IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 13, Issue 4 Ver. III (Jul. - Aug. 2016), PP 10-16
www.iosrjournals.org

Analysis of factors affecting the performance of selected manufacturing firms in Anambra State, Nigeria.

Ugochukwu, Kingsley E.[1], Nwosu, H.U.[2], Ugochukwu, Stanley C.[3]
[1,2]*Department of Mechanical Engineering,University of Port Harcourt, Rivers State, Nigeria.*
[3]*Department of Quantity Surveying, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.*

Abstract: *The research work was conducted to analyze the performance of selected manufacturing firms in Anambra state. To achieve this, primary and secondary data were used. The primary data was the questionnaire developed which was distributed to 30 production workers, 10 for each of the 3 companies (Chikason plastics, Fino plastics and Citizens paints Nig. Ltd.) studied. The questionnaires contained Likert items which were mainly on the five factors under investigation – power/energy, motivation, training, technology and participative leadership. Questionnaires proved reliable after a reliability test was carried out. The secondary data was derived from the production record for each selected worker over a six day period. The Kendall Wallis ranked test was used in ranking the 3 firms, according to their performance. Chikason Plastic performed best with a value of 2.7 followed by Fino Plastic and Citizens Metal can at 2.1 and 1.2 respectively. The difference in performance is significant at 0.003 p-value. Predictors were categorized into technological development (power/energy and improved technology) and manpower development (motivation, training and participative leadership) to elucidate the analysis. Regression analysis of data gave good correlation coefficients at 0.56 for technological development and 0.52 for manpower development. Therefore, technological development has more effect on the performance of workers. The study also established, using ANOVA, that there was no significant difference in performance variance (F>0.05) of the employees in days 1,2,3,4 and 6, whereas day 5 (F=0.03) showed significant differences in variance of the performance. Thus, it was concluded that performance goals and targets set by industries in Anambra State can only be achieved when industries improve power/energy supply, motivation, training, technology and inclusive leadership.*

Keywords: *Anambra State, Manpower development, Manufacturing firms, Performance, Technological development.*

I. Introduction

The history of manufacturing begins with the word itself, to manufacture, meaning to make by hand. It spans the cottage industry of individual artisans and ends with today's mass production for mass consumption [1]. The manufacturing industry is the sector of business responsible for the creation of goods. During the industrial revolution, production workers became significant because the items being manufactured required human input [2]. The performance of manufacturing industries therefore, became intertwined to performance of production workers. The production worker seeks to achieve optimal performance through motivation, constant power supply, training, improved technology and a sense of belonging in the decision making process of the manufacturing firm. Other determining factors include the timely maintenance of machines, workplace safety, effective managerial skills amongst others. The problems facing the production workers as regards his output and performance was researched on, with a view to proffering solutions as a model which will be applied to address these problems. This research looks into factors such as Power/energy infrastructure, motivation, training, technology and participative leadership, as independent variables which affect performance (dependent variables). The work determines the correlation between the independent and dependent variables. A regression model has also been developed to predict the effect of the independent variables on the performance of the firms. Also, it determines if there is any significant difference between the performance of the 3 firms studied.

II. Literature review

The contribution of workers on a job is the most important factor for development and excellence in business. [3] states that the performance of employees on different jobs in close coordination is needed for success of the unit. The importance of worker performance must be understood by the management and sincere efforts must be put in that direction. The management of the company taking timely steps in that direction will be in a position to develop and motivate workers to be diligent. Nigeria's economy has been fraught with ineffectiveness in the manufacturing sector. According to a World bank report in 2001, Nigeria has only some 5 per cent of its GDP coming from manufacturing, which is low among the countries of Africa. Today, many small, medium and large-scale private manufacturing firms exclusively owned and managed by Nigerians are

found in many parts of the country, in cities and rural areas alike. A class of indigenous industrial entrepreneurs is therefore fast emerging in Nigeria and in the Igbo states of the southeastern region in particular [4]. Manufacturing in Nigeria and more especially the southeastern part of Nigeria has been bedevilled by factors such as Power/ Energy infrastructure (ii) Motivation (iii) Training (iv) Modern technology and (v) Participative leadership. However, other factors, such as, working conditions, business environment, level of competition in market, quality of leadership, maintenance of machines, time management, nature of job, process change, and others, have also affected manufacturing [3]. All these factors hinder production workers from performing optimally.

2.1 Power/Energy Infrastructure

Nigeria is richly endowed with various energy sources, crude oil, natural gas, coal, hydropower, solar energy, fissionable materials for nuclear energy. Yet the country consistently suffers from energy shortage - a major impediment to industrial and technological growth. Her total generating capacity is about 3000MW, approximately thrice the current level of national demand. However, the actual power available at any given time is less that 40 percent of the total capacity due to poor maintenance; hence there is a perennial shortage. The Industry's response has been running permanently on internal generating plants and use PHCN supply as standby. It is ironical that, in spite of the enormous power generation potential, about 60 percent of the country still has no access to electric power supply [5]; [6] and [7]. The recent survey on power distribution to the industrial sector in Nigeria showed that the average power outage in the industrial sector increased from 13.3hours in January 2006 to 14.5 hours in March 2006. In a worsening experience, the outage increased to 16.48 hours per day in June. In other words, power distribution in the month of June, 2006 to the industrial sector, on the average, was 7.52 hours per day [8]. In Enugu / Anambra zone it increased from 17.2 hours to 18.5 hours within the same period [9]; [8].

2.2 Motivation and Manufacturing Workers Performance

Motivation is an art targeted at getting people to work willingly and an art of inducing one to behave in a particular manner to achieve a task. [10] viewed motivation as a human engineering approach being triggered by the individual needs. From the definition of productivity, which states that productivity is a measure of a specific measure of input per unit of labour and is measured as total output divided by the members of units of labour employed to produce that output. It is obvious that productivity entails having higher output and in order to attain such, motivation of workers should be an important factor to consider. Financial motivation is seemingly more pronounced in the Nigerian setting. A worker who derives rewards after every job he has done strives more to enhance production knowing that the rewards will go a long way in taking care of his needs. The economy of Nigeria has been fraught with high inflation and an increase in the cost of basic necessities (food, housing, clothing, transportation and health care). The worker constantly seeks a higher income so as to enable him to meet with the ever negatively changing trend that threatens his survival.

2.3 Effect of Training on Manufacturing Workers Performance

Learning workplace skills on the job has also been shown to positively affect earning rates (nearly 25% increase in earnings in some cases) of manufacturing workers[11]. Manufacturing Worker training has also been known to improve the productivity and the quality of goods produced. A manufacturing organization is driven by the products it develops and markets. The productivity of the organization is improved by developing processes that aid in manufacturing the product with the required quality, short lead times, and low unit cost. For a worker, training and learning on the job also have consequences beyond the current job. Training also improves processing operation, efficiency of doing work and man-machine interface.

2.4 Effect of Technology on Manufacturing Workers Performance

[12], propose that, there are two mechanisms by which technological advancement is likely to affect the firm's decision to its workers or the worker's decision to invest in on-the-job training. First, an increase in the rate of technological advancement is likely to accelerate the rate of obsolescence of human capital. According to human capital theory [13], higher rates of obsolescence will reduce the optimal amount of investment in training at any point in time. Since general human capital is likely to be more immune to the introduction of new work processes, the rate at which an individual's stock of general knowledge and problem-solving skills depreciate will be less than the rate for specific vocational skills. The second mechanism by which technology change will reduce training is related to the fact that technological advancement increases the risk of uncertainty of investment in human capital [14].

2.5 Manufacturing Worker and Participative Leadership

Participative leadership has been discovered to increase productivity, lower unit cost, increase morale and improve labour management relations [15]. The primary aim of PDM is for the organization to benefit from

the "perceived motivational effects of increased employee involvement" [16]. However, organizations benefit from the perceived motivational influences of employees. When employees participate in the decision-making process, they improve understanding and perceptions among colleagues and superiors, and enhance personnel value in the organization. Participatory leadership by the top management team ensures the completeness of decision-making and increases team member commitment to final decisions. In a participative leadership process each team member has an opportunity to share their perspectives, voice their ideas and tap their skills to improve team effectiveness and efficiency.

III. Methodology

The research entails the identification and measurement of some characteristics of a population under study. A sample survey will be employed. A total of Thirty(30) production workers were selected from three(3) firms, namely Citizens Paints (Metal Can Factory)- Onitsha, Fino Plastics- Awka and Chikason plastic- Nnewi. Ten (10) workers will be selected per company to represent the sample. This constitutes the primary source for this report. To ensure validity, the researcher took a few days to observe the workers' output in relation to factors such as power supply, motivation, training, technology and participative leadership. The researcher observed and recorded the actual daily output of these sampled machine operators for at least one week. The observed and recorded production quantity when divided by the company machine maximum daily capacity gives the performance for the day P_1, P_2.....P_6. The average of these $P_{(1-6)}$ gives the particular worker average performance "P". The enlisted factors were categorized into two parts, namely, technological development (power Supply and Technology) and manpower development (Motivation, Training and Participative Leadership). This gave an elucidated view of the analysis. On the other part, Test studies were also performed at the various companies using the same sampled thirty workers, ten from each company. The data obtained in these test study sheets/questionnaires were used to validate the observed performances of the workers. The test study sheets were structured in a Likert scale format.

3.1 Instrument Validity Test and Reliabily Test

The researcher verified that the questionnaires being used are credible enough to check what is being intended. Consistency in workers response was needed to help give a better guide to ensuring the workers understood the questionnaires irrespective of the number of times they were issued. Such verification enabled the researcher to proceed further into using the test study results for analysis.The researcher carried out a validity and reliability test which showed viable results.

Table 1. Cronbach's Alpha Test of Response Consistency**.**

		N	%	N of Items	Cronbach's Alpha
Cases	Valid	10	100	2	**0.961*** **
	Excluded	0	0		
	Total	10	100		

Table 2. Pearson's Correlation of Respondent's Uniformity in Questionnaire**.**

		TEST 01	TEST 02
TEST 01	**Pearson Correlation**	1	.929**
	Sig. (2-tailed)		.000
TEST 02	**Pearson Correlation**	.929**	1
	Sig. (2-tailed)	.000	
	N	**10**	**10**

*** Correlation is significant at the 0.01 level (2-tailed)

Reliability statistics were determined using Cronbach's alpha analysis which was obtained to be 0.961 (96.1%) in the questionnaire responses and 0.929 (92.9%) for uniformity in questionnaires. The values derived from the respondent's comment concerning the factors were computed using the Likert scale format. The computed values were used to relate the effect of each factor on the job performance of each particular manufacturing worker.

Table 3: Treatments and Performance Values Generated from Test and Time Studies**.**

Company workers	Power X1	Motivation X2	Training X3	Technology X4	Participative Leadership X4	Performance P
M_1	19	13	15	13	15	59
M_2	19	14	14	15	14	53
M_3	16	14	16	12	19	39
M_4	19	16	14	16	12	54
M_5	23	15	13	12	18	59
M_6	18	11	17	17	21	43

M_7	11	16	17	17	16	43
M_8	18	14	8	10	16	62
M_9	19	10	11	6	14	34
M_{10}	15	16	7	11	16	55
F_1	19	14	22	20	20	74
F_2	22	15	20	24	20	52
F_3	13	13	16	21	20	52
F_4	21	7	21	22	20	70
F_5	21	13	21	22	18	90
F_6	15	10	18	16	17	49
F_7	16	10	14	14	13	54
F_8	19	17	17	18	19	45
F_9	22	18	17	24	19	67
F_{10}	21	16	17	23	18	62
C_1	19	20	18	21	23	80
C_2	18	18	18	21	21	73
C_3	19	16	20	19	24	80
C_4	19	17	21	19	23	62
C_5	18	19	17	17	21	62
C_6	13	17	20	19	23	65
C_7	15	16	20	18	22	49
C_8	17	19	20	18	23	76
C_9	20	21	21	18	22	76
C_{10}	17	17	17	17	22	73

NB: M = Citizens paint workers.
F = Fino Plastic workers.
C = Chikason Plastic workers.

IV. Results and Discussion

All preceding data computed, were used by the researcher to ensure results been derived will be worthy uplifting mechanisms for ailing firms and firms that intend to elevate their profit margin in the ever competitive arena of manufacturing business.

4.1 Response pattern to Questions

A total of thirty (30) employes from three (3) companies were interviewed. A 100% response was recorded. The questionnaire was sectioned into five (5) categories - (1) Power/Energy in terms of availability of electricity and other forms of energy to drive production, (2) Motivation in terms of compensation/rewards/recognition, (3) Training of workers (4) Technological development (5) Participative leadership. Performance index or score was also recorded for the 30 employees.

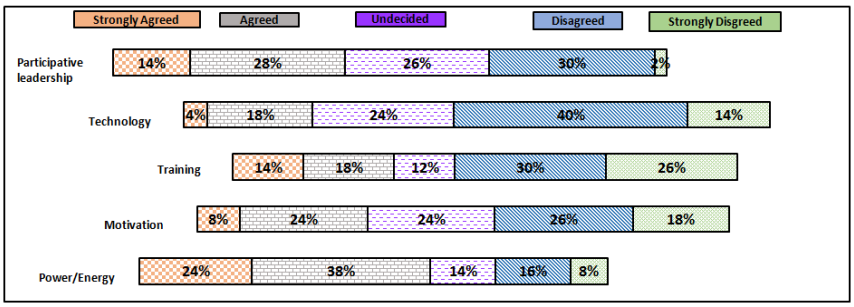

Figure 1. Percentage distribution of Respondents from Citizens Paint Nig. Ltd.

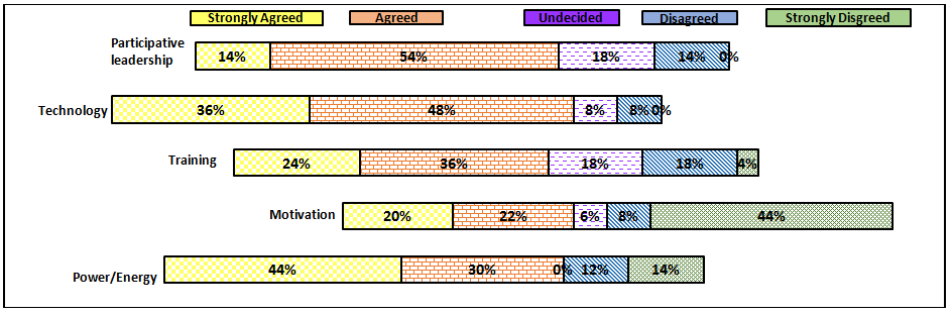

Figure 2. Percentage Distribution of Respondents from Fino Plastic.

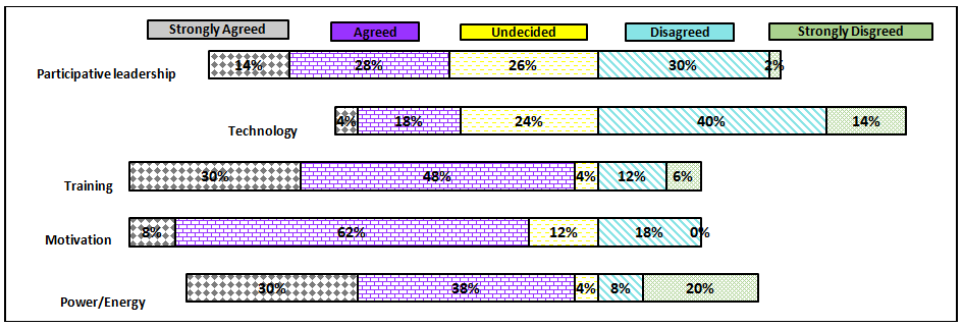

Figure 3. Percentage Distribution of Respondents from Chikason Plastic.

4.2 Response Pattern from Descriptive Charts

On the aspect of participative leadership, disagreed ranked most with 30% for Citizens Metal can as against 54% agreed for Fino Plastic and 30% disagreed and 28% agreed for Chikason plastic. 18% undecided and 14% each for strongly agreed and disagreed; as Chikason Plastic employees had 26% undecided and 14% strongly agreed. The issue of technological availability had 40% disagreeing for Citizens paint, while Fino Plastic had most employees strongly agreeing and agreeing - 36% and 48% respectively. Percentage level of training of workers was not encouraging with Citizens paint recording 30% disagree.

4.3 Treatment Analysis Using Kendall's Wallis Ranked Test

The researcher used Kendall Wallis ranked test to their performance and determine if there is any significant difference.

Table 4. Test Statistics from Kendall W ranked test.

Variables	Mean Rank	Inference (In terms of performance)
Citizens	1.20	3rd
Fino	2.10	2nd
Chikason	**2.70**	**1st = Best output**

Chikason Plastic had the best performance at 2.70 with Fino Plastic coming second at 2.10. Citizens Metal Can was the least in performance at 1.2, which shows an unacceptable performance level.

Table 5: Test Statistics from Kendall W ranked test.

Variables	mean±S.D	N	Kendall's W[a]	Chi-Square	df	P-value	Inference
Citizens	50.1±9.608	10	0.57	11.4	2	**0.003**	**Sig***
Fino	61.5±13.890						
Chikason	69.6±9.902						

A p-value of 0.003 lies below the 0.05 significance level, thereby indicating a conspicuous significance in the performance between the 3 companies. This means the difference between the performances of the three companies is statistically significant.

4.4 Correlation and Regression Equations for Determination of Various Variables.

Determination of the relationship between the dependent and independent variables**.** The regression equation (y = □ x +ß) in the graphs below can be used to determine the various measured variables from others. The constant difference between both variable is ß with a constant rate change of the conditional mean of the variable □ .

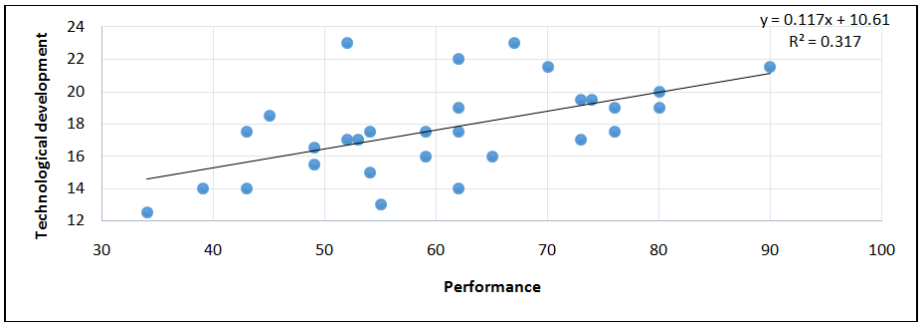

Figure 4. Scatter plot of the correlation between technological development and performance.

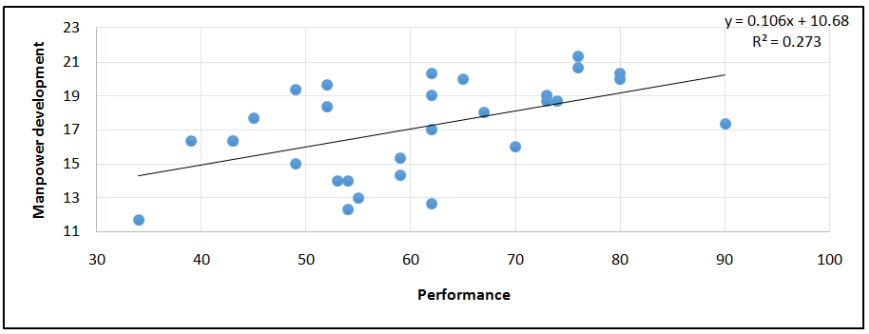

Figure 5. Scatter plot of the correlation between manpower development and performance**.**

From graphs (Fig. 4 and Fig. 5) and model summaries therein, it is vividly seen that all the plotting is linear with good correlation coefficient hence, a good coefficient of determination R^2. This summarizes that all the independent variables affect performance of manufacturing workers. The graphs clearly prove that the predictors- technological development and manpower development affects performance positively. The relationship between the independent variables and dependent variable are highlighted in the regression models.
Regression formula for estimation of company performance
Performance = 10.61 + 0.1171 (Technological development).....1
Performance = 10.681 + 0.1061 (Manpower development).....2

The researcher analysed the extent of the relationship between the input and output of the 3 firms using Pearson correlation analysis. The result indicated an average correlation of 56% (Technological development) and 52% (Manpower development) to performance. The p-values for technological development and manpower development which lies at 0.0012 and 0.0030 respectively, which lies below the 0.05 significant level. Hence, Technological development affects performance more than manpower development.

4.5 Analysis of Variance and Post Hoc Test

We use One-way Analysis of variance to determine whether there are any significant differences between the performance means in the various groups ie. the 3 companies. To determine which specific groups differed from each other, we use the Post Hoc test.

Table 6. Multiple comparison of performance outcome of FP, CM and CK companies.

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
DAY 1	**FP**	**CM**	.041900	.076654	.849	-.14816	.23196
		CK	-.054600	.076654	.758	-.24466	.13546
	CM	**CK**	-.096500	.076654	.430	-.28656	.09356
DAY 2	**FP**	**CM**	.187500	.099154	.161	-.05834	.43334
		CK	-.041000	.099154	.910	-.28684	.20484
	CM	**CK**	-.228500	.099154	.072	-.47434	.01734
DAY 3	**FP**	**CM**	.043800	.064341	.777	-.11573	.20333
		CK	-.112400	.064341	.207	-.27193	.04713
	CM	**CK**	-.156200	.064341	.056	-.31573	.00333
DAY 4	**FP**	**CM**	.123400	.089808	.368	-.09927	.34607
		CK	-.105500	.089808	.478	-.32817	.11717
	CM	**CK**	**-.228900***	.089808	**.043**	-.45157	-.00623
DAY 5	**FP**	**CM**	**.207400***	.075334	**.027**	.02062	.39418
		CK	-.071600	.075334	.614	-.25838	.11518
	CM	**CK**	**-.279000***	.075334	**.003**	-.46578	-.09222
DAY 6	**FP**	**CM**	.091100	.077127	.474	-.10013	.28233
		CK	-.103400	.077127	.386	-.29463	.08783
	CM	**CK**	**-.194500***	.077127	**.046**	-.38573	-.00327

NB: CK- Chikason Plastic.
CM- Citizens Paint.
FP - Fino Plastic.

The multiple comparison of performance of the employees with respect to the six(6) days of observation on the various workers. For the ANOVA, there was no significant difference in variance (F>0.05) of the employees on day's 1,2,3,4 and 6, whereas day 5 (F=0.003) showed a statistically significant difference in variance of the performance between CM and CK.

V. Conclusion

It is important that organizations understand the processes that ultimately lead manufacturing workers to perform optimally and in turn improve their performance. In conclusion, this study has achieved its research objectives. The hypotheses development, theoretical framework and research design were designed to achieve the research objectives. In this study, there are five determinants(independent variables) that are significant to performance (dependent variable) of the manufacturing worker. The study has been able to identify that there are relationship between manufacturing workers performance and the five predictors and also developed linear regression models to predict the effect of these factors after careful survey and study of activities, functions and program of three selected industries in Anambra state. The model if improved and applied will help to address the effects of those factors on workers performance.

It is pertinent to realize that performance goals and targets set by industries can only be achieved when our industries handle the issue of workers performance as it relates to power/energy supply, improved motivation, adequate training, modern technology and inclusive leadership as well. Considering the correlation analysis it is important to note that power/energy supply and technology have greatest influence on the workers performance, but notwithstanding issues of motivation, training and participative leadership have conspicuous effects on performance. The models could easily be assessed by our industries and it is also easy to understand. A company that strives to remain relevant in the ever changing competitive environment should imbibe improvement in performance enhancing factors which will at the long run, increase profit**.**

References

[1]. M. Srijan, and S. Danduram, Green manufacturing and its impact on environmental sustainability(India, Dhanbad, Jharkhand: Himalaya,2013).

[2]. B. John, *The history of the manufacturing industry*, Retrieved from http://www.ehow.com/about_5336403_history-manufacturing-industry.html, 2013.

[3]. V.S. Balyan, *Personnel,human resources and labour management in India* (New Delhi: Himalaya Publishing, 2011).

[4]. C.C. Ukaegbu, Working conditions and employee commitment in indigenous private manufacturing firms in Nigeria: Managing business organizations for industrial development. *Journal of Modern African Studies, 38(2),* 2000, 295-324.

[5]. UNDP, *Human development report on Nigeria* (Oxford: Oxford University Press, 2001).

[6]. L. Ajanaku, Battling with darkness, *TELL* (*Special Edition),* May 21, 2007, 31-33.

[7]. A. Adegbamigbe, Obasanjo's Legacies, *The News*, June 9, 28(21), 2007, 68-70.

[8]. P. Odiaka, Power Sector reforms: Still a reign of blackout, *The Guardian*, August 24, 2006.

[9]. J. Nwaoshai, Healthy Power Sector will create jobs in the telecom industry, *Vanguard*, October, 25, 2006.

[10]. M. Mee-Edoiye, and M.M. Andawei, Motivation: An alternative to improve workers performance in todays construction industry, *The Quantity Surveyor. 40(3),*2002, 2-6.

[11]. B. B. Flynn, R. Schroeder, and S. Sakakibara, Determinants of quality performance in high and low-quality plants, *Quality Management Journal, 12 (2),* 1995, 9 - 25.

[12]. A. P. Bartel, and N. Sicherman, *Technological change and skill Acquisition of young workers* (Washington D.C, USA: Columbia University Press,1995).

[13]. Y. Ben-Porath, The production of human capacity and the life cycle of earnings, *Journal of Political Economics*, *75*, 1967, 352-361.

[14]. J. T. Williams, Uncertainty and the accumulation of human capital over the life cycle, *Journal of Economics*, *52*, 1979, 521 -548.

[15]. R. Likert, A technique for the measurement of attitudes, *Archives of psychology,* 140, 1961,1-55.

[16]. G. B. Walker, Public participation as participatory communication in environmental policy decision-making: From concepts to structured conversations, *Environmental Communication, 1,* 2007, 99–110.