Evaluation on the Use of Plants and Equipment in Building Project Delivery in Imo State, Nigeria

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Author’s contribution
The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT
Modern construction is characterized with complex designs, new and innovative materials that are sensitive with high precision. In addressing the accompanying challenges, mechanization of construction process is said to be the guarantee especially in this era of crash programmes and advancement in technology to reduce poor workmanship and eliminate avoidable holdup in construction processes in the industry. Amidst this belief, attributes of construction industry in Imo state still reflect ineffectiveness in the use of plant and equipment. Hence, the study assesses the involvement of plants and equipment in building delivery for improved project performance. Field survey and work measurement methods were adopted to gather both non-parametric and parametric data respectively. The survey design targeted the sampled building professionals while work measurement focused on selected earth and concrete works in the area of the study. Inferential and descriptive statistical tools of Chi-square on likert scale and Comparative measurements on work activities respectively were used to analyze the respective non-parametric and parametric data. Findings show that selection of various plants are dependent on their rates of use for increased site work productivity; while the socio-economic and political issues as militating factors against effective use of plants are determined by their levels of acceptance. It was also discovered comparatively that mechanization of construction processes is more time and cost effective in building project than manual approach at work. The study therefore recommends that a systematic and holistic awareness be created by the stakeholders on the usefulness of mechanization of construction process in physical development. Besides, government should
Keywords: Plants and equipment; construction methods; construction process; site work productivity; time and cost effectiveness.

1. INTRODUCTION

The implication of manual production process on building delivery performance have sparked growing concern for adequate plant input in construction process, especially in heavy construction projects. Although the dependency on manual production approach in the medieval era was due to low level of science and technology, complexity in design and advancement in construction elements require mechanization of construction process for effective delivery of projects in Nigeria. According to [1] construction is the final objective or transformation of a design through production activities into a useful by man/machines. Man and machine during construction process transform project plans into realities; and as the construction tasks become complex and demanding machines evolve.

Plants and equipment (machine) is indispensable item of construction resources these days. It produces output at an accelerated speed, and enables completion of construction tasks in a limited time [2]. This is because plants saves time and manpower, increase productivity of and improves quality of works. In a broader sense therefore, mechanization can be seen as a method of construction situation where the use of plants and equipment are employed in the majority of the activities [3].

In many developed nations, use of plants and equipment have revolutionized majority of the operations that were manually based earlier. Some have even attained between 30 -50% partial mechanization in some areas of construction [4]. In Nigeria, this is not the situation; because not much has been achieved in the use of construction plants and equipments. Ranges of socio-economical, political, and historical factors are known to have hindered progress in effective use of plants and equipment for improved construction project performance in Nigeria in general. Among the factors are believed to be high cost of acquiring plants and equipment from the foreign countries, since there is no functional iron and steel industry in Nigeria. In the list also is the unavailability of spare parts of the plants, which usually affects adversely the schedules of project work programme [5]. Although there is no clear evidence on the extent of use of plants in the study area, from the foregoing, it is obvious that ineffective use of construction plants, poor production performance, and the attendant waste of scarce resources have continued to mount pressure on project delivery in Nigeria. Considering the level of construction activities in the major cities of Imo state with the absence of plants/equipment parks, the availability and affordability of required construction plants in achieving effective mechanization of construction process in the industry is seemingly not feasible. Since every construction project has its own peculiar characteristics, selection and deployment of appropriate categories of construction plants remains a vital issue for effective project delivery [6]. According to [7] categorization of plants and equipment into their functional uses ranks high amongst other objectives in deployment of plants.

In the context of the study, it is therefore necessary to investigate the use of plants/equipment, examine the factors affecting the effectiveness of use of plants, and to examine the implication of adoption of mechanization and manual methods of construction in the study area.

2. RESEARCH METHODS AND PROCEDURE

A survey research design method was adopted in soliciting for information from the targeted respondents in the area of the study. The data obtained are of discrete nature for deductive reasoning to arrive at solutions to the problem of the study. Structured questionnaires and activities sampling methods were devised for gathering data in the field. The targeted professionals in the building industry include; the Architects, Builders, Civil engineers and Quantity surveyors in the study area for data on the usage
rate of the various categories of the plants/equipment and the implication of the major socio-economic and political issues on the effective use plants/equipment for improved project delivery in the area. Assessment of effects of mechanization and manual methods of work production respectively was by direct observation of construction activities through method study and work measurements.

Random method of sampling was adopted in gathering data from the field; using system approach in the survey design. The instrument of data collection used was administered and retrieved directly.

Data obtained from the survey were analyzed using non parametric tools like likert scale for ranking, and Chi-square for test of independency between the independent and dependent factors. Besides, performances of the mechanical and manual methods of production were evaluated.

In the study, the respective methods of data analyses according to [8] are therefore presented in the following forms. They are:

\[
MS = \frac{1}{N} \sum_{i=1}^{5} \frac{(F \times S)}{N} \quad \text{Eq. 1}
\]

Where;
- MS is Mean Score,
- F = Frequency of Sample,
- S = Weighted Score,
- N = Total Sample Number.

Thus the Ranking Index (RI) is expressed as;

\[
RI = \frac{1}{5} \sum_{i=1}^{5} \frac{(F \times S)}{N} \quad \text{Eq. 2}
\]

Chi-square \((X^2) = \Sigma k_{i-1} \Sigma k_{i+1} \left( (O_{ij} - E_{ij})^2 / E_{ij} \right)\) (for test of independence) \(\text{Eq. 3}\)

Where;
- \(X^2\) is the Chi-square,
- \(O\) = Observed Frequency in the Sample,
- \(E\) = Expected Frequency if \(H_0\) is true,
- \(K\) = the number of category of variables.

In construction of contingency table in the test, the expected frequency \((E)\) therefore is presented in the form:

\[
E_{ij} = \frac{(R_i \times C_j)}{N} \quad \text{Eq. 4}
\]

Thus, if \(X^2 > \chi^2_{(r-1)(c-1)}\) calculated is more than the critical value at 95% confidence interval, the \(H_0\) is failed to be accepted, otherwise it is accepted and, the \(H_a\) rejected, to confirm the independency or otherwise of one group of variables on the others in the study area.

3. DATA PRESENTATION, ANALYSES AND DISCUSSIONS

In assessment of the acceptance level of application of the various categories of construction plants and equipment for improved work productivity, Table 1 shows that Scraper equipment, Haulage, and Dozer’s equipment rank first, second and third places with the corresponding mean scores of 4.10, 4.02, and 3.76 respectively. Hoisting equipment however takes the last place amongst the identified categories of construction plants and equipment with the mean score of 2.23 in the study area.

Table 2 shows that among the ten factors identified in the study, High maintenance cost of machine, High procurement cost of the machines, and Scarcity of spare parts have the leading roles of first, second and third positions with the corresponding mean scores of 4.52, 4.49, and 4.35 respectively, as factors affecting the effectiveness of use of plants and equipment. Lack of indigenous plant manufacturing industry in Nigeria for heavy projects with mean score of 2.28 comes last in ranking.

In Table 3 are shown the cost implications of both mechanical and manual methods of production. In all the earth and concrete works activities, use of plants and equipment are seen to cost lesser than the manual approach of production in the study area. On average, the total cost of completing the measured work activities using plants and equipment is higher than the cost incurred on the same set of activities using manual labour with about 5%.

The percentage values obtained for the cost impact of mechanization on the earth and concrete works however are presented in Table 4, with a view to emphasizing the level at which the cost differences exist.
Table 1. Acceptance level of application of the various categories of construction plants and equipment in the study area

| S/N | Categories of Plants/Equipment | (5) | (4) | (3) | (2) | (1) | Total | MS   | Rank   | Index |
|-----|--------------------------------|-----|-----|-----|-----|-----|-------|------|--------|-------|
| 1   | DOZER                          | 137 | 102 | 28  | 54  | 28  | 349   | 3.76 | 3<sup>rd</sup> | 0.75  |
| 2   | SCRAPER                        | 100 | 200 | 40  | 5   | 4   | 349   | 4.10 | 1<sup>st</sup>  | 0.82  |
| 3   | LOADER                         | 150 | 100 | 0   | 50  | 49  | 349   | 3.72 | 4<sup>th</sup>  | 0.74  |
| 4   | EXCAVATOR                      | 46  | 41  | 39  | 163 | 60  | 349   | 2.56 | 7<sup>th</sup>  | 0.51  |
| 5   | HAULAGE                        | 100 | 200 | 17  | 20  | 12  | 349   | 4.02 | 1<sup>st</sup>  | 0.80  |
| 6   | COMPACTOR                      | 76  | 56  | 28  | 157 | 32  | 349   | 3.02 | 5<sup>th</sup>  | 0.60  |
| 7   | CONCRETE PLANT                 | 63  | 50  | 28  | 165 | 43  | 349   | 2.78 | 6<sup>th</sup>  | 0.56  |
| 8   | MATERIAL HANDLING PLANTS       | 39  | 47  | 28  | 139 | 96  | 349   | 2.26 | 8<sup>th</sup>  | 0.45  |
| 9   | HOISTING EQUIPMENT            | 18  | 40  | 43  | 153 | 95  | 349   | 2.23 | 9<sup>th</sup>  | 0.45  |

Source: Author’s Field Survey Data, (2021)

Table 2. Severity levels of effects of socio-economic and political factors on the effectiveness of use of construction plants and equipment

| S/N | Factors Affecting the Effective Use of Construction Plants/Equipment | (5) | (4) | (3) | (2) | (1) | Total | MS   | Rank   | Index |
|-----|---------------------------------------------------------------------|-----|-----|-----|-----|-----|-------|------|--------|-------|
| 1   | High Cost of Plants and Equipment                                 | 220 | 100 | 10  | 19  | 0   | 349   | 4.493| 2<sup>nd</sup>  | 0.90  |
| 2   | High Maintenance Cost of Machines                                 | 250 | 70  | 0   | 20  | 9   | 349   | 4.524| 1<sup>st</sup>  | 0.90  |
| 3   | Scarcity of Machine Spare Parts                                   | 230 | 50  | 50  | 0   | 19  | 349   | 4.352| 3<sup>rd</sup>  | 0.87  |
| 4   | Implication of Government Policy                                  | 189 | 80  | 40  | 20  | 20  | 349   | 4.037| 6<sup>th</sup>  | 0.81  |
| 5   | Lack of Indigenous Manufacturing Industry                         | 200 | 77  | 0   | 70  | 2   | 349   | 2.281| 10<sup>th</sup> | 0.46  |
| 6   | Foreign Firm Domination in the Industry                           | 15  | 10  | 50  | 260 | 14  | 349   | 2.829| 9<sup>th</sup>  | 0.57  |
| 7   | Lack of Qualified Expertise                                       | 180 | 140 | 0   | 29  | 0   | 349   | 4.350| 4<sup>th</sup>  | 0.87  |
| 8   | Insufficient Number of Available Plants/Equipment                 | 222 | 70  | 30  | 0   | 27  | 349   | 4.318| 5<sup>th</sup>  | 0.86  |
| 9   | Lack of New Technology and Methods                                | 210 | 14  | 14  | 100 | 11  | 349   | 3.885| 7<sup>th</sup>  | 0.78  |
| 10  | Challenges in Allocation of Plants and Equipment                  | 117 | 70  | 0   | 120 | 42  | 349   | 3.264| 8<sup>th</sup>  | 0.65  |

Source: Author’s Field Survey Data, (2021)
### Table 3. Comparative assessment of cost of using plants and manual labour in Earth and concrete works in a building project

| Construction Task | MANUAL LABOUR | PLANTS/EQUIPMENT |
|-------------------|---------------|-------------------|
| **Activity**      | Mode | Time | Cost | Mode | Time | Cost |
| **Excavation Works** | Labour Wage | Direct Labour | 16hrs | 214,000 | Wheel-dozer + Skimmer | 16hrs | 170,000 |
| **Site Clearing (840m^3)** | Labour Wages | - | - | - | Labour Wages | - | 20,000 |
| **Fueling and Lubrication** | - | - | - | - | - | - | 12,000 |
| **Total Cost** | 214,000 | **Total Cost** | 170,000 |
| **Pit Excavation** | Trenching (362m^3) | Direct Labour | 16hrs | 140,000 | Crawler Back-actor Hoe | 12hrs | 100,000 |
| **Trenching (362m^3)** | Labour Wages | - | - | 12,000 |
| **Fueling and Lubrication** | - | - | 8,000 |
| **Total Cost** | 144,000 | **Total Cost** | 120,000 |
| **Backfill and Compaction** | Earth Filling and Compaction (164m^3) | Direct Labour | 16hrs | 116,500 | Angle Dozer | 8hrs | 90,000 |
| **Earth Filling and Compaction (164m^3)** | Labour Wages | - | - | 12,000 |
| **Fueling and Lubrication** | - | - | 6,500 |
| **Total Cost** | 116,500 | **Total Cost** | 108,500 |
| **Concrete works** | Casting at Ground Floor Level (86.4m^3) | Direct Labour | 8hrs | 140,000 | Tilting Drum Mixer & Mixing Bucket | 6hrs | 90,000 |
| **Casting at Ground Floor Level (86.4m^3)** | Labour Wages | - | - | 15,000 |
| **Fueling and Lubrication** | - | - | 8,000 |
| **Total Cost** | 140,000 | **Total Cost** | 113,000 |
| **Casting at 3m Height (54m^3)** | Direct Labour | 8hrs | 168,500 | Tilting Drum Mixer, Mobile Crane & Mixing Bucket | 8hrs | 140,000 |
| **Casting at 3m Height (54m^3)** | Labour Wages | - | - | 16,000 |
| **Fueling and Lubrication** | - | - | 10,000 |
| **Total Cost** | 168,500 | **Total Cost** | 166,000 |

*Source: Author’s Work Measurements and Cost Analyses, (2021)*
Table 4. Cost benefit on effective use of construction plants and equipment in the industry

| S/N | Construction Task  | Work Activity                        | Cost of Manual Method (#) | Cost of Mechanical Method (#) | Cost Difference (#) | Average Cost Effectiveness of Plants (%) |
|-----|-------------------|--------------------------------------|---------------------------|-------------------------------|---------------------|------------------------------------------|
| 1   | Earth Works       | Surface Excavation                   | 214,000                   | 202,000                       | 12,000              | 2.88                                     |
|     |                   | Trench Excavation                    | 144,000                   | 120,000                       | 24,000              | 9.09                                     |
|     |                   | Backfilling & Compaction             | 116,500                   | 108,500                       | 8,000               | 3.56                                     |
|     |                   | Ground Floor Slabs                   | 140,000                   | 113,000                       | 27,000              | 10.67                                    |
|     |                   | Reinforced Concrete Columns          | 168,500                   | 166,000                       | 2,500               | 0.75                                     |
|     | **Total**         | **783,000**                          |                           | **709,500**                   |                     | **167,500**                              |

Source: Author’s Work Measurements and Cost Analyses, (2021)

Table 5. X² Contingency table for test of independency of acceptance levels of usage of various categories of plants for site work productivity

| S/N | Economic Factors causing fluctuation in Building Material Prices | Weight of Acceptance (O) | Observed Frequency (O) | Expected Frequency (E) | O-E | (O-E)² | (O-E)²/E |
|-----|-----------------------------------------------------------------|---------------------------|------------------------|------------------------|-----|--------|---------|
| 1   | DOZER                                                           | 5                         | 137                    | 81                     | 56  | 3136   | 38.7    |
|     |                                                                 | 4                         | 102                    | 93                     | 9   | 81     | 0.87    |
|     |                                                                 | 3                         | 28                     | 28                     | 0   | 0      | 0       |
|     |                                                                 | 2                         | 54                     | 101                    | 47  | 2209   | 21.9    |
|     |                                                                 | 1                         | 28                     | 47                     | 19  | 361    | 7.7     |
| 2   | SCRAPER                                                         | 5                         | 100                    | 81                     | 19  | 361    | 4.5     |
|     |                                                                 | 4                         | 200                    | 93                     | 107 | 11449  | 123.1   |
|     |                                                                 | 3                         | 40                     | 28                     | 12  | 144    | 5.1     |
|     |                                                                 | 2                         | 5                      | 101                    | 96  | 9216   | 91.2    |
|     |                                                                 | 1                         | 4                      | 47                     | 43  | 1849   | 39.3    |
| 3   | LOADER                                                          | 5                         | 150                    | 81                     | 69  | 4761   | 58.8    |
|     |                                                                 | 4                         | 100                    | 93                     | 7   | 49     | 0.53    |
|     |                                                                 | 3                         | 0                      | 28                     | 28  | 784    | 28      |
|     |                                                                 | 2                         | 50                     | 101                    | 51  | 2601   | 25.8    |
|     |                                                                 | 1                         | 49                     | 47                     | 2   | 4      | 0.09    |
| 4   | EXCAVATOR                                                      | 5                         | 46                     | 81                     | 35  | 1225   | 15.1    |
|     |                                                                 | 4                         | 41                     | 93                     | 52  | 2704   | 29.1    |
|     |                                                                 | 3                         | 39                     | 28                     | 11  | 121    | 4.3     |
|     |                                                                 | 2                         | 163                    | 101                    | 62  | 3844   | 38.1    |
|     |                                                                 | 1                         | 60                     | 47                     | 13  | 169    | 3.6     |
| 5   | HAULAGE                                                        | 5                         | 100                    | 81                     | 10  | 361    | 4.5     |
|     |                                                                 | 4                         | 200                    | 93                     | 167 | 11449  | 123.1   |
|     |                                                                 | 3                         | 17                     | 28                     | 11  | 121    | 4.3     |
|     |                                                                 | 2                         | 20                     | 101                    | 81  | 6561   | 65      |
|     |                                                                 | 1                         | 12                     | 47                     | 35  | 1225   | 26.1    |
| 6   | COMPACTOR                                                      | 5                         | 76                     | 81                     | 5   | 25     | 0.31    |
|     |                                                                 | 4                         | 56                     | 93                     | 38  | 1444   | 15.5    |
|     |                                                                 | 3                         | 28                     | 28                     | 0   | 0      | 0       |
|     |                                                                 | 2                         | 157                    | 101                    | 56  | 3136   | 31      |
|     |                                                                 | 1                         | 32                     | 47                     | 15  | 225    | 4.8     |

Source: Author’s Work Measurements and Cost Analyses, (2021)
Table 6. X² contingency table for test of independent of acceptance level on the effect of socio-economic and political factors on effective use of plant and equipment

| S/N | Economic Factors                          | Weight of Impact | Observed Frequency (O) | Expected Frequency (E) | O-E | (O-E)² | (O-E)²/E |
|-----|------------------------------------------|------------------|------------------------|------------------------|-----|--------|---------|
| 7   | CONCRETE PLANTS                          | 5                | 63                     | 81                     | 18  | 324    | 4       |
|     |                                          | 4                | 50                     | 93                     | 43  | 1849   | 19.9    |
|     |                                          | 3                | 28                     | 28                     | 0   | 0      | 0       |
|     |                                          | 2                | 165                    | 101                    | 64  | 4096   | 40      |
|     |                                          | 1                | 28                     | 47                     | 4   | 16     | 0.34    |
| 8   | MATERIALS HANDLING PLANTS                | 5                | 39                     | 81                     | 42  | 1764   | 21.8    |
|     |                                          | 4                | 47                     | 93                     | 46  | 2116   | 22.8    |
|     |                                          | 3                | 28                     | 28                     | 0   | 0      | 0       |
|     |                                          | 2                | 139                    | 101                    | 38  | 1444   | 14.3    |
|     |                                          | 1                | 96                     | 47                     | 49  | 2401   | 51.1    |
| 9   | HOISTING EQUIPMENT                      | 5                | 18                     | 81                     | 63  | 3969   | 49      |
|     |                                          | 4                | 40                     | 93                     | 53  | 2809   | 30.2    |
|     |                                          | 3                | 43                     | 28                     | 15  | 225    | 8.04    |
|     |                                          | 2                | 153                    | 101                    | 52  | 2704   | 26.8    |
|     |                                          | 1                | 93                     | 47                     | 48  | 2304   | 49.0    |
|     | **TOTAL X² (CALCULATED)**               |                  |                        |                        | 1147.68 |

Source: Analyses of Data from the Field, (2021)
| S/N | Socio-economic and Political Factors | Weight | Observed | Expected | O-E | (O-E)^2 | (O-E)^2 | X^2 | (Calculated) |
|-----|-------------------------------------|--------|----------|----------|-----|---------|---------|-----|-------------|
| 7   | Lack of Qualified Expertise          | 5      | 180      | 183      | 3   | 9       | 0.05    |     | 1663.3      |
|     |                                     | 4      | 140      | 68       | 72  | 5184    | 76.2    |     |             |
|     |                                     | 3      | 0        | 19       | 19  | 361     | 19      |     |             |
|     |                                     | 2      | 29       | 64       | 35  | 1225    | 19.1    |     |             |
|     |                                     | 1      | 0        | 14       | 14  | 196     | 14      |     |             |
| 8   | Insufficient Number of Plants/Equipment Available | 5 | 222 | 183 | 39 | 1521 | 8.3 |     |             |
|     |                                     | 4      | 70       | 68       | 2   | 4       | 0.06    |     |             |
|     |                                     | 3      | 30       | 19       | 11  | 121     | 6.4     |     |             |
|     |                                     | 2      | 0        | 64       | 64  | 4096    | 64      |     |             |
|     |                                     | 1      | 27       | 14       | 13  | 169     | 12.1    |     |             |
| 9   | Lack of New Technology and Methods.  | 5      | 210      | 183      | 27  | 729     | 4.0     |     |             |
|     |                                     | 4      | 14       | 68       | 54  | 2916    | 42.9    |     |             |
|     |                                     | 3      | 14       | 19       | 5   | 25      | 1.3     |     |             |
|     |                                     | 2      | 100      | 64       | 36  | 1296    | 20.3    |     |             |
|     |                                     | 1      | 11       | 14       | 3   | 9       | 0.64    |     |             |
| 10  | Challenges in Allocation of Plants  | 5      | 117      | 183      | 66  | 4356    | 23.8    |     |             |
|     | and Equipment                       | 4      | 70       | 68       | 2   | 4       | 0.06    |     |             |
|     |                                     | 3      | 0        | 19       | 19  | 361     | 19      |     |             |
|     |                                     | 2      | 120      | 64       | 56  | 3136    | 49      |     |             |
|     |                                     | 1      | 42       | 14       | 28  | 784     | 56      |     |             |
|     | **Total X^2 (Calculated)**          |        |          |          |     |         | 1663.3  |     |             |

Source: Analyses of Data from the Field, (2021)

As seen in Table 5, Row (r) is 9, while Column (c) = 5; with Confidence Interval of 90%. Consequently, X^2_cal is 114.68; while X^2_{1-0.05(4-1)} from the table is 46.20.

Hence, since X^2 calculated is greater than the critical X^2 tabulated, we fail to accept H_0, but reject it. H_a therefore is accepted, that the socio-economic and political factors are dependent on their level of acceptance in affecting the effective use of plants and equipment.

The socio-economic and political factors according to the findings contribute considerably to effective use of machine for improved project delivery in the study area. According to [1], it is very necessary to understand the criteria for appropriate selection towards effective use of machines before deployment to site; in order to achieve optimal use of plants and equipment in a given construction task. The finding therefore justifies his conclusion that equipment selection is highly influenced by many factors like; historical data, socio-economic, political factors and experience from similar projects, for effective delivery of projects.

4. SUMMARY OF FINDINGS

In this study, inference for every specific objective was realized respectively in the context of the work. In the assessment of level of application of the various categories of construction plants and equipment, Scraper equipment, Haulage, and Dozer’s equipment are discovered as the most commonly used plants and equipment for improved work productivity in the study area. Analysis explains that the choice of the various categories of plants and equipment...
are dependent on their rates of usage for their impact on productivity of work in the study area.

On the effective use of the various construction plants and equipment, high maintenance cost of machine, high procurement cost of the machines, and scarcity of spare parts are seen as the major causes of low level of use of construction plants. It is therefore deduced that the socio-economic and political factors militating against mechanization of construction processes are dependent on their level of acceptance for leading to the ineffective use of plants and equipment in the study area.

Measured information on the cost implications of mechanical and manual methods of production respectively emphasis the fact that use of plants and equipment is cost effective than manual approach, as well save time; even at the short run when there is effective construction methodology and plan.

5. RECOMMENDATIONS

Since the low mean scores of most of the available plants and equipment implies low usage rate in construction, adequate awareness by the building professionals in the Nigeria construction industries on the significance of mechanization of construction process over manual approach should be encouraged for a revolutionised construction methodology in Nigeria.

In the light of the finding that high cost of maintenance, high cost of procurement, and scarcity of spare parts of the machines mostly affect adversely the effective use of plants for improved project delivery, Nigeria government as a matter of urgency should make a frantic effort to review and revive the popular Ajeokuta steel industry project abandoned decades of years ago.

It is also recommended that every project be critically examined of its scope and nature before embarking on either fully or partially mechanized construction process, so as to ensure effectiveness in project time and cost deliveries. In order to guarantee this condition, government is hereby advised to incorporate and enforce construction methodology plan as an official production document in the general condition of physical development before the approval of such project by the authority.

6. CONCLUSION

In conclusion, the need to effectively sensitize all the stakeholders and revolutionise the construction process in Nigeria from manpower production arrangement to the mechanization is of essence and timely in project delivery, as project cost and time will be reduced with optimum performance. Hence, more plants will be used frequently in the study area for increased site work productivity.

With the revival of the abandoned steel manufacturing industry and possibly more new one, costs of procurement, maintenance, and scarcity of machine’s spare parts will be significantly reduced to a barest minimum to encourage mechanization in the industry. This scenario automatically will encourage indigenous firms in the competition against the dependency on the foreign nations for both the plants/equipment and prospective construction firms.

CONSENT

As per international standard or university standard, respondents’ written consent has been collected and preserved by the authors.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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