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Professionals View on The Effects of Mechanization On Construction Cost Of Building Projects In Nigeria

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Abstract - ***One of the major means of providing solution to the problems encountering project delivery is the application of mechanization in projects execution. Mechanization in construction is the application of plants, equipment and machineries for carrying out construction activities. This research work studied the effects of mechanization on construction cost of building projects in Nigeria. Questionnaire survey type of research design was adopted to seek data from professionals in building construction industry in order to examine the level of awareness, areas of application and economic importance of mechanization as well as factors being considered when selecting construction equipment in building project delivery. 70 questionnaires were administered while 52 responses were obtained to give a return rate of 74%.Analysis of data was done by descriptive statistical tools (SPSS and R.I.I). The result showed that 90% of the respondents have adequate knowledge and adopt the use of mechanization in building projects in Nigeria. Above 70% agreed that direct procurement of plants and equipment is good while 52% agreed hiring of plants and equipment is good in construction of building projects. The study also established that excavation, earthwork and piling works are the highest areas of application of mechanization in building construction projects. The study therefore suggested that much focus be placed on the factors to be considered when selecting construction equipment to enhance completion of project within scheduled time and budgeted cost. It also recommends that much focus be placed on implementation of mechanization to enhance good workmanship, quality standard, increase productivity and reduces the cost of building construction projects in Nigeria.***

Keywords: Building, Equipment, Mechanization, Plant and Project

1.0 Introduction

Mechanization in construction can be defined as the application of plants, equipment and machineries for carrying out construction activities (Idoro, 2004). In Nigeria the importance of mechanization in the achievement of project objectives seems to be increasing on daily basis, which has led to growth and development of the society(Waris*et al.,* 2014). Oyewande (1990) claimed that plant and equipment plays an increasingly important role in building construction. Both time and money can be saved by efficient use and proper maintenance of such plant and equipment.

Several problems are encountered in the delivery of construction projects worldwide that need urgent and drastic solutions because they have far reaching consequences on the industry. One of these problems is the long delay experienced in project delivery. Tijani and Ajagbe (2016) mentioned delay as one of the most important causes of project abandonment.Jagboro(2002) identified delay as one of the global problem confronting the construction industry. A survey of the delivery time of construction projects in Nigeria reveals a delay of between 50 and 420% (Elinwa and Buba, 1993). Another problem is the excessive cost-overrun experienced in the delivery of construction projects. Most projects overshoot their budgets to an extent that renders clients bankrupt and unable to continue with their financial obligations. Still another problem bedeviling the industry is poor quality standards or workmanship. Tam *et al.* (2000) maintain that quality management is far more difficult to achieve in construction industry than in other

industries. Lagos State Physical Planning Authority (2008) discovered that Nigeria is bedeviled by numerous cases of building collapse and that the phenomenon is one of the major challenges facing the built environment in Nigeria.

Idoro (2008) discovered that Nigerian clients have greater importance to quality than project delivery time and cost and that client will be willing to forgo time and cost for good workmanship. These and other problems have consequences not only on the construction industry but also on the entire economy. Okpala and Aniekwu (1988) observed that delay in the construction project execution is responsible for time and cost overruns experienced in the delivery of projects. Elinwa and Joshua (2001) discovered that delay is the most important factor for project abandonment and contractors' failure.

One of the major means of providing solution to the problems encountering project delivery is the application of mechanization in projects execution and delivery. Certainly, using manual method in project execution cannot provide effective and sound solution to the numerous problems facing the construction industry rather it will aggravate them. Recently, contractors have been making use of mechanized method in construction instead of manual method in the efforts to increase productivity, meet increasing complex specifications, construct or actualize or improving the growing complexity of modern designs, utilizing the numerous new construction materials that are being introduced into the industry, meeting up the tight schedules and targets placed by the client's demands, implement control measures required to bring projects on track and ensure effective and efficient utilization of the numerous resources involved in the construction of projects.

Seeley (1995) asserted that the increased in mechanization speeds up construction projects and reduces the overall cost of construction project while Olomolaiye*et al.* (1998) maintained that the adoption of advanced technology affects productivity. Purchasing with cash, financing through a loan, renting and leasing are four most common ways for Construction Equipment Acquiring (Sajoudi et al, 2011). According to Amasun (2011) plant and equipment procurement issue is one of the important factors that impacts project success.

In appreciation of the important roles that mechanization plays in achieving project objectives, clients now consider the possession of necessary plants and equipment by prospective contractors as a major criterion for the award of contracts. That is, clients expect the contractingfirms to have necessary equipment before bidding for certain construction project contracts. Plebankiewicz (2009) identifies the possession of equipment by contractors as one of the three criteria that are used to determine the technical ability of contractors during prequalification. In response to this development, contractors often embark on efforts to own construction plant and equipment to carry out construction projects in order to be able to compete favorably with their counterparts during the prequalification and tendering processes. Not only that, they also stipulate mechanized methods in their production method statements during prequalification and tendering processes to ensure that all the methods stipulated in their tenders are adopted when contracts are eventually won and during execution of the construction projects.

The purpose of this study is to appraise the effect of mechanization on construction cost of a building project in Nigeria. The problem of high cost of building production, delay in time of construction project cannot be over emphasized; its occurrence consequences and economic implications with accommodation challenges are numerous. All these problems and many make the contractors not to meet set dead-line of handing over of the project. In order to augment the combat with the rising cost of building production in the country and other related issues such as delay in completion time and low level of productivity of building construction project, this work evaluates the economic importance of mechanization in building construction project delivery against the usual manual labour.

2.0 Methodology

The study based on a quantitative research design with the use of questionnaire survey methods in generating the needed data.The study populations for this research were registered professionals in the

building industry within Lagos State. This population was chosen with the intension of getting reliable information for the study. Seventy (70) questionnaires were distributed to the professionals from construction companies in Lagos State. The selected companies includelarge/multinational construction company, large/local construction company and small scale Construction Company.Fifty-two (52) copies of the questionnaire were dully filled and returned representing a response rate ofseventy-four percent (74%) of the total number of the questionnaire administered in the study area. A descriptive statistical tool, SPSS and Relative Importance Index (RII) were used to analyse data.

3.0 Results and Discussion

Table 1: Size of Organization

S/N		Frequency	Percent	Valid Percent	Cumulative Percent
1	large/multinational construction company	22	42.30	42.3	42.30
2	large/local construction company	15	28.85	28.85	71.15
3	small scale construction company	15	28.85	28.85	100
	Total	52	100.00	100.00	

Source: Field Survey (2019)

Table 1 showed the size of organization studied.It could be observed that large/multinational construction company possess the highest size of organization percentage of 40.4% with 21 respondents, while large/local construction company have 11 respondents with 21.2% of participants, small scale local construction company has 11 respondents with 21.2% of participants and other (consulting firm/company) has 9 respondents with 17.3% of participants.

Table 2: Professions of Respondent

S/N		Frequency	Percent	Valid Percent	Cumulative Percent
1	Engineer	16	30.8	30.8	30.8
2	Quantity Surveyor	14	26.9	26.9	57.7
3	Builder	8	15.4	15.4	73.1
4	Architect	14	26.9	26.9	100.0
	Total	52	100.0	100.0	

Source: Field Survey (2019)

From Table 2 above, shows that Engineer has the highest professional designation percentage which is 30.8% of participant with 16 Respondents, Quantity Surveyor has 26.9% participant with 14 Respondents, Builders has 15.4% participant with 8 Respondents, Architect has 26.9% participant with 14 Respondents, and Client organization has 0 Respondent with 0% of participant.

Table 3: Identify and examine level of awareness of mechanization in building construction project

S/N		Frequency	Percent	Valid Percent	Cumulative Percent
1	strongly agree	25	48.1	48.1	48.1
2	Agree	22	42.3	42.3	90.4
3	indifferent	5	9.6	9.6	100.0
	Total	52	100.0	100.0	

Source: Field Survey (2019)

In the table 3, showcase the number of respondents and a distribution of their profession. The figure illustrates their knowledge on Mechanization. From the table, it is observed that all the professionals out of which a total of 48% strongly Agreed, 42% Agree, 10% Indifferent and none disagreed.
Deduction: This means that the set of questions were administered to professionals with adequate knowledge to the area of study.

Table 4: Construction Company Adopt the Use of Mechanization in Construction Project

S/N		Frequency	Percent	Valid Percent	Cumulative Percent
1	strongly agree	27	51.9	51.9	51.9
2	Agree	23	44.2	44.2	96.2
3	indifferent	2	3.8	3.8	100.0
	Total	52	100.0	100.0	

Source: Field Survey (2019)

In the Table 4, showcase the level of respondents towards Construction Company adopt the use of mechanization in construction project. 27 respondents with 51.9% of participants chose strongly agree. 23 respondents with 44.2% of participants agree while 2 respondents with 3.8% of participants chose indifferent.

Table 5: Type of Construction Project Determines the Plant and Equipment to be used

S/N		Frequency	Percent	Valid Percent	Cumulative Percent
1	strongly agree	28	53.8	53.8	53.8
2	Agree	22	42.3	42.3	96.2
3	Indifferent	1	1.9	1.9	98.1
4	Disagree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

Source: Survey (2019)
In the table 5, showcase the level of respondents toward the type of construction project that determines the plant and equipment to be used. 28 respondents with 53.8% of participants chose strongly agree. 22 respondents with 42.3% of participants agree, 1 respondent with 1.92% of participants chose indifferent while 1 respondent with 1.92% participants disagree.

Table 6: Identify and Examine Areas of Application of Mechanization in Building Project Activities.

S/N	Areas of Application of Mechanization in building construction project activities	5	4	3	2	1	RII	RANKING
1	Excavation, earthworks and piling works	39	10	3	0	0	0.9385	1
2	Structural steel works	22	15	13	2	0	0.8192	3
3	Filing	4	27	17	2	2	0.7115	5
4	Demolition and site clearance	21	24	7	0	0	0.8538	2
5	Concrete works	13	28	10	1	0	0.8038	4
6	Formwork	5	10	24	11	2	0.6192	9
7	Building component assembly	9	16	21	6	0	0.7077	6
8	Flooring and pavement works	5	19	24	3	1	0.6923	7
9	Plumbing and drainage works	3	20	8	19	2	0.6115	10
10	Brickwork and masonry works	7	7	12	25	1	0.5769	11
11	Painting and finishing works	7	2	18	18	7	0.5385	12
12	Roof works	9	10	15	15	3	0.6269	8

Source: Field Survey (2019)

The perception of the respondent regarding Areas of Application of Mechanization in building construction project activities in Table 6 established that excavation, earthworks and piling works ranked first position [1st] with RII of 0.9385; Demolition and site clearance ranked second [2nd] with RII of 0.8538; Structure steel works ranked third position [3rd] with RII of 0.8192; Concrete works ranked fourth [4th] with RII of 0.8038; Filling ranked fifth position [5th] with RII of 0.7115; Building component assembly ranked sixth position [6th] with RII of 0.7077; Flooring and pavement works ranked seventh position [7th] with RII of 0.698; High noise level ranked eighth position [8th] with RII of 0.6269; Formwork ranked ninth position [9th] with RII of 0.6192; Plumbing and drainage works ranked tenth position [10th] with RII of 0.6115; brickwork and masonry works ranked eleventh [11th] with RII of 0.5769; painting and finished works ranked twelfth [12th] with RII of 0.5385.

Table 7: Identify and Examine Factors to be Considered When Selecting Construction Equipment in Building Project Delivery.

S/N	Factors to be Considered when Selecting Construction Equipment in Building Projects Delivery	5	4	3	2	1	RII	RANKING
1	Careful investigation of construction methods	36	16	0	0	0	0.9385	1
2	Methods of equipment's procurement	13	33	6	0	0	0.8269	6
3	The records of contemporary maintenance policy of equipment employed	16	19	16	1	0	0.7923	9
4	Economic and cost analysis of plants and equipment before selecting them for use	18	26	7	1	0	0.8346	5
5	The equipment must be standard	32	14	6	0	0	0.9000	2
6	The equipment must give paramount service at low cost	19	21	8	3	1	0.8077	7
7	The equipment should be effortlessly repaired with low shutdown period	24	22	3	3	0	0.8577	4
8	The equipment should suit the bulk of the requirement of the job	25	22	5	0	0	0.8769	3
9	The equipment should be capable of doing more than one task	12	17	19	4	0	0.7423	10
10	The equipment should be of reasonable size and have low working cost	13	29	7	2	1	0.7962	8

Source: Field Survey (2019)

The perception of the respondent regarding factors to be considered when selecting construction equipment in building projects delivery in Table 7 established that careful investigation of construction methods ranked first position [1st] with RII of 0.9385; the equipment must be standard ranked second position [2nd] with RII 0.9000; the equipment should suit the bulk of the requirement of the job ranked third position [3rd] with RII of 0.8769; the equipment should be effortlessly repaired with low shutdown period ranked fourth position [4th] with RII of 0.8577; economic and cost analysis of plants and equipment before selecting them for use ranked fifth position [5th] with RII of 0.8346; methods of equipment's procurement ranked sixth position [6th] with RII of 0.8269; The equipment must give paramount service at low cost ranked seventh position [7th] with RII of 0.8077; The equipment should be of reasonable size and have low working cost ranked eighth position [8th] with RII of 0.7962; The records of contemporary maintenance policy of equipment employed ranked ninth position [9th] with RII of 0.7923 ; The equipment should be capable of doing more than one task ranked tenth position [10th] with RII of 0.7423

Table 8: Identify and Examine Economic Importance of Mechanization in Construction Project Delivery

S/N	Economic Effects of Mechanization on Building Projects Delivery	5	4	3	2	1	RII	RANKING
1	Reduces final cost of projects	16	18	9	4	5	0.7385	9
2	Reduces wastages	15	27	9	1	0	0.8154	6
3	Achieving good workmanship/quality standards	34	17	1	0	0	0.9269	1

4	Improving construction projects to standard	36	13	3	0	0	0.9269	1
5	Ensures safety operations	11	23	9	9	0	0.7385	9
6	Cost of incurring plants and equipment increases the final cost of a project	17	16	7	12	0	0.7462	8
7	Completion of project within scheduled time to impacts positively on the duration of building construction	29	18	3	2	0	0.8846	3
8	Increases the initial cost of a building project	7	27	12	6	0	0.7346	11
9	Keeping standard of works as specified	16	21	15	0	0	0.8038	7
10	Increases productivity, efficiency and consequently reduces cost of construction	21	26	5	0	0	0.8615	4
11	Ensures effective and efficient utilization of resources	22	27	1	5	0	0.8400	5
12	Increases the cost of building project due to depreciation	6	11	26	8	1	0.6500	12

Source: Field Survey (2019)

The perception of the respondent regarding Economic Effects of Mechanization on Building Projects in Project Delivery in Table 8 established that achieving good workmanship/quality standards and improving construction projects to standard ranked first position [1st] with RII of 0.9269; completion of project within scheduled time to impacts positively on the duration of building construction ranked third position [3rd] with RII of ; 0.8846; increases productivity, efficiency and consequently reduces cost of construction ranked fourth [4th] with RII of 0.8615; Ensures effective and efficient utilization of resources ranked fifth position [5th] with RII of 0.8400; Reduces wastages ranked sixth position [6th] with RII of 0.8154; Keeping standard of works as specified ranked seventh position [7th] with RII of 0.8038; Cost of incurring plants and equipment increases the final cost of a project ranked eighth position [8th] with RII of 0.7462; Reduces final cost of projects and ensures safety operations ranked ninth position [9th] with RII of 0.7385; increases the initial cost of a building project ranked eleventh position [11th] with RII of 0.7346; increases the cost of building project due to depreciation ranked twelfth [12th] with RII of 0.6500.

4.0 Conclusion and Recommendations

This work studied the effects of mechanization on construction cost of building project in Nigeria (Lagos State).

After a proper analysis of data, the following conclusions were drawn.

1. It is determined from the respondent's feedbacks that they are well aware and have a good knowledge about mechanization and adopts the use of mechanized construction processes.
2. Analysis of the data shows that excavation, earthworks, pilling, structural works, demolition, site clearance and filling are the high ranking activities where machineries and equipment are mostly used by the building constructions
3. Factors considered when selecting construction equipment in building projects delivery are careful investigation of construction methods, standard of equipment, suitability of equipment, low cost of service and maintenance, economic and cost analysis.
4. Economic importance of mechanization in construction project delivery are as follows; Achieving good workmanship/quality standards/ quality standard, improving construction project to standards, completion of project within scheduled time to impact positively on the duration of building construction, increases productivity, efficiency and consequently reduces

cost of constructions and ensures effective and efficient utilization of resources and reduces wastages.

In light of the above conclusions, the following recommendations are therefore made.

1. The use of plant and equipment should be implemented more into the building construction activities to reduce the cost, improve quality standards and productivity of building construction works in Nigeria.
2. This study recommends that much focus should be placed on the factors to be considered when selecting construction equipment to enhance the completion of project within scheduled time to impact positively on the duration of building construction and reduce any avoidable delay.
3. Costs of equipment and plants (whether for hiring or purchasing) are generally high. To reduce construction costs, it will be necessary to intensify efforts to reduce rates of purchasing and hiring of plants and equipment since it has great impact on overall construction costs.

4. An integrated and well planned approach to the use of plants guarantees great benefits in cost, time and quality of production. Efforts should therefore be intensified in ways of developing a cost effective approach to the use of plants in order that the numerous inherent advantages can be realized.

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