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# THE EFFECT INFLUENCING COST PERFORMANCE OF UNPAVED ROAD MAINTENANCE PROJECTS IN NORTH-WESTERN NIGERIA

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**ABSTRACT**
*In order to strengthen tourism, agriculture, and mining, the government of Nigeria has implemented plans for road building and maintenance and increased its financial allocations. But road maintenance is still difficult because of price discrepancies, contractor-inflicted unit cost inflation, and maintenance intervention delays. With the Federal Roads Maintenance Agency (FERMA) as a case study, this research looked at how to reduce costs while increasing efficiency on maintenance projects for unpaved roads in Northern Nigeria. The primary goal was to provide a framework for enhancing cost performance in unpaved road repair projects. The research took place at four randomly selected sites in Northern Nigeria (Nahuche, Kaura Namoda, Talata Mafara, Gusau). Information was gathered quantitatively and qualitatively through questionnaire surveys and archival research. Statistics including correlation and regression as well as descriptive statistics were used to examine the data. It was found that there were negative cost departures from planned budgets for both drainage and wearing course/shoulder upgrades. The reasons that were found to contribute significantly to cost variances were variations in the prices of materials, shortages of those materials, delays in delivery, and the availability and failure of equipment. To better manage road maintenance budgets, the created model will be put to use in precise cost estimates for upkeep projects.*

**Keyword:** Project Expenditures, Cost Variations, Road Maintenance, and Outcomes

## INTRODUCTION

Goal 9 of the Sustainable Development Agenda identifies investment in infrastructure as one of the most effective ways to promote economic growth and development. Reduced mobility and skyrocketing gas prices are direct results of subpar road upkeep. Furthermore, it raises the frequency of accidents and the expenses connected with them, both in terms of human lives and material goods. Isolation, poverty, bad health, and illiteracy all worsen in rural areas when roads are poorly maintained (Burnigham and Stankevic, 2005). Road maintenance is a crucial duty, therefore it's important to get it done as soon as possible (PIARC, 1994). Maintenance costs need to be reduced so that savings may be realized and more maintenance can be done with the money saved, especially in light of the increasingly competitive use of limited public resources by different sectors. To learn about the extent to which actual project costs deviated from those estimated, researchers examined the results of Nigeria National Roads Authority's previously completed periodic road repair projects. Using the obtained data, we were able to create a model that can be used to enhance road maintenance project cost deviations by forecasting whether or not a maintenance project's cost will vary from the projected budget.

## LITERATURE REVIEW

### Investment Sum

Definition: A comprehensive, time-phased forecast of a project's total resource costs (Al-Agele and Al-Hassan, 2016). Sometimes there just isn't enough money or manpower to go around for all the tasks that need doing on a project (Scot and Jefferson, 2007). Preliminary estimates of a project's price tag are most accurate (Atkinson, 1999). The methods of cost management include cost estimation, budgeting, and control to ensure that the project is completed within the allotted budget (PMBOK, 2013). Managers of such endeavors should check that their approved initiatives have reasonable scope, schedule, and cost parameters. In order to estimate how much a project will cost, it is necessary to make educated guesses about the quantities, unit costs, and/or prices of the resources that will be needed (WSDT, 2015). It is also possible to estimate these costs by calculating the most likely price of the resources needed to finish the project, with room for inflation and unexpected expenses included in (PMBOK, 2013). When the cost estimates for a project are added up, the resulting budget may be used as a yardstick against which actual expenditures can be compared. Cost management is essential for projects to be completed on schedule and within budget without compromising on quality (Al-Agele and Al-Hassan, 2016). Two methods have been developed to manage project costs: standard costing and budgetary management. When a budget is utilized for planning and regulating all elements of an organization, this is known as budgetary control. To contrast, standard costing is a method of controlling operations with the goal of creating performance benchmarks and cost objectives applicable to a specified context (Chan, 2014). Similarly, project cost management comprises keeping tabs on and reining in any and all fluctuations in project expenditures by keeping an eye on the reasons that lead to those fluctuations and acting as needed (Guo-Li, 2010). According to the research, controlling the cost of a project entails monitoring performance to identify deviations, recording those deviations accurately in the cost baseline, preventing unauthorized changes from being reflected in the cost baseline, calculating positive and negative deviations, and integrating the results with the rest of the control processes. A company's financial risk can be reduced if it can make reliable predictions about its future cost performance (Pennypacker, 2005).

## PRICE DISPARITIES

A cost variation is the amount by which the total cost of a project deviates from the agreed-upon contract price (estimated cost). The construction industry as a whole, regardless of project

magnitude, has a serious issue with cost overruns (Mahamid and Amund, 2012). An analysis of 169 road building projects in the West Bank of Palestine found that 76 percent under-estimated their costs (negative deviation) and 24 percent over-estimated them (positive deviation). Pricing increases are one cause of price discrepancies (Omoregie and Radford, 2006). In highway construction projects in Bahrain, frequent change orders, inexperience, and a lack of communication with suppliers were identified as the primary causes of cost deviations (Ahmed et al., 2014), whereas in Afghanistan, corruption, delays in progress payments by clients, difficulties in financing projects by contractors, security concerns, and client-requested changes were identified as the primary causes of cost deviations (Abbas & Painting, 2016). It was shown that road construction price variations are affected by a variety of physical factors (Mahamid and Amund, 2012). Variations in Egypt's construction costs were broken down into their respective root causes and categorized as either "owner originated," "designer originated," "contractor originated," or "miscellaneous" (Aziz, 2013). Factors related to contractor site management, design and documentation, financial management, Information communication and technology, labor management, material and machinery, and project management and contract administration were identified as the most common causes of cost overruns in large construction projects in Malaysia in 2013 (Rahman et al., 2013). It has been demonstrated that there are regional variances in the extent to which prices can vary (Odeck, 2004). After analyzing the final costs of eight separate projects in Iraq, Al-Agele and Al-Hassan (2016) identified acceptance of the lowest offers, insufficient planning, and delayed cash flows by owners as three of the sixteen variables responsible for cost variances in construction work in Iraq. As with their results, Ahmed et al (2014). According to Oguya and Muturi (2016), the main determinants determining the outcomes of road projects in Kenya's dry and semi-arid regions are the competency of contractors, the financial management of construction parties, the timely availability of construction resources, and disputes. Whereas Alinaitwe et al. (2013) looked into the issue and found that the main causes of construction delays and cost overruns in Nigeria were changes to the scope of work, delayed payments, poor monitoring and control, a high cost of capital, and political instability. Delays in paying contractors, delays in decision making, and a shortage of supplies and equipment are only some of the problems that Otim et al. (2011) identified as impediments to effective cost management in building projects.

## ROUTINE UPKEEP OF ROADS

To preserve a road, its buildings, and property inside the road's borders in as close to their original, as-built or restored state as feasible, various interventions and/or activities are performed under the umbrella term of "road maintenance" (World Bank, 2005). Road reserve, formation width, road surface, carriage way, road shoulders, gravel pavement, subgrade surface, and road drains and drainage structures are the primary components of an unpaved road (MoWT Technical Manual, 2004). They need be kept in excellent condition by maintenance interventions, which may be divided into the categories of routine, periodic, and emergency. This study centered on the topic of using contractors for routine maintenance of unpaved roads, specifically with regards to the subgrade, gravel pavement, and drainages. New road building projects, whether paved or unpaved, accounted for the bulk of the evaluated literature's focus on cost overruns. Although Nigeria is now facing difficulties in maintaining its unpaved roads, little is known about the major reasons of cost variations in unpaved road construction. This study was conducted in response to the aforementioned knowledge gap; the results were used to guide the creation of a model that might aid in the enhancement of the cost performance of unpaved road maintenance projects across Nigeria.

## METHODOLOGY

Case study research was used to examine the factors at play at UNRA Stations. Methods including both quantitative and qualitative data analysis can be integrated into case studies (Zainal, 2007). The research used both quantitative and qualitative methods. Since the study's primary goal was to identify the variables that affect the financial outcomes of road maintenance projects at UNRA Stations, a quantitative strategy was used for this investigation. The quantitative method was chosen for this investigation because it permits the collection of numerical data on observable individual behavior of samples and their subsequent statistical analysis (Amin, 2005). To fill up the gaps left by the quantitative method, the study also employed a qualitative research strategy. The 32 participants in the study all had engineering degrees and included 4 Station Managers, 12 Maintenance Engineers, and 16 Maintenance Technicians from UNRA. All of the projects considered were carried out by means of contracting, with maintenance periods ranging from one to three years. After two decades of insurgencies in the region, authorities abandoned maintenance of most road network facilities, therefore the northern part of Nigeria was chosen specifically because of the high priority placed on infrastructural development and maintenance there. UNRA was also chosen on purpose because they are the organization in charge of maintaining the country's primary transportation infrastructure: the roads. But the research roads were chosen because of the contracted-out maintenance interventions. Secondary data were gathered by document analysis and the use of closed-ended questions.

## STATISTICS GATHERING

Questionnaires were utilized in the study because they allow researchers to get information from a sizable sample of participants in their own environments. Amin (2005) proposed it, and it's not just efficient but also inexpensive. In addition to allowing respondents to share their ideas and opinions without the fear of being attacked, questionnaires also allow busy respondents to fill them out at their convenience (Oso & Onen, 2008:18). Questionnaires were utilized to gather primary data for this investigation. The purpose of the survey's closed-ended questions was to facilitate speedy decision-making on the part of respondents, while the researcher's use of predetermined categories simplified data coding and reduced room for mistake in analysis, as noted by Sekaran (2003). Every effort was made to ensure that data gathering was conducted in an ethical manner.

## HOW RELIABLE THE DATA IS?

Validity was achieved by having three (3) experts review and rate the usefulness of each item on the sample questionnaires created for the study. Two (2) Station Managers and a Maintenance Engineer made up the group of specialists. These people were chosen with care because of their assumed expertise in the area being researched. Twenty-five out of the survey's thirty-three questions were marked as being important in determining the origins of cost discrepancies. Experts were asked to rate the importance of each item on the study instrument, and then a content validity index (C.V.I.) was calculated using the formula (1)

$$CVI = \frac{No.items\ \ declared\ \ relevant}{Total\ \ no.items}$$
$$= 25\ /33$$
$$= 0.76 \qquad (1)$$

According to what Amin (2005) proposes, a CVI of 0.7 or more is OK. As recommended by Mugenda and Mugenda (1991), we only pre-tested 10% of responders. To ensure the reliability of the instrument, the researcher employed a subset of the whole sample size (n = 3) to conduct pilot

tests. The CVI in this example was calculated to be 0.76, which is deemed to be high enough to produce trustworthy outcomes.

## CONSISTENCY WITH PREVIOUS RESULTS

Ten percent of the total sample was given a preliminary test as a last-stage reliability check. The Cronbach Alpha Coefficient Estimating the questionnaire's reliability required the use of a computer algorithm that produced coefficients. Cronbach's alpha values above 0.6 are considered satisfactory (Sekaran, 2003). If the value of Cronbach's alpha is less than 0.3, it indicates that the data are unreliable and should not be used. If the Cronbach's is above .80, however, when dependability is measured at 0.7, it is quite high (Rahman et. al., 2013). According to the tabulated data, the responses were considered credible.

**Table 1.** Conclusions from the Study's Reliability Tests

| **Factors** | **Cronbach Alpha coefficient** | **Number of items** |
|---|---|---|
| Site management considerations for contractors | 0.7134 | 6 |
| Relevant aspects of design and documentation | 0.7803 | 5 |
| Financial management factors | 0.7358 | 6 |
| Things connected to the Internet and other forms of electronic communication | 0.7451 | 3 |
| Constraints in labor management | 0.7762 | 5 |
| Considerations involving tools and equipment | 0.7242 | 4 |
| Aspects of Project Management and Contract Management | 0.7249 | 4 |
| **Average** | **0.7490** | |

Source: *Primary data (2019)*

Table 1 shows that the Cronbach Alpha Coefficient for the study instruments was 0.749, indicating that the results of the pilot study were consistent with this finding.

## ANALYZING THE DATA

Since SPSS version 21 is the gold standard for interpreting research data, it was used to examine the results of the questionnaires (Sekaran, 2013). Both descriptive and inferential statistics were used in the analysis. Counts, percentages, the mean, and the standard deviation were all employed as descriptive statistics. Scaled variables from a self-developed questionnaire were used to collect information regarding the respondent's beliefs and perspectives on the factors influencing cost performances. Respondents' opinions on the research variables were gauged using a Likert scale, with 1 = not at all, 2 = to a very small amount, 3 = to a moderate extent, 4 = to a large extent, and 5 = to a very large extent.

## STUDY FINDINGS AND DISCUSSION

Table 2 shows that out of the 32 questionnaires sent out, 21 were returned for analysis, for a 65.6% response rate. The findings from this survey on improving the cost-effectiveness of maintenance projects for Nigeria's unpaved roads were typical of those found when looking at the Nigeria National Roads Authority as a case study.

**Table 2.** Responses Based on Number of Respondents

| **Station** | **Number of Respondents** | **Percentage Response rate (%)** |
|---|---|---|
| Gulu | 6 | 28.6 |
| Kitgum | 4 | 19 |
| Moyo | 3 | 14.3 |
| Arua | 8 | 38.1 |
| **Total** | **21** | **100** |

*Source: Primary Data, (2019)*

### Cost-Effectiveness Analyses of Road Maintenance Projects

Arua UNRA station had the most replies (8, or 38.1%). Gulu UNRA station contributed the second-most responders (6 or 28.6% of the total) from any other location. Four responders (19% of total) came from the Kitgum UNRA station. Moyo UNRA station only contributed 3 responders, or 14.3% of the total.

According to Table 3, 11 (52.4%) of the respondents worked as Maintenance Technicians, 7 (33.3%) worked as Maintenance Engineers, and the remaining 3 (14.3% of the total) worked as Station Managers. These findings demonstrate that information was gathered from a sample of respondents thought to be competent about road maintenance activities, which bodes well for the credibility of the study's conclusions.

**Table 3.** Rates of Participation According to Respondent Occupations

| **Title** | **Number of respondents** | **Percentage response rate (%)** |
|---|---|---|
| Station Managers | 3 | 14.3 |
| Maintenance Engineers | 7 | 33.3 |
| Maintenance Technicians | 11 | 52.4 |
| **Total** | **21** | **100** |

*Source: Primary Data, (2019)*

**Table 4.** Experiences of Respond

| **Experience** | **Number of respondents** | **Percentage response rate (%)** |
|---|---|---|
| 1-5 years | 10 | 48 |
| 6-10 years | 6 | 28 |
| 11-15 years | 4 | 19 |
| 16-20 years | 1 | 5 |
| **Total** | **21** | **100** |

*Source: Primary Data, (2019)*

Table 4: shows that of the total number of respondents, 48 percent had worked for UNRA in road maintenance capacities for between one and five years. Six respondents (or 28% of the total) have between 6 and 10 years of professional experience. Additionally, 4 respondents, accounting for 19% of the total number of respondents, had between 11 and 15 years of experience, and 1 respondent, accounting for 5% of the total number of respondents, had between 16 and 20 years of experience. Thus, the study's findings are not skewed by the distribution of responders across duty stations, titles, or levels of expertise with road maintenance.

## CLASSIFICATION OF CONTRIBUTING FACTORS

The found elements that impact cost variances in paved road maintenance works were given a score between 1 and 5 on a 5-point likert scale, with 1 indicating "Not at All," 2 "Small Extent," 3 "Moderate Extent," 4 "Large Extent," and 5 "Very Large Extent." Note that the scores of NA (Not at all) and SE (Small extent) are aggregated to reflect a minor impact, whereas the scores of LE (large extent) and VLE (Very Large Extent) are grouped to represent respondents who feel that a factor greatly influences cost variations. Furthermore, ME (Moderate Extent) stands in for respondents who were unsure whether or not the element influenced cost variations. If a factor's score was below 3.00 on the Average Mean, it was seen as having a low impact on the cost deviation, while a score above 3.00 was interpreted as having a high impact on the cost deviation.

## CONTRACTORS' SITE MANAGEMENT CONSIDERATIONS

From the results in Table 5, we may infer that most respondents evaluated inadequate site management and supervision as the fifth least important factor in cost variation, with a mean score of 2.86. With a mean score of 3.10, the majority of respondents seem to agree that poor planning and scheduling are key contributors to cost overruns. This is consistent with the results found by Al-Agele and Al-Hassan (2016) and Otim and Alinaitwe (2017). With a mean of 2.81, most respondents indicated that insufficient experience was the sixth most significant factor in cost deviation; with a mean of 3.19, most respondents indicated that inadequate time and cost estimates were the second most significant factor in cost deviation. It became out that the majority of contractors had significantly overestimated their costs. Similar results were found by Ahmed et al. (2014), Al-Agele and Al-Hassan (2016), Aziz (2013), and Omoregie and Radford (2016); the mean score of 2.95 indicated that most respondents believed that mistakes during construction had a negligible influence on cost deviation and was ranked in fourth place; the mean score of 3.24 indicated that most respondents believed that inadequate monitoring and control had a strong influence on cost deviation and was ranked in first place. The majority of contractors were found to be lacking in site monitoring and management. Low productivity from both employees and machinery causes a rise in the expenses of both payroll and rental machinery, not to mention the price of gasoline and lubricant. These results are consistent with those obtained by Apolot et al (2013). The overall Average Means was 3.025, indicating that most respondents thought that Contractors Site Management was a significant factor in the cost variance of Road Maintenance Projects within the Nigeria National Roads Authority.

**Table 5.** Descriptive Statistics of Contractor's Site Management

| No. | Details | NA(1) | SE(2) | ME(3) | LE(4) | VLE (5) | Total | Mean | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| **1** | Inadequate monitoring and control | **0** 0% | **7** 33.3% | **4** 19% | **8** 38.1% | **2** 9.5% | **21** 100% | 3.24 | 1 |
| **2** | Inadequate time and cost estimate | **1** 4.8% | **3** 14.3% | **9** 42.9% | **7** 33.3% | **1** 4.8% | **21** 100% | 3.19 | 2 |
| **3** | Inadequate planning and scheduling | **0** 0% | **6** 28.6% | **7** 33.3% | **8** 38.1% | **0** 0% | **21** 100% | 3.10 | 3 |
| **4** | Mistake during construction | **2** 9.5% | **5** 23.8% | **6** 28.6% | **8** 38.1% | **0** 0% | **21** 100% | 2.95 | 4 |
| **5** | Poor site management and supervision | **2** 9.5% | **7** 33.3% | **4** 19% | **8** 38.1% | **0** 0% | **21** 100% | 2.86 | 5 |
| **6** | Lack of experience | **3** 14.3% | **6** 28.6% | **5** 23.8% | **6** 28.6% | **1** 4.8% | **21** 100% | 2.81 | 6 |

**Average Means: 3.025**
**Key: NA = Not at All, SE = Small Extent, ME = Moderate Extent LE = Large Extent and VLE = Very Large Extent**

**Source:** *Primary Data, (2019)*

**Table 6.** Descriptive statistics of Design and Documentation

| No. | Details | NA(5) | SE(4) | ME(3) | LE(2) | VLE(1) | Total | Mean | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| **1** | Incomplete design at the time of tender | **2** 9.5% | **5** 23.8% | **6** 28.6% | **5** 23.8% | **3** 14.3% | **21** 100% | 3.10 | 1 |
| **2** | Frequent design changes | **1** 4.8% | **8** 38.1% | **4** 19% | **5** 23.8% | **3** 14.3% | **21** 100% | 3.05 | 2 |
| **3** | Mistakes and errors in designs | **0** 0% | **9** 42.9% | **5** 23.8% | **5** 23.8% | **2** 9.5% | **21** 100% | 3.00 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **4** | **4** Poor designs and delays in design 19% | **3** 14.3% | **5** 23.8% | **7** 33.3% | **2** 9.5% | **21** 100% | 3.00 | 3 |
| **5** | **4** Delay preparations and approval of drawings 19% | **4** 19% | **3** 14.3% | **9** 42.9% | **1** 4.8% | **21** 100% | 2.95 | 4 |

**Average Means: 3.02**

**Key: NA = Not at All, SE = Small Extent, ME = Moderate Extent LE = Large Extent and VLE = Very Large Extent**

**Source:** *Primary Data, (2019)*

Table 6's mean score of 3.05 suggests that most respondents consider frequent design modifications to be a significant factor in cost variation. These results are consistent with those of Aziz (2013), Enhassi et al. (2010), Omoregie and Radford (2006), and Otim and Alinaitwe (2013); a mean of 3.00 implied that most respondents believed that mistakes and errors in designs had a strong influence on cost deviation, ranking in third place; a mean of 3.10 implied that most respondents believed that incomplete design at the time of tender had a strong influence on cost deviation, ranking in first place. Findings are consistent with those of Chilese and Berko (2010) and Enhassi et al. (2010); a mean of 3.00 implied that most respondents believed that poor designs and delays in design had a strong influence on cost deviation, placing it in third place; a mean of 2.95 implied that most respondents believed that delay preparations and approval of drawings had a negligible influence on cost deviation. With a mean score of 3.02, most respondents clearly identified factor design and documentation as a key driver of cost variation on Road Maintenance Projects within the Nigeria National Roads Authority.

**FINANCIAL MANAGEMENT FACTORS**

**Table 7.** Descriptive statistics of Financial Management

| No. | Details | NA(5) | SE(4) | ME(3) | LE(2) | VLE(1) | Total | Mean | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| **1** | Contractual claim such as extension of time with claim | **0** 0% | **3** 14.3% | **8** 38.1% | **8** 38.1% | **2** 9.5% | **21** 100% | 3.43 | 1 |
| **2** | Delay in payment to supplier/ contractor | **1** 4.8% | **4** 19% | **6** 28.6% | **8** 38.1% | **2** 9.5% | **21** 100% | 3.29 | 2 |
| **3** | Financial difficulties of owners | **0** 0% | **5** 23.8% | **7** 33.3% | **8** 38.1% | **1** 4.8% | **21** 100% | 3.24 | 3 |
| **4** | Cash flows and financial difficulties faced by contractors | **2** 9.5% | **4** 19% | **5** 23.8% | **9** 42.9% | **1** 4.8% | **21** 100% | 3.14 | 4 |
| **5** | Delays in progress payments by owners | **1** 4.8% | **4** 19% | **9** 42.9% | **5** 23.8% | **2** 9.5% | **21** 100% | 3.14 | 4 |
| **6** | Poor financial control on site | **1** 4.8% | **4** 19% | **9** 42.9% | **6** 28.6% | **1** 4.8% | **21** 100% | 3.10 | 5 |
| | **Average Means: 3.223** | | | | | | | | |
| | **Key: NA = Not at All, SE = Small Extent, ME = Moderate Extent LE = Large Extent and VLE = Very Large Extent** | | | | | | | | |

**Source:** *Primary Data, (2019)*

According to Table 7, a mean of 3.14 implied that majority of the respondents believed that *cashflow* Cost overruns, and the fourth most influential factor was the financial troubles that many contractors were experiencing. The result is consistent with research by Al-Agele and Al-Hassan (2016), who found that a mean of 3.10 indicated that most respondents considered that weak financial control on site had a considerable effect on cost variation and was rated 5th. In line with the research of Oguya and Muturi (2016), we found that respondents placed financial difficulties of owners as the third most important factor in cost deviation (mean = 3.24) in their responses. A mean of 3.14 indicates that most respondents thought that delays in progress payments by owners had a considerable effect on cost deviation, which is consistent with the findings of Tarimo (2017). Consistent with the findings of Alinaitwe et al. (2013) and Otim et al. (2011), the majority of respondents (as shown by a mean score of 3.29) stated that late payments to suppliers and contractors were a key contributor to cost overruns (ranking second). Across all of the analyzed UNRA sites, there was a delay in contractor payments. Due to the delays, contractors often file extra claims; with a mean score of 3.43, the majority of respondents ranked contractual claim, such as an extension of time with a claim, as the most influential factor in cost variation. Generally, the

total Average Means was 3.223 signaling that most of the respondents considered that the factor Financial Management is one of the primary elements that impact cost variance within Road Maintenance Projects in Federal Roads Maintenance Agency (FERMA) (FERMA)

**CONSTRAINTS LINKED TO INFORMATION AND COMMUNICATION TECHNOLOGIES**

Based on the data, we can infer that most respondents (as indicated by a mean score of 2.57) think that poor coordination between parties has little to no impact on cost deviation; that most (as indicated by a mean score of 2.57) think that slow information flow between parties has little to no impact on cost deviation; and that most (as indicated by a mean score of 2.71) think that lax oversight has little to no impact on cost deviation. The average mean score was 2.62, suggesting that most respondents did not consider ICT to be a significant influence in the cost variation of Road Maintenance Projects managed by the Nigeria National Roads Authority. From what we can see, contractors and UNRA personnel have open lines of communication and work together pretty well at all of the study's UNRA locations. Although this contradicts the results obtained by Rahman et al (2013).

**FACTORS ASSOCIATED WITH LABOR MANAGEMENT**

The results are consistent with those found in other countries by Rahman et al. (2013): a mean of 3.43 indicates that most respondents feel that high labor costs are a substantial contributor to cost divergence, and so are rated first. Consistent with the research by Rahman et al. (2013) in Malaysia, where a mean of 3.05 indicated that most respondents thought that labor absenteeism had a considerable effect on cost variation and placed third, our data show that this factor is indeed important. Similar results were found by Rahman et al (2013). The average mean score was 3.334, indicating that most respondents agreed that labor management is a significant contributor to budget overruns on Nigeria National Roads Authority road maintenance projects.

**RELEVANT ASPECTS OF MATERIALS AND EQUIPMENT**

Results from Table 8 indicate that most respondents (mean = 4.00) consider changes in material coststo be the most influential factor in cost variance. These results are consistent with those found in other nations by Rahman et al. (2013), Ahmed et al. (2014), and Omoregie and Radford (2015). (2016). Negative cost deviations, resulting in poor cost performance, were allegedly highly widespread in the region, and the major cause was the fluctuation of material costs such cement, steel, gasoline, lubricants, and gravels. Material shortages were ranked third by respondents, with a mean of 3.81, consistent with the findings of Ahmed et al. (2014), Omoregie and Radford (2016), and Otim et al. (2013); late delivery of materials and equipment was ranked fourth by respondents, with a mean of 3.67, consistent with the findings of Omoregie and Radford (2016) and Otim et al. (2013). Similarly, this is consistent with the results found by Alinaitwe et al. (2013), Enhassi et al. (2010), Otim et al. (2013), and Tarimo (2017). When asked what they thought contributed most to cost variance in road maintenance projects under the Nigeria National Roads Authority, the majority of respondents (mean = 3.835) cited material and machinery. For nine of the fourteen projects, the negative cost variations in wearing course and shoulder costs were attributed to the effect of materials and equipment components.

**ISSUES IN PROJECT MANAGEMENT AND CONTRACT MANAGEMENT**

According to Table 9, the average score of 3.14 indicates that most respondents (or the top four) consider poor project management to be a substantial contributor to cost variation. This result is consistent with the research of Al- Agere and Al-Hassan (2016) and Omoregie and Radford (2006);

a mean of 3.67 indicates that the majority of respondents identified a change in the project's scope as the most important factor influencing cost variation. Ahmed et al. (2014), Alinaitwe et al. (2013), Aziz (2013), Chilese and Berko (2010), and Niazi and Painting (2014) have found similar things in different nations, so ours isn't an outlier (2017). With a mean score of 3.33, the majority of respondents indicated that they viewed delays in decision making as having a considerable effect on cost deviation. Findings by Omoregie and Radford (2006) and Otim et al., (2013) are consistent with this one; a mean of 3.43 indicates that most respondents thought that erroneous quantity take off had a considerable effect on cost deviation and was thus rated in second place. This result is in line with those of Aziz (2013) and Omoregie and Radford (2017). (2006).

**Table 8.** Descriptive statistics of Material and Machinery

| No. | Details | NA(5) | SE(4) | ME(3) | LE(2) | VLE(1) | Total | Mean | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| **0 1** | Fluctuation of prices of materials | **1** 4.8% | **3** 14.3% | **12** 57.1% | **5** 23.8% | **21** 100% | 4.00 | 1 | 0% |
| **0 2** | Equipment availability and failure | **2** 9.5% | **2** 9.5% | **14** 66.7% | **3** 14.3% | **21** 100% | 3.86 | 2 | 0% |
| **0 3** | Shortages of materials | **1** 4.8% | **4** 19% | **14** 66.7% | **2** 9.5% | **21** 100% | 3.81 | 3 | 0% |
| **0 4** | Late delivery of materials and equipment | **2** 9.5% | **5** 23.8% | **12** 57.1% | **2** 9.5% | **21** 100% | 3.67 | 4 | 0% |

**Average Means: 3.835**
**Key: NA = Not at All, SE = Small Extent, ME = Moderate Extent LE = Large Extent and VLE = Very Large Extent**

**Source:** *Primary Data, (2019)*

**Table 9.** Descriptive statistics of Project Management and Contract Administration

| No. | Details | NA(5) | SE(4) | ME(3) | LE(2) | VLE(1) | Total | Mean | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| **1** | Change in the scope of the project | **1** 4.8% | **3** 14.3% | **2** 9.5% | **11** 52.4% | **4** 19% | **21** 100% | 3.67 | 1 |
| **2** | Inaccurate quantity take off | **2** 9.5% | **3** 14.3% | **4** 19% | **8** 38.1% | **4** 19% | **21** 100% | 3.43 | 2 |
| **3** | Delays in decision making | **1** 4.8% | **6** 28.6% | **3** 14.3% | **7** 33.3% | **4** 19% | **21** 100% | 3.33 | 3 |
| **4** | Poor project management | **2** 9.5% | **7** 33.3% | **0** 0% | **10** 47.6% | **2** 9.5% | **21** 100% | 3.14 | 4 |

**Average Means: 3.393**

**Key: NA = Not at All, SE = Small Extent, ME = Moderate Extent LE = Large Extent and**
**VLE = Very Large Extent**

**Source:** *Primary Data, (2019)*

To sum up, it's clear that when it comes to allocating funds for road maintenance, each of these variables has to be given the utmost consideration. To put it another way, this will help reduce the overall cost of paving and repairing roads. However, the study also found that ICT had no effect on cost variances across UNRA road projects, and hence could be disregarded when calculating maintenance road project costs.

**Table 10.** Overall Ranking of Factors Affecting Cost Performances

| Factor | Mean | Ranking |
|---|---|---|
| Material and machinery related | 3.835 | 1 |
| Project management and contract administration related | 3.393 | 2 |
| Labour management related | 3.334 | 3 |
| Financial management related | 3.223 | 4 |
| Contractor site management related | 3.025 | 5 |
| Design and documentation related | 3.02 | 6 |

Source: Primary Data, (2019)

## RESULTS AND SUGGESTIONS

Inadequate evaluation of factors impacting cost variances is a common cause of error in unpaved road maintenance project cost estimation or computation. Major elements that impact the cost performances of road maintenance projects include material price fluctuations, equipment availability and breakdown, and equipment failure. The parties involved in road maintenance projects in UNRA are well-coordinated, communicate well, and share information quickly. Cost performance elements that cause negative cost deviations in the analyzed projects may be mitigated by allocating more time for planning and budgeting for Term / Periodic maintenance of unpaved roads. When developing and executing project budgets, policymakers, organization leaders, and project implementers would do well to pay more attention to the elements impacting the cost performance of road maintenance projects. The study authors suggest more investigation into the correlation between project management approaches and budget overruns.

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