes the result acceptable.

## 5. Discussion

The cumulative analysis of the three studied brewing firms also revealed a strong significant positive relationship between employee training and product availability. This is in line with the study of Kaushik, Khanduja, Mittal and Jaglan (2012) whose study aimed at applying Lean Six Sigma to small-medium size manufacturing firms in India. The selected unit was motorcycle industrial unit. Data analyzed using logistics regression analysis showed that a relationship exists between employee training and quality product availability. The work of Alkunsol, Sharabati, AlSalhi and El-Tamimi (2019) who investigated the influence of Six Sigma on the performance of the Jordanian pharmaceutical product manufacturing firms aligns with findings obtained from the test of hypothesis three. Results showed that an application of Six Sigma variables (employee training) has an effect on product availability of Jordanian pharmaceutical manufacturing firms. Yong (2016) examined Lean Six Sigma and performance of manufacturing firms in Malaysia. Findings of his study is in agreement with findings obtained from the test of hypothesis three. Findings from the survey revealed that a relationship exists between employee training and product availability.

## 6. Implication to Research and Practice

The implication of this study to research and practice is that this study will help management of the studied brewing firms to have an insight of the effect an adoption of Lean Six Sigma Manufacturing (LSSM) methodologies could have on their operations. Also, this study will give other Nigerian manufacturing firms an idea of what Lean Six Sigma Manufacturing is all about.

Lastly, this study will be of benefit to students and future researchers who intend to carry-out a related study.

## 7. Conclusion

Base on the results obtained from a test of the hypothesis, the researcher concludes that there exists a significant positive relationship between Lean Six Sigma Manufacturing (LSSM) and performance of brewing firms in South-South, Nigeria. Findings of the study revealed that a relationship exists between equipping employees with the skills required for effective usage of LSSM and product availability of the studied brewing firms (Guinness Nigeria Plc, Paphod Brewery and Champion Brewery).

## 8. Future Research

Empirical studies revealed that there exist inadequate studies on Lean Six Sigma Manufacturing as it relates to the performance of some Nigerian industries. Some industries where Nigerian scholars need to carry-out a related study are:

- The Nigerian automobile industry.
- The Nigerian Textile industry.
- The Nigerian Plastic industry.
- The Nigerian Pharmaceutical industry.
- The Nigerian Cosmetic industry.
- The Aluminium industry.

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### Appendix

Options: Strongly Agree = SA, Agree = A, Undecided = UD, Disagree = D, Strongly Disagree = SD. Please tick ( / ) as it represents your view

<b>Questionnaire Item for Independent Variable(Lean Six Sigma Manufacturing)</b>						
<b>No</b>	<b>Employee Training</b>	<b>SA 5</b>	<b>A 4</b>	<b>UD 3</b>	<b>D 2</b>	<b>SD 1</b>
1	Employees of the production department are frequently trained on production processes.					
2	Supervisors of your department always encourage employees to learn.					
3	Supervisors of your department are always happy to transfer ideas to employees.					
4	Supervisors of your department mentor subordinates.					
5	Employees of your department are regularly updated with current manufacturing methodologies by superiors.					
<b>Dependent Variable (Performance)</b>						
	<b>Product Availability</b>	<b>SA 5</b>	<b>A 4</b>	<b>UD 3</b>	<b>D 2</b>	<b>SD 1</b>
1	Your department always have product on ground.					
2	Most-times, your department fail to deliver products on a timely basis.					
3	There are occasions your department has failed to deliver product requested.					
4	On an annual basis, there is always a difference between product demanded and product delivered by your department.					
5	The product delivery rate of your organization is satisfactory.					

Table 12: Questionnaire Items on Lean Six Sigma Manufacturing and Performance