

Maintenance Practice of Process Plants in Cement Industry: Analysis of Perception of Practising Estate Valuers in Lagos and Ogun States of Nigeria

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Abstract - This study analysed the views of practising estate surveyors and valuers in Lagos and Ogun States on Maintenance Practice of Process Plants in Cement Industry because of the importance of this industry to developing nations. The objectives employed in achieving this aim were to: identify factors that affect the useful life of process plants in cement industry; obtain and rank the views of practising estate surveyors and valuers on factors affecting useful life of process plants in cement industry in Lagos and Ogun States; obtain and rank the perception of practising estate surveyors and valuers on the periods observed for implementation of maintenance schedules in the study industry in the two states; obtain and rank the views of practising estate surveyors and valuers on the periods observed for retainership of maintenance engineers in cement industry in the two states under research and establish if this industry keeps maintenance history of its plants. Out of 337 practising estate surveyors and valuers administered with questionnaires in the two states under examination, only 172 questionnaires were successfully completed and returned for analysis. Frequency distribution and mean item Score (MIS) of responses were the analytical approaches adopted in this research. It was found out among others that frequency of use and age of the plant when acquired were the two most significant influencers of useful life of process plants in cement industry. It was recommended that routine, preventive or turnaround maintenance should be carried out monthly as against other options, such as weekly, half-yearly or yearly.

Keywords: valuers, maintenance practice, cement process plants, Nigeria.

I. INTRODUCTION

Cement is an important construction material all over the world. In Nigeria, there are quite a number of cement

manufacturing companies such as: Dangote Cement; BUA Cement; Lafarge; Bauchi-Gwana Cement; and Sokoto Cement. The demand for cement is incalculably high in Nigeria, for this reason cement manufacturing companies in the country are under pressure to deliver high quality cement to consumers at competitive prices. Thus, for any cement manufacturing company to be competitive; production of high quality cement must be delivered at the highest level of efficiency. To achieve this, the components of the cement process plant should be frequently maintained throughout the economic life cycle of the plant. Through maintenance, the availability of the production system can be kept constant and the life of the machinery extended. Conversely, poor or neglected maintenance causes equipment to fail more often thus delaying production or causing defects in the products.

Estate Surveyors and Valuers perform foremost functions in the Nigerian manufacturing sector Okoh, Ebi and Johnson, (2017). A major function performed is the valuation of plant and machinery for various purposes, including: insurance against fire; merger and acquisition; disposal; mortgage and sales. In performing this function optimally, valuers need sound knowledge of maintenance of the various components of process plant. This knowledge becomes important in the valuation of process plant because the valuer needs to account for depreciation induced by physical deterioration when applying the cost method of valuation.

In research parlance, most studies on plant of machinery have centred on plant and machinery valuation (see Okoh, Ebi and Johnson, 2017). Although, Okoh, Ebi and Alabi (2018); and Ebi, Okoh and Kemiki (2018) have researched on maintenance practice of process plants within the brewery and paper industries; maintenance practice of cement process plant has not been empirically researched in Nigeria. The intention of this present study is to fill this gap by analyzing the maintenance practice in process plants in cement industries in

Lagos and Ogun States industrial axes of Nigeria from the perception of practising Estate Surveyors and Valuers.

The objectives were to:

- a. Identify factors that affect the useful life of process plants in cement industry;
- b. Obtain and rank the views of practising estate surveyors and valuers on factors affecting useful life of process plants in cement industry in Lagos and Ogun States;
- c. Obtain and rank the perception of practising estate surveyors and valuers on the periods observed for implementation of maintenance schedules in the study industry in the two states;
- d. Obtain and rank the views of practising estate surveyors and valuers on the periods observed for retainership of maintenance engineers in cement industry in the two states under research and establish if this industry keeps maintenance history of its plants.

The effort of this study is relevant to the valuation profession, as the knowledge of the maintenance practice will assist valuers who are saddled with the responsibility of valuing process plants in cement industry to accurately estimate depreciation in the application of the cost approach to valuation. From the academic point of view, the outcome of this effort will add to the existing body of knowledge in plant and machinery maintenance management. Finally, the cement industry stands to benefits from the study outcome. The knowledge of maintenance practices and recommendation provided will assist in prolonging the life of process plants in the industry.

II. MAINTENANCE MANAGEMENT PRACTICES OF PROCESS PLANT IN CEMENT INDUSTRY

According to BS3811:1964 maintenance defined as: ‘a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition or standard’. In the context of process plant in cement industry, maintenance means - designed activities set-out to ensure continuous functionality of the plant for the purpose of achieving the expected production. To corroborate this, the BS3811: 1984 defined maintenance as ‘the combination of all technical and associated administrative action intended to retain an item in or restore it to a state in which it can perform its required function’. Thus, maintenance means the improvement of any item to make it functional with the co-operation of technical and management parties. In conclusion, maintenance is work undertaken to keep, restore or improve every facilities.

Maintenance approaches open to process plant maintenance department includes:

- a. **Custodial Maintenance:** The day-to-day routine maintenance activities (Seeley, 1984).
- b. **Corrective Maintenance:** The repair and restoration of items after problems are identified but before major breakdowns or emergencies occur (Seeley, 1984; Adenuga, Odusami, Faremi, 2007).
- c. **Preventive Maintenance:** Scheduled inspection, service, and repair to maximize equipment life, and the level of services at plant, and reduce equipment breakdowns and service interruptions (Seeley, 1984; Adekunbi, 2010).
- d. **Emergency Maintenance:** Corrective action that must be taken immediately to protect process plant (Seeley, 1984).

Previous Studies on Maintenance Practice of Process Plants in Plant and Machinery

As stated earlier, little empirical studies have been conducted on maintenance practice of process plants in plant and machinery. The few studies were: Okoh, Ebi and Alabi (2018) and Ebi, Okoh and Kemiki (2018). The former analyzed the views of practising estate surveyors and valuers in Lagos and Ogun States States on maintenance practice of process plants in brewery industry, the study found out that: 22.4% of the responding valuers agreed that turnaround maintenance should be practiced on weekly basis, further 31.1% agreed that this type of maintenance should be done on monthly interval while 24.7% and 20% of the responding valuers agreed on half-yearly and yearly basis and lastly 1.6% agreed on others. In the context of routine maintenance, 30.5% of the responding valuers in the study areas agreed that maintenance should be done on weekly basis, 38.9% agreed that maintenance should be done on monthly, furthermore, 22.1% the responding valuers opined that maintenance should be done on half-yearly basis and 7.9% agreed that maintenance should be done on yearly basis while 0.5% agreed on others. In the case of preventive maintenance, 27.5% of the responding valuers agreed that maintenance should be done on weekly basis, 48.1% agreed on monthly interval, further 16.4% agreed on half-yearly interval and 17.4% agreed on yearly preventive maintenance intervals. In the case of curative maintenance, 29.4% agreed on weekly maintenance, 40.1% on monthly interval, 16.6% agreed on half-yearly basis and 13.9% yearly basis. Finally, for other maintenance types, 4.3% of the responding valuers agreed on weekly maintenance basis, 25.5% agreed on monthly basis, 12.8% on half-yearly basis, 12.8% agreed on yearly basis, while 44.7% agreed on other schedules for maintenance of

brewery industry machines. The authors recommended that brewery industry should undertake monthly maintenance to ensure that their operations are not hampered.

Ebi, Okoh and Kemiki (2018) also examined the perception of estate surveyors and valuers in Lagos and Ogun States States on maintenance practice of process plants in paper industry, the authors opined that: 19.8% of the responding valuers agreed that turnaround maintenance should be practised on weekly basis. Furthermore 29% and 25% of the responding valuers that maintenance should be practised on monthly and half-yearly intervals. In addition, 22% of the responding valuers agreed that maintenance should be practised on yearly, while 4% agreed to others. In the case of routine maintenance, 28.1%, 37.9%, and 21.7% of the responding valuers agreed that maintenance should be done on weekly, monthly and half-yearly intervals, while further 12.3% of the valuers in the study areas opined that maintenance should be carried out on yearly basis. In the context of preventive maintenance, 25.9%, 39.0%, and 21.9% of the responding valuers all opined that maintenance should be done on weekly, monthly and half-yearly intervals, while 11.4% agreed to yearly basis and 1.6% agree to others. For curative maintenance, 27.6% and 36.4% opined that maintenance should be done on weekly and monthly intervals, while 20.4% and 15.6% opined that maintenance should be

done on half-yearly and yearly intervals. For others, 5.5% opined that maintenance should be done on weekly basis, while 30.1%, 11%, and 4.1% opined that maintenance should be done on monthly, half-yearly and yearly intervals.

III. METHODOLOGY

This study used survey design approach to gather information from Estate Surveyors and Valuers on the maintenance practices of process plants in cement industry. The population of respondents were obtained from the Directory of the Nigeria institution of Estate Surveyors and Valuers (2014) and made up of 337 respondents; 317 for Lagos and 20 for Ogun States. A census of the respondents was administered with questionnaires and 172 questionnaires were successfully completed and used for the final analysis. The Mean Item Score (MIS) was the main data analysis technique used to analyze the views of respondents on the maintenance practices of process plants in cement industry. This was achieved with the aid of Statistical Package for Social Sciences (SPSS 22 for windows).

IV. FINDINGS

This section of the study on maintenance practices of process plant in cement industry is centred on the findings.

TABLE 1
Factors That Affect Useful Life of Process Plants in Cement Industry by Rank

Physical Deterioration	Mean	Rank
Frequency of use	4.38	1
How often repairs and part replacement occurred	3.79	3
Age when acquired	4.10	2
Progress in the arts	3.48	7
Prohibitory laws	3.49	6
Reasonably foreseeable economic changes	3.47	8
Shifting of business centres	3.40	9
Technological improvements	3.56	4
The climate in which it is used	3.49	5
Others	3.09	10

Source: field survey, 2018

Table 1 above, reveals ranking of factors affecting meaningful life of process plants in cement industry. First in order of rank is Frequency of Use (with a mean of 4.38), while Second, Third and fourth in rank are Age When Acquired, Frequency of Repairs and Part Replacement, and Technological improvement with mean of 4.10, 3.79 and 3.56

respectively. Fifth, Sixth and Seventh in rank are Climate in Which Machine Was Used, Prohibitory Laws and Progress in Arts, with mean of 3.49, 3.49 and 3.48 respectively. Eighth, Ninth and Tenth in rank are Reasonably Foreseeable Economic Changes (with rank of 3.47), Shifting of Business Centres (with rank of 3.40) and others (with rank of 3.09).

TABLE 2
Maintenance Schedules in Cement Industry

Maintenance Schedules in Cement Industry	Weekly	Monthly	Half-yearly	Yearly	Others
Turnaround maintenance	58(23.2)	74(29.6)	55(22)	60(24)	3(1.2)
Routine maintenance	56(22.3)	122(48.6)	47(18.7)	18(7.2)	8(3.2)
Preventive maintenance	63(24.9)	110(43.5)	56(22.1)	21(8.3)	3(1.2)
Curative maintenance	57(22.9)	95(38.2)	67(26.9)	27(10.8)	3(1.2)
Others	10(19.6)	8(15.7)	11(21.6)	4(7.8)	18(35.3)

Source: field survey, 2018

Table 2 above shows the frequency distribution of responses from practising estate surveyors and valuers to maintenance schedule in cement industry in Lagos and Ogun States. For turnaround maintenance, 23.2% agree on weekly turnaround maintenance, 29.6% agree on monthly, 22% agree on half-yearly while 24% agree on yearly. 1.2% agree on other schedules. For routine maintenance, 22.3% agree on weekly maintenance, 48.6% on monthly, 18.7% agree on half-yearly

while 7.2% on yearly. For preventive maintenance, 24.9% agree on weekly maintenance, 43.5% agree on monthly, 22.1% agree on half-yearly and 8.3% agree on yearly. For curative maintenance, 22.9% agree on weekly maintenance, 38.2% agree on monthly, 26.9% on half-yearly while 10.8% agree on yearly maintenance schedule. On other maintenance schedules, 19.6% agree on weekly maintenance, 15.7% agree on monthly, 21.6% agree on half-yearly, while 7.8% agree on yearly schedule. 35.3% others agree for other maintenance schedules.

TABLE 3
Maintenance Engineers Retained on Cement Industry

Maintenance Engineers Retained	Weekly	Monthly	Half-yearly	Yearly	Others
External service engineer	82(32.4)	92(36.4)	55(21.7)	21(8.3)	3(1.2)
In-house service engineer	76(30)	100(39.5)	40(15.8)	33(13)	3(1.2)
Manufacturer's service engineer	54(21.3)	74(29.2)	73(28.9)	46(18.2)	6(2.4)
The three (3) types of maintenance service engineer	40(16.2)	86(34.8)	73(29.6)	48(19.4)	0(0)
Outside service contractor	44(17.5)	92(36.7)	50(19.9)	50(19.9)	15(6)
Others	7(14)	4(8)	20(40)	4(8)	15(30)

Source: field survey, 2018

Table 3 above shows frequency distribution of responses on types of maintenance engineers retained in cement industry. For external service engineer, 32.4% agree on weekly retained engineers, 36.4% agree on monthly, 21.7% agree on half-yearly, 8.3% agree on yearly while 1.2% agree on others. For in-house maintenance engineers, 30% agree on weekly, 39.5% agree on monthly, 15.8% agree on half-yearly, 13% agree on yearly while 1.2% agree on others. For manufacturer's service engineers, 21.3% agreed on weekly,

29.2% agree on monthly, 28.9% on half-yearly, 18.2% on yearly and 2.4% on others. On the three types of maintenance above-mentioned, 16.2% agree on weekly different types of service engineers, 34.8% on monthly, 29.6% on half-yearly and 19.4% on yearly. On other maintenance service engineers in cement industry, 14% agree on weekly, 8% agree on monthly, 20% agree on half-yearly, 8% on yearly and 30% on others. On outside service contractors, 17.5% agree on weekly, 36.7% agree on monthly, 19.9% on half-yearly and 19.9% on yearly, while 6% agree on others.

TABLE 4
Maintenance History of the Plants in Cement Industry

Maintenance History of the Plants in Cement Industry	Yes	No
Keep maintenance history	237(94.4)	14(5.6)
Indicate other types of maintenance history you keep	75(45.2)	91(54.8)

Source: field survey, 2018

Table 4 above shows maintenance history of plants in cement industries. 94.4% of respondents claim to have kept maintenance record while 5.6% do not keep history of maintenance. On other types of maintenance history kept, 45.2% answered yes while 54.8% answered no.

V. DISCUSSIONS ON FINDINGS, RECOMMENDATIONS

Discussions on findings:

- By rank, the most significant factor affecting useful life of process plants in cement industry is frequency of use, followed by age when acquired. Other factors by rank include: how often replacement of parts and repairs take place, technological improvements, climatic factors at location of use, prohibitory laws, progress in the arts, reasonable foreseeable economic changes and shifting of business centres in that order of significance.
- Larger percentage of practising estate surveyors and valuers in Lagos and Ogun States agree that turnaround maintenance, routine maintenance, preventive maintenance and curative maintenance should all be carried out on monthly basis for cement industry's process plants.
- Majority of practising estate surveyors and valuers in Lagos and Ogun States agree that external service engineers, in-house service engineers, manufacturer's service engineers, a combination of the three above and other service contractors should be retained for servicing on monthly basis.
- Majority of estate surveyors and valuers agree that cement industry maintenance history is kept and few of them agree that other types of maintenance history are kept.

Recommendations:

- Every type of maintenance, whether it is routine, preventive or turnaround should be done on monthly basis considering the volume of work done by process plants in cement industry.
- Maintenance records should be kept without fail in order to keep accurate history of repair schedules on cement industry.
- Since practising estate surveyors and valuers render facility management, valuation and agency services to cement industries, they should be conversant with ranking of factors that affect useful life of plants in cement industry, in addition to study of maintenance books of these concerns.

VI. CONCLUSION

This study has investigated the maintenance practice of process plant in cement industry from the view of estate surveyors and valuers. The study recognized the challenges in the maintenance of process plants in this industry, and opined that if the above recommendations are adhered to strictly, industrialists and facility managers on cement industry will have no difficulties in their activities as they relate to production and management of their concerns.

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