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Total Productivity Maintenance and Performance of Selected Aluminium Manufacturing Companies in Anambra State

[1]Hope Ngozi Nzewi PhD, [2]Obianuju Mary Chiekezie PhD and
[3]Augustine Ebuka Arachie
[1-3] *Department of Business Administration, Nnamdi Azikiwe University, Awka, Nigeria*

Abstract: *Following the apparent intense competition and dynamic turbulence in the business environment, maintaining productivity and sustaining performance are paramount. The objective of the study was to determine the relationship between Total Productivity Maintenance and the Performance of selected Aluminium Firms in Anambra State. Specifically, this study explored the type of relationship between Maintenance Autonomy and Employee Commitment. The study employed a correlation research design. It was anchored on the Theory of Structural Empowerment. Pearson's Product Moment Correlation Co-efficient was used in analyzing the data. The findings revealed that Maintenance Autonomy has a significant positive relationship with Employee Commitment. It is therefore advocated that management should empower the operatives by giving them necessary working resources to succeed in the maintenance activity. Effort should be geared towards avoiding stock out syndrome. In addition, state of the art equipment should be provided in order to ensure optimum level of coordination among the various departments in the organizations.*

I. Introduction

The business environment is characterized by high level of competition, discontinuities and changes to the extent that some organizations appear to outmuscle the other in a bid to capture the maximum market share possible. Many firms desire to create a competitive edge over others in such areas as Human Resources, Production, Marketing, Equipment Maintenance, Research and Development Departments of the organizations. Production equipment is one of the most important critical success factors (CSF) in the manufacturing firms. Achieving the profitability, cost competitiveness, and growth in the long-term would be generated through productivity improvement (Neely, Adams, & Kennerley, 2002). Maintenance management has to become more productive, efficient and innovative in order to cope with the changing business environment (Cholasuke, Bhardwa,& Anthony, 2004). One approach to increase the performance of maintenance activities is to implement a total productivity maintenance system (Hermann, 2000).

The productivity of organizations which is a yardstick used in measuring organizational performance depends on the effectiveness and efficiency of the equipment critical to meeting orders placed by customers, sales volume and revenue generation. The output of productive equipment depends to a large extent on the care and maintenance of the equipment. This was corroborated by Ahmed, Hassan, and Taha (2005) when they said "equipment maintenance is an indispensable function in a manufacturing enterprise". The recent competitive trends and ever increasing business pressures have been putting maintenance function under the spotlight as never before (Garg & Deshmukh, 2006).

Total Productive Maintenance(TPM) has been viewed differently by different people, but what remains constant in their definitions is the fact that TPM involves everybody in the organization and it is proactive in nature (Venkatesh, 2006).Within the last few decades, there has been an evolution of perceptions on the concept of plant maintenance from a reactive perception of repairs to proactive perception of maintenance (Ahuja & Khamba, 2008). TPM is a plan, which concentrates on total involvement of everyone from top management to all employees to implement a comprehensive maintenance program for all productive equipment throughout its life (Campbell & Reyes-Picknell, 2006).

The level of awareness of TPM in Jimex Industries Limited and Best Aluminium seems very low. They tend to rely solely on the engineering department to carry out maintenance on the Productive equipment. The operatives probably play no role in the maintenance of equipment. Their maintenance culture also is such that depends on the seldom check on the equipment and not on daily monitoring and detection of faults. However, TPM involves total engagement and commitment of everybody in the organization, and the maintenance is on a daily basis (Ahuja & Khamba, 2008). It is an approach to maintenance that optimizes equipment effectiveness, eliminates breakdown and promotes autonomous maintenance by operators through day-to-day activities involving total workforce (Bhadury, 2013). This culture of scheduled maintenance of equipment seems to be the reason these firms' witness regular packing and breakdown of productive equipment because faults are not detected early enough and employees possibly do not have the skills and knowledge to do so. This affects the goodwill of the organization on the promise of delivering products on schedule to their customers and also

affects the profit generation ability of the firms. This exposes the firm to the competitiveness of the industry as other organization capitalizes on this situation to capture more customers and increase their customer base.

1.2 Statement of the Problem

Manufacturing organizations rely heavily on the number of products produced during specific periods to measure their performance as this will determine whether they will meet schedules and orders placed by customers. The effectiveness of the productive equipment also directly or indirectly depends on the maintenance culture adopted by the organization. In the focused organizations, it is believed that the duty of maintaining productive equipment and machinery is that of engineers, technicians and the engineering department as a whole. Oil check, cleaning and greasing machines, changing of worn-out parts, replacement of machineries, checking the operating parameters and general inspection seem to be left to the engineering department to carry out during specific periods. This implies that the organizations maintenance culture is scheduled maintenance and breakdown maintenance.

The operatives who use these machines daily are not trained and empowered with the basic knowledge to do the simple things like cleaning of equipment, fault detection and changing of oil. In TPM, the most important requirement for operators is to have ability to detect abnormalities in the working of the equipment with respect to operation and quality of output, based on a sense that there is something wrong (Sharma Kumar& Kumar,2012;Shiroze, 1996).The maintenance culture in the organizations is possibly the reason why the organizations encounter frequent machine breakdown which makes the organizations unable to meet with the order placed by customers and reduction in the revenue of the firms.

1.3 Objective of the Study

The broad objective of this study is to explore the relationship between total productivity maintenance and performance of selected manufacturing companies in Anambra State. Specifically, the study determined the type of relationship between Maintenance Autonomy and Employee Commitment of the focused organizations.

1.4 Research Question

1. What is the type of relationship between Maintanance Autonomy and Employee Commitment of the focused organizations?

1.5 Research Hypothesis

H_a: There is a significant positive relationship between Maintenance Autonomy and Employee Commitment in the focused organizations.

II. Review Of Related Literature

2.2 Conceptual Review

2.2.1 Total Productivity Maintenance

Total Productive Maintenance means the daily care and attention given to productive equipment in order to ensure they are in good working condition, operate maximally and last longer. BhadSury (2013) defined TPM as an approach to maintenance that optimizes equipment effectiveness, eliminates breakdown and promotes maintenance autonomy by operators through day-to-day activities involving total workforce.TPM is designed to maximize the overall equipment effectiveness. It involves all departments that plan, use and maintain equipment, including employees, top management and front line managers (Tsang, & Chan, 2011). Ahuja (2009) stated that TPM is greatly known and acting as a weapon of strategy for enhancing manufacturing performance by improving production facilities effectively. He averred that TPM is a collection of methodologies and practices which improve manufacturing equipment performance developed towards extensive efforts to maximize manufacturing productivity. Witt (2006) saw TPM as a communication, in which there is an opportunity that enables operators, maintenance engineers and people to cooperate and deduce each other's language. Herd (2012) stated that TPM establishes a total (company-wide) maintenance system encompassing maintenance prevention, preventive maintenance and improvement related maintenance whose purpose is to prevent losses and waste.

TPM combines the best features of productive and preventive maintenance procedures with innovative management strategies and encourages total employee involvement (Campbell2006; & Reyes-Picknell2006). Rhyne (1990) introduces TPM as a collaboration between production function and company maintenance to increase product quality, reduce waste, reduce the cost of manufacturing, increase equipment accessibility, and enhance the state of the organization regarding maintenance.TPM seeks to maximize equipment effectiveness throughout the life time of the equipment and strives to maintain the equipment in optimum condition in order to prevent unexpected breakdown, speed losses and quality defects occurring from process activities (Ahuja & Khamba, 2008).

2.2.2 Performance of Organization

A positive strategic outcome of TPM implementation is the reduced occurrence of unexpected machine breakdown, which ultimately results in enhanced profits in the organization (Gosavi,& Abhijit 2006). In their studies, the results of the analyses indicate that TPM controls manufacturing cost, quality, and delivery time. In financial terms, maintenance can represent 20 to 40 per cent of the value added to a product as it moves through the plant (Hora, 1987; Eti, Ogaji, & Probert, 2006).

TPM is a systematic approach to understand the equipment's function, the equipment's relationship to the product quality and the likely cause of failure of the critical equipment conditions (McKone, Schroeder, & Cua, 2001). Therefore, the quality of maintenance itself is important, since it affects equipment performance and consequently, the final product quality (Hansson & Backlund, 2002). TPM can be a strong contributor to the strength of the organization and has the ability to improve manufacturing performance (McKone, Kathleen; Schroeder, Roger, Cua, &Kristy 2001). With competition in manufacturing industries rising relentlessly, TPM can be the maintenance philosophy that prevents the failure of an organization. Efficiency and effectiveness of equipment play a dominant role in modern manufacturing industry to determine the performance of the organizational production function as well as the level of success achieved in the organization (Manu, Vsihal, Anish & Dureja 2011).

2.2.3 Maintenance Autonomy

Erickson (2003), states that empowerment is thought to occur when an organization sincerely engages people and progressively responds to this engagement with mutual interest and intention to promote growth. Progress of TPM is directly related to the priority which the management assigns to it. Without top management involvement, TPM implementation will probably fail. Once the top management is on board, the next step is to convince the employees, educate and empower them on TPM concepts, actions needed to be carried out for a successful TPM implementation and the gains that can be accrued once TPM is established (Willmott & McCarthy, 2001).

The most important requirement for operators is to have ability to detect abnormalities in the working of the equipment with respect to operation and quality of output, based on a sense that there is something wrong, and to have this abilities, the employees need to be empowered with training, skills and resources needed and most importantly the autonomy to take decision on when to maintain the equipment (Sharma, Kumar, & Kumar, 2012;Shiroze, 1996). While top management commitment and leadership is essential for TPM success, it is not sufficient on its own. TPM embraces empowerment of production operators establishing a sense of ownership in their daily operating equipment (Tsang & Chan, 2000). TPM implementation will involve design operation, maintenance, engineering and sales activities, and may require hiring or appointing a TPM coordinator whose responsibility is to advocate through an educational program the TPM concepts to the workforce, and check that they are being implemented. Each person becomes a "stakeholder" in the process and is encouraged to do his or her best to contribute to the success of the team (Robert, 2002). Klusker, Laschinger-Spence, and Kerr (2004) have noted that psychological empowerment includes feeling of competence, autonomy, job meaningfulness, and ability to impact the organization. Employees who are empowered has been found to be more committed to the organization, more accountable for their work and actions, and better able to fulfill job demands in an effective manner (Degner, 2005).

The concept of empowerment is closely aligned with this thrust to gain organizational effectiveness through the wise utilization of human resources (Siegall & Gardner, 2000). The logic behind employee empowerment is to increase the employee's responsibility, to build employee morale and to improve the quality of employee's work life. Ideally, when an employee feels vested in an organization, he will be more productive, loyal and more confident (Fryer 2006).Wagner & Harter (2006) reconfirmed this notion, citing empowered employees with higher levels of satisfaction than organizations with more structured, hierarchical, and less flexible work environments.

2.2.4 Employee Commitment

Employee commitment can be defined as the degree to which the employee feels devoted to the organization (Akintayo, 2010). It is an effective response to the whole organization and the degree of attachment or loyalty employees feel towards the organization (Ongori, 2007). Zheng, (2010) describes employee commitment as simply employees' attitude to organization. The commitment level of the employees determines to what extent employees are willing to go for an organization. This assertion was made known by Dixit and Bhati (2012) when they said that employee commitment reflects the extent to which employees identify with the organization and and committed to its goals. Commitment of employees is an important issue in an organization because it may be used to predict employees' performance, absenteeism and other behaviors (Dordevic, 2004)

3.1 Theoretical Framework

The study was anchored on the Theory of Structural Empowerment credited to the work of Kanter (1977). According to this theory, the behavior of employees and their performance in the organization depend on how empowered they are. Empowerment in this theory means the level of opportunity given to the employees for growth and mobility, the amount of power possessed by employees to access resources and information to carry out their duties. This theory states that when employees are provided with access to information, resources, support and the opportunity to learn and develop, then it can be said that such an organization promotes empowerment (Larkin, Ciepial, Stack, Morrison & Griffith, 2008). The rationale for anchoring this study on the theory of Structural Empowerment is because part of the problem that contributed to frequent machine breakdown is probably lack of empowerment. The operatives seemed not empowered to carry out simple maintenance activities and to exercise maintenance autonomy.

3.2 Empirical Review

McKonea, Schroederb, and Cuab (2001) studied manufacturing companies in the United States of America, Japan, Germany and Italy in order to ascertain the impact of TPM practices on manufacturing performance (MP). A survey design was used and random sampling technique was employed to select an approximately equal number of plants in each country and each industry. Data were collected using questionnaire. Two hypotheses were formulated and tested using correlation matrix and regression analysis. From their findings, they concluded that TPM has a significant positive relationship with low cost, high levels of quality, and strong delivery performance.

Seng and Jantan (2012) assessed the implementation of TPM in selected Manufacturing companies in Malaysia. A structured survey approach was used in the study and data were collected using questionnaire. Three hypotheses were formulated and tested with the use of multiple regression analysis. Their findings showed that there is a positive relationship between human-oriented strategy and the extent of TPM implementation.

Badli (2012) studied Automotive Small and Medium Enterprises in Malaysia to explore the TPM implementation level and Critical Success Factor (CSF).The surveys covered 550 companies with 94 responses considered valid. Questionnaire was used in data collection and analysis was done using a combination of ANOVA test statistics and paired comparison test. He found out that TPM was a part of overall maintenance management evolution and important for keeping the assets in good condition and enhancement of the manufacturing performance. Awolabi (2012) carried out a study in Ibadan, Nigeria to determine the type of relationship between equipment maintenance and performance of breweries. Information was sort through the use of questionnaire and data analyzed with the Pearson's Product Moment Correlation Coefficient. Hypotheses were tested with Z –test statistics. The study concluded that maintenance is a veritable tool for enhanced performance and advocated more frequent equipment maintenance.

Gautam, Ravinder, Amandeep and Dhillon (2012) appraised the contribution of total productive maintenance initiatives to manufacturing industries in India. After testing the two hypotheses formulated using regression analysis, they found that the success of TPM implementation depended on the commitment and awareness level of all employees in the organization.

Mfowabo (2006) studied the impact of TPM on the manufacturing performance at the Colt Section of Daimler Chrysler in the Eastern Cape, South Africa. The total population of the study was 228 and the sample size was 74. Data were collected using questionnaire. He found out that Top management support for TPM and training of personnel was essential for successful implementation of TPM and therefore recommended more commitment from employees.

Mwanaongoro and Imbambi (2014), assessed the relationship between plant and equipment maintenance strategies and the factory performance in Kenya sugar firms. The researchers used survey research design. A sample of sixty respondents composed of ten respondents from Mumias, Chemelil, Muhoroni, Nzoia, South Nyanza and West Kenya Sugar Companies was used to provide information for analysis. The study concluded that robust plant and equipment maintenance strategies were vital for factory performance.

Suzaituladwini, Nurul, Juriah, Nurzatul, Seri, and Zubir (2012) carried out a study to examine the relationship between TPM practices and innovation performance for Malaysian automotive industry. Data were collected using structured questionnaire. The population of this study comprised Malaysian automotive firms. Structural equation modeling technique was utilized in the statistical analysis. The researchers concluded that TPM was an integral part of productive maintenance in manufacturing firms in Malaysia.

Bister (2011) studied manufacturing companies in Ukraine to ascertain the relationship between equipment performance and productivity. The study found out that both variables were positively correlated and thus recommended a thorough weekly check of equipment to ensure maximum performance.

Defoe (2012) in Wales examined the performance of wine producers to ascertain the level of relationship existing between scheduled maintenance and profitability. He analyzed data through the use of

regression analysis. The study revealed that a positive relationship exists between scheduled maintenance and profitability in the organization.

III. Methods

4.2 Research Design

The study employed a correlation survey design so as to determine the relationship between total productivity maintenance and performance of selected manufacturing companies in Anambra State.

Table 1: ***Sampling Frame***

S/N	NAME OF ORGANIZATION	POPULATION	LOCATION
1.	**Best Aluminium Manufacturing Limited**	**114**	**Onitsha**
2.	Alo AluminiumNig Ltd	170	Nkpo
3.	Flight AluminiumNig Ltd	201	Onitsha
4.	JoecarisAluminium Ltd	85	Onitsha
5.	Lento AluminiumNig Ltd	71	Awka
6.	Charted AluminiumNig Ltd	187	Nnewi
7.	**Jimex Aluminium Industries Nig Ltd**	**285**	**Nnewi**
8.	Map Aluminium& Steal Ind Ltd	171	Nnewi
9.	Simco AluminiumNig Ltd	115	Onitsha
10.	Arcmaster Aluminium Products	121	Onitsha
11.	Skif Aluminim Company	88	Awka
TOTAL		**1608**	

Sources: Anambra Ministry of Commerce and Field Survey, 2015.

Table 1 above shows a list of 11 Aluminium firms in Anambra State. Out of the entire list above, two were selected using a convenient sampling approach because of accessibility. Their population figure and proportions are given below:

Table 2: ***Population of the firms and proportions***

Organization	JimexAluminium	Best Alluminium	Total
Number	285	114	399
Proportion	0.71	0.29	1.0

The table 2 above shows the proportion of Jimex Aluminium Company(71%) and Best Aluminium(29%).

4.3 Sample Size and Sampling Technique

The sample was determined using Taro Yamane Formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where N=population (399), n=sample size, e=error estimate (5%)

$$n = \frac{399}{1+399(0.05)^2} \quad n = \frac{399}{1.9975} \quad n = 200$$

The questionnaire was distributed using the proportion given in table 2 above:

Jimex 200 X 0.71 = 142

Best 200 X 0.29 = 58

Table 3: ***Distribution and Response Rate to the questionnaire***

S/N	Organization	No Distributed	No returned	% of Response
1	JimexAluminium	142	139	70%
2	Best Aluminium	58	56	28%
Total		**200**	**195**	**98%**

The table above (table 3) shows that a total of 200 copies of questionnaire were distributed to the employees of the focused organizations, out of which 195 were filled and returned. Five, out of the 195 were

invalid due to wrong answers and ticking of the questionnaire. Therefore, 190 copies of the questionnaire which represent 95% of the sample size were used..

4.4 Instrument of Data Collection

The instrument used in data collection was questionnaire. The questionnaire was a structured one arranged in a 5 point Likert scale ranging from strongly agree (5), agree (4), strongly disagree (3), disagree (2), to undecided (1).

4.5 Reliability of the Instrument

Reliability Statistics

Cronbach's Alpha	N of Items
.892	10

Source: Computed from Questionnaire Data with SPSS version 20

4.6 Data Analysis

Data were analyzed using the Pearson's Product Moment Correlation Coefficient to determine the type of relationship that exists between the dependent and independent variables. The level of significance used was 5% while 95% confidence interval was adopted.

IV. Data Presentation And Analysis

5.2 Data Analysis

In line with the hypothesis formulated, data were presented and analyzed.

Table 4.1.1: ***Questionnaire Analysis***

S/N	Questionnaire Items						
		SA	A	SD	D	UD	n
	What is the nature of relationship between empowerment and increase in productivity of selected manufacturing firms in Anambra State?	5	4	3	2	1	
	TPM (Maintenance Autonomy)						
1	Training enhances our knowledge of equipment maintenance	66	30	34	60	-	190
2	If we are given necessary information about equipment maintenance, we would use it to maintain equipment	41	46	31	54	18	190
3	Autonomy will increase our urge to maintain the equipment	34	59	53	38	6	190
4	With adequate resources, worn out parts will be changed promptly	29	67	61	33	-	190
5	Regular maintenance workshop will increase our knowledge of equipment maintenance.	69	22	40	49	10	190
	Performance (Employee Commitment)						
6	I will take care of the equipment if I am happy	72	14	39	46	19	190
7	The quality of our products will be high if machines are managed well	58	37	41	52	2	190
8	We will be able to meet orders placed by customers with a good working equipment	75	11	21	63	20	190
9	Machine breakdown will be greatly reduced if they are maintained on a regular basis	63	32	22	73	-	190
10	If am satisfied with my job, I will take care of the company's equipments	28	61	43	43	15	190

Source: Field Survey, 2015.

Correlations

		AUTONOMY	COMMITMENT
MAINTENANCE AUTONOMY	Pearson Correlation	1	.983**
	Sig. (2-tailed)		.000
	N	190	190
COMMITMENT	Pearson Correlation	.983**	1
	Sig. (2-tailed)	.000	
	N	190	190

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

Source: Computed from Questionnaire Data with SPSS Version 20

5.3 Findings and Management Implications

The results obtained from the correlation analysis show that there is a significant positive relationship between the two variables with a coefficient of .983, and p value of 0.0000, which is less than 0.01 (at 2-tailed test). The null hypothesis is rejected, while the alternate hypothesis which states that there is a strong positive relationship between Maintenance Autonomy and Employee Commitment is accepted. The finding that follows the result of the analyzed data shows that Autonomy has a significant positive relationship with Employee

Commitment in Jimex Industries Limited and Best Aluminium Nig Limited. The implication of this is that as Autonomy to maintain equipment increases in the organization, there could be a concomitant increase in Employee Commitment. The result confirms the findings of Gautam, Ravinder, Amandeep and Dhillon(2012) which revealed that the success of TPM implementation depended on the commitment and awareness level of all employees in the organization. Additionally, this study is supported by Mwanaongoro and Imbambi(2014), who concluded that robust plant and equipment maintenance strategies were vital for factory performance.

5.4 Conclusion

From the value of the Correlation analysis above, it was seen that Autonomy in Decision has a significant positive relationship with Employee Commitment in the focused firms. Therefore, it is concluded that maintenance autonomy is essential in eliciting commitment from employees of the organizations.

V. Recommendations

Following the conclusion, the following recommendations are made:

*Management should see maintenance as an organization wide strategy and that it should be made part of production strategy.

*Operatives should be empowered with information about how to handle and maintain equipment properly.

*They should be given the finance needed to purchase materials needed for the maintenance and given autonomy to carry out the maintenance.

*Management effort should be geared towards purchasing the best equipment that require little technical knowledge in maintaining.

* The stock of inventory should also be put into consideration to prevent stock-out.

*There should be top notch coordination amongst the operatives, the engineering department and the production department to make maximum use of each segment potential.

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