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Highlights

Depelction in Crude Oil

Duplication and Restoration

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Adopting Geographic Information System (GIS) for Land Valuation for Infrastructure Development

By Subash Ghimire

Kathmandu University

Abstract- In many developing countries, infrastructure development projects are not sustainable due to land valuation conflicts. Mostly, land valuers have assessed land value based on their experiences and without inference. They carry out the subjective land valuation. The detailed spatial analysis of the parcel is not considered for land valuation. The main objective of this study is to analyze the use of GIS in land valuation for land acquisition in infrastructure development. The study is carried out by a literature review with secondary data and primary data. The result shows that adopting GIS for land valuation is necessary and very important for establishing a realistic land valuation system. The model uses various criteria for weighted land valuation and follows an analytical hierarchical process.

Keywords: *geographical information system, land acquisition, land valuation.*

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Adopting Geographic Information System (GIS) for Land Valuation for Infrastructure Development

Subash Ghimire

Abstract- In many developing countries, infrastructure development projects are not sustainable due to land valuation conflicts. Mostly, land valuers have assessed land value based on their experiences and without inference. They carry out the subjective land valuation. The detailed spatial analysis of the parcel is not considered for land valuation. The main objective of this study is to analyze the use of GIS in land valuation for land acquisition in infrastructure development. The study is carried out by a literature review with secondary data and primary data. The result shows that adopting GIS for land valuation is necessary and very important for establishing a realistic land valuation system. The model uses various criteria for weighted land valuation and follows an analytical hierarchical process.

Keywords: geographical information system, land acquisition, land valuation.

I. INTRODUCTION

There is no official land valuation system in Nepal except Adhoc land valuation for compensation during land expropriation (Tuladhar, 2004) and is still the case in Nepal. The unfair procedure of land valuation and management, delayed payment of compensation, and inequitable compensation can reduce tenure security, harm public faith, and confidence in government and the rule of law. When this process is done poorly, it may leave affected people homeless, farmless, and jobless with a feeling that they suffered a grave injustice. Appeals against unfair procedure may delay the project and increase project costs that exceed the previously estimated costs (FAO, 2008). The land conflicts, such as low compensations, unfair compensations, etc. arise due to lack of reliable, consistent, transparent and efficient land valuation model for land acquisition in infrastructure development. The detailed spatial analysis of the parcel is not considered for land valuation. The current land valuation for land acquisition in developing countries, such as Nepal is done conventionally as given in Equation 1 and Equation 2, therefore, is not based on its objective analysis of geographical location.

$$V_i = R * AREA_i \dots \dots \dots (1)$$

$$Value = \sum V_i \dots \dots \dots (2)$$

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Where, $AREA_i$ = Area of each parcels, Value=Total land value of each parcel, R = Rate of land and $i=1$ to n (number of parcels)

II. OBJECTIVE

The objective of the study is to develop the land valuation model by adopting GIS. To support the main objective, the following sub- objectives are formulated as.

- To analyses the criteria affecting land valuation for land acquisition in infrastructure development
- To integrate the knowledge of GIS in land valuation for land acquisition in infrastructure development

III. MATERIALS AND METHODS

The desk, and case study are followed for the research and desk study is followed by the scientific literature review in the field of geo-information science, and technology, land valuation and infrastructure development. The qualitative and quantitative research approaches were used to collect primary and secondary data in a case study area at Kathmandu Terai Fast Track Road Project in Makwanpur district, Chatiwan VDC of Nepal. Household survey, key informants' interviews, focus group discussion and field observation were conducted to collect primary data while the relevant documents such as detailed project report, property valuation document and spatial data (cadastral data, image etc.) was also collected for the study. The formula given by Glenn (1992) is used for calculating a sample of the respondents for the household data collection because it is very simple to understand, and calculate the sample.

IV. STUDY AREA

The location map of the case study area has been shown in Figure 1.

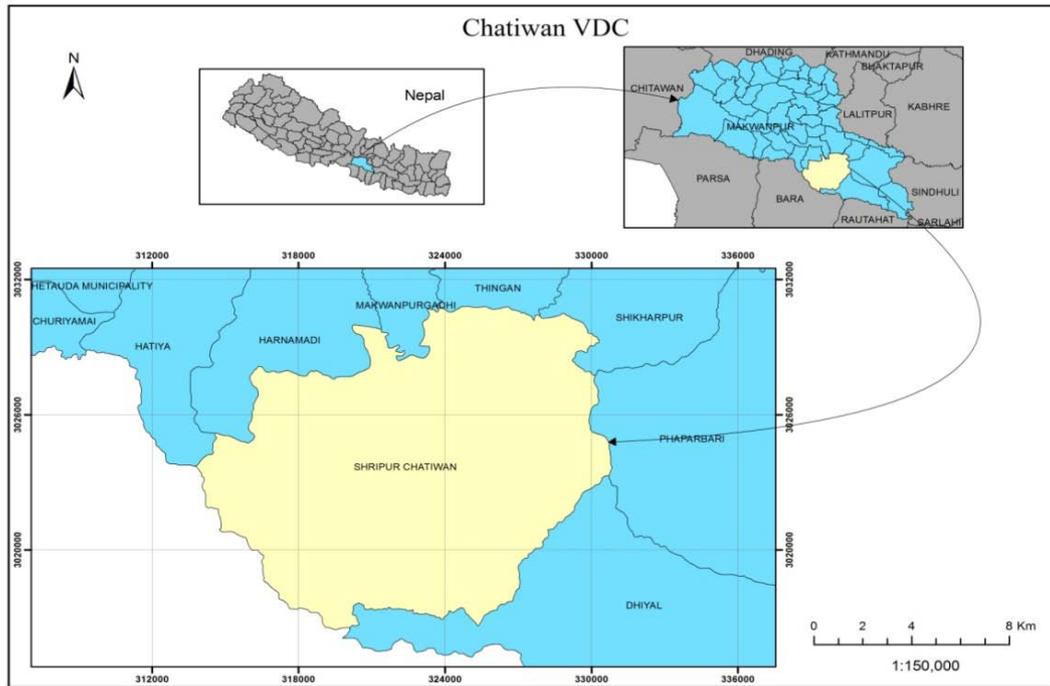


Figure 1: Location map of Chatiwan VDC

V. RESULTS

The results are discussed in following subsections

a) Weight allocated based on Analytic Hierarchy Process

Analytic Hierarchy Process is an effective tool for dealing with the complex decisions by setting priorities and makes the best decision. According to Saaty (2008), it is a theory of measurement through pair wise comparisons and depends on the judgments of experts to find out a priority. Pair wise comparisons are based on forming judgments between two particular

criteria rather than attempting to prioritize an entire list of criteria. Saaty (2008) has shown that weighting activities in multi-criteria decision-making can be effectively dealt with using the hierarchical structure and pair wise comparisons. An AHP aim is to obtain quantitative weights from qualitative statements on the relative performance of alternatives and the relative importance of criteria obtained from the comparison of all pairs of alternatives and criteria. As graduation scale for quantitative comparison of alternatives, the following numerical values are graduated as shown in Table 1.

Table 1: Graduation scale for quantitative comparison (Row vs Column)

Extremely less important	1/9
Very strongly less important	1/7
Strongly less important	1/5
Moderately less important	1/3
Equal important	1
Strong more important	3
Moderately more important	5
Very strongly more important	7
Extremely more important	9

Source: (Saaty, 2008)

AHP is working with the matrix comparing each criteria to each other. The pair wise comparisons of different criteria by its importance carried out from the response of different stakeholders in Fast Track Road Project, Chattiwan VDC are mentioned in Table 2. The criteria are chosen based on (Yomralioglu & Nisanci,

2004), (Koirala et al, 2015) and from primary data collection.

Table 2: Calculating Eigen vector

Land valuation criteria	Road	Slope	Built up	Natural environments	Soil type	5th root of product	Eigen vector
Road	1	1	3	5	5	2.371	0.360
Slope	1	1	3	5	5	2.371	0.360
Built up	0.333	0.333	1	3	3	0.998	0.160
Natural environments (River and forest)	0.2	0.2	0.333	1	1	0.419	0.060
Soil type	0.2	0.2	0.333	1	1	0.419	0.060
SUM	2.733	2.733	7.666	15	15	6.578	1.000
SUM*PV	0.983	0.983	0.830	1.157	1.157	5.110	

Table 3: Land valuation criteria & the Eigen vector and its weightage

S. No.	Land valuation criteria and Eigen vector	Weightage calculated from AHP
1	Road	0.36
3	Built up	0.16
2	Slope	0.36
4	Natural environments (River & forest)	0.06
5	Soil type	0.06

Similarly, the mathematical model for land valuation is:

$$V_i = R * AREA_i * \sum W_i \dots\dots\dots (3)$$

$$Value = \sum V_i \dots\dots\dots (4)$$

Where, AREA_i = Area of each parcel, W_i = Factor weight calculated from weighted overlay i=1 to n, Number of each parcel, R = (0.6* Market rate + 0.4* Government rate).....(5) and Value = Total land value of each parcel.

The governments valuation is taken from (Government of Nepal, 2017). The process and result of GIS overlay are shown in Figure 2 and Figure 3.



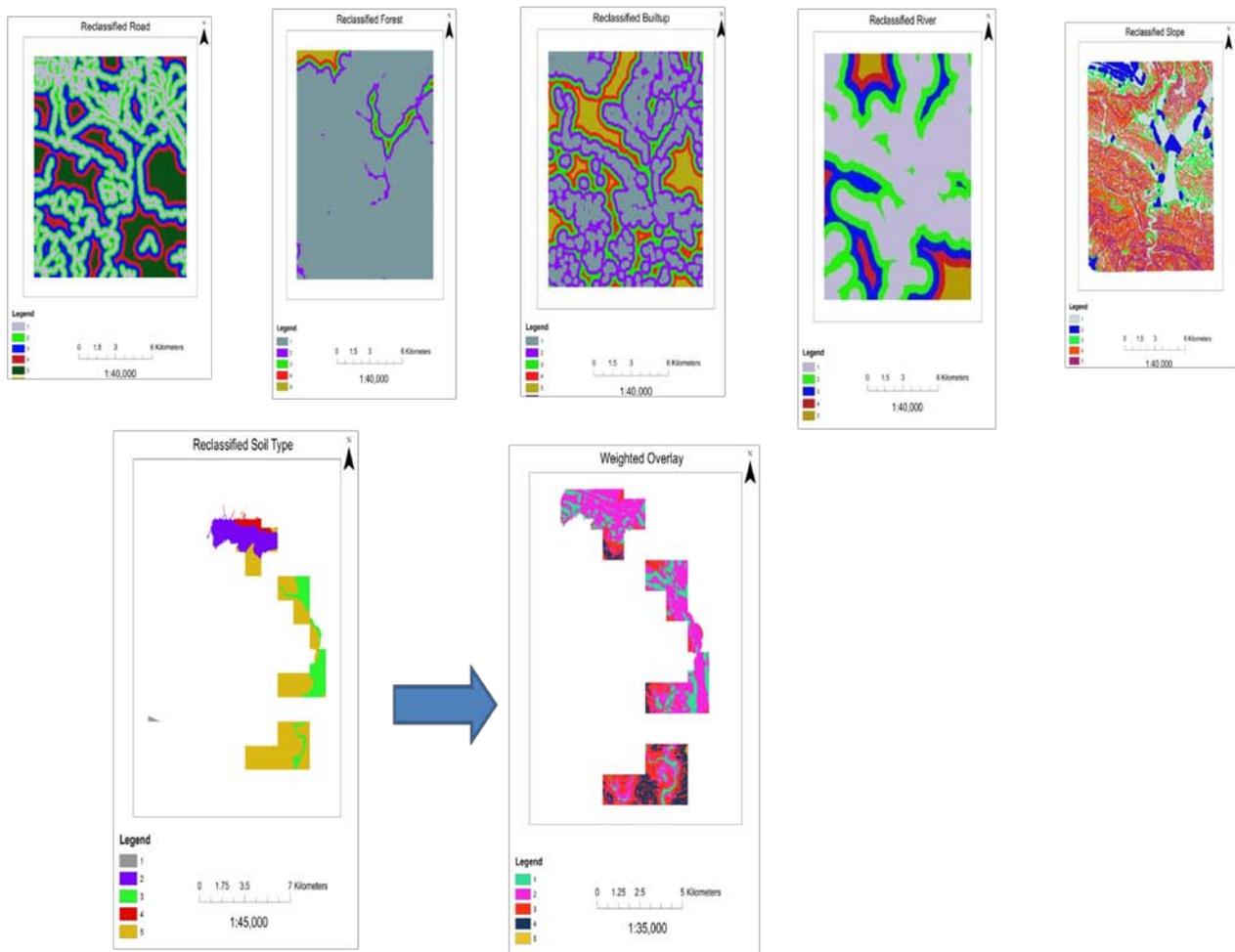


Figure 2: The process and result of GIS overlay

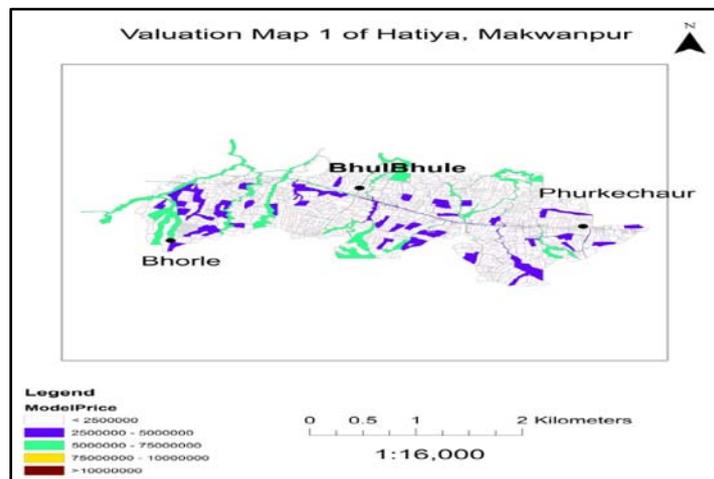


Figure 3: The valuation map of the study area

VI. CONCLUSION

An unrealistic land valuation system in infrastructure development generates conflicts during land acquisition and compensation. It is seen that there is dispute in the government land valuation and owner

demand of land price during the land acquisition process. Therefore, an appropriate land valuation model has been developed for fair land valuation. The integration of GIS and the AHP concept in the land valuation process is appropriate for land acquisition in infrastructure development. The model has used several



land valuation criteria and its weights to develop a land valuation model of land acquisition and compensation in infrastructure development. The input data are of different layers in a vector formats such as points, lines, or polygons. They are changed in raster format, and the criteria are used in the valuation process in proximity analysis. The AHP uses different combinations of criteria and weights to calculate for a combination for a weighted overlay of different criteria.

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Prediction of Soil Nitrogen Depelction in Crude Oil Contaminated Soil in Southern Nigeria

By N. L Nwakwasi, B. U Dike, E. U Nwakwasi, A. N. Nwachukwu,
H. U. Nwoke & J. C. Agunwamba

Federal University of Technology

Abstract- Oil spillage is a major environmental threat in southsouth of Nigeria where most of the oil exploration and exploitation activities take place. If this goes on unchecked or poorly managed, it will lead to the total annihilation of the ecosystem. The objective of this study is to develop a model for the prediction of soil nitrogen depletion in crude oil contaminated soil with time using regression analysis. Each sample containing 10kg of soil were artificially polluted with 0.5, 1.0, 1.5, 2.0, and 2.5 liters of crude oil (Bonny Light). The Soil Nitrogen concentrations were determined using standard methods. Results show that the concentration of residual soil nitrogen in the soil for all the volumes of crude oil introduced into the soil depleted significantly with time when compared to values obtained for the control sample. The residual concentration in the control soil sample was about three times higher than the concentration obtained for other samples. The results obtained from the derived model were very close to the experimental value. The model is suitable for determining Soil Nitrogen content in crude oil polluted sites.

Keywords: *crude oil, pollution, soil nitrogen, model, niger delta.*

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Prediction of Soil Nitrogen Depelction in Crude Oil Contaminated Soil in Southern Nigeria

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Abstract- Oil spillage is a major environmental threat in south-south of Nigeria where most of the oil exploration and exploitation activities take place. If this goes on unchecked or poorly managed, it will lead to the total annihilation of the ecosystem. The objective of this study is to develop a model for the prediction of soil nitrogen depletion in crude oil contaminated soil with time using regression analysis. Each sample containing 10kg of soil were artificially polluted with 0.5, 1.0, 1.5, 2.0, and 2.5 liters of crude oil (Bonny Light). The Soil Nitrogen concentrations were determined using standard methods. Results show that the concentration of residual soil nitrogen in the soil for all the volumes of crude oil introduced into the soil depleted significantly with time when compared to values obtained for the control sample. The residual concentration in the control soil sample was about three times higher than the concentration obtained for other samples. The results obtained from the derived model were very close to the experimental value. The model is suitable for determining Soil Nitrogen content in crude oil polluted sites.

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I. INTRODUCTION

In Nigeria, oil spillage in the Niger Delta region, especially on Agricultural Lands, has been a significant issue of concern both to the government and the people in the area. The outcome of this research work can serve as a vital tool in resolving problems associated with oil pollution and bioremediation of affected lands. Oil has hostile effects on the physicochemical properties of soils, plant and animal community. Beyond 3% concentration, crude oil has been reported to be increasingly deleterious to soil biota and crop growth (Osuji et al., 2006). Unfortunately, available data to manage the ecological spoils of the Niger Delta Region has been found inadequate. Though existing data has found various uses in the Post spill management program of the affected ecosystem and communities, recent advances have shown that such data has been specific to particular sites and incidences, predominantly because of the nature of the crude oil contaminant and possible environmental modifications (Osuji et al., 2006).

Soil fertility is the result of the interaction between the biological, chemical, and physical properties of soil due to soil type, land use, and effects of climate. Soil chemical properties are related to the supply of plant nutrients that is essential for plant growth. Generally, oil affects the physicochemical properties in plant communities in soil. Oil spill reduces crop yield, land productivity, and grandly decreases farm income. Observation shows that a 10% increase in oil spill reduces crop yield by 1.3% while farm income plummeted to 5% (Odjuwuederhie et al., 2006). According to Shell 1996, half of the volume of the crude oil spill is due to the corrosion of aging facilities mostly flow line. Another 21% happens in the course of operations to produce oil, while about 28% is due to sabotage. The remaining 1% is mainly due to engineering and drilling activities. There have been numerous reports on the impact of crude oil spill on farmland in the Niger Delta region (Osuji and Nworie, 2007; Eneje et al., 2012; Onwuka et al., 2012, Uzoho et al., 2007 and Choron et al., 2010).

Mathematical Models can be used to predict the impacts of crude oil spill on the physicochemical properties of soil to reduce the complaints about polluted farmlands. In predictive modeling, data are collected for relevant predictors (variables that are likely to influence future behavior or results) followed by a model formulation, then predictions are made, and the model is validated. The different approaches to deciding model validity include conceptual model validation and operational validation (Nwaogasi, 2006). A case in which n- control variables X_1, X_2, X_3 to X_n are involved a corresponding linear multiple regression equation is of the form

$$Y = A_0 + A_1X_1 + A_2X_2 + A_3X_3 \dots + A_nX_n \quad 1.0$$

The regression coefficient for A_0, A_1 to A_n can be obtained using Panel Data Computer Software.

II. METHODS

They carried out the study over a period of sixteen (16) weeks using different containers measuring 17cm (height) by 18.5cm (diameter). The study area is the research farm of the Federal University of Technology Owerri, located in Owerri, Imo State Nigeria. The soils are derived from coastal plain sands called acid sands – Benin formation (Orajaka, 1975). Samples measuring 10kg polluted soil were placed in each of the

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containers and exposed to the same atmospheric and environmental conditions.

Table 1: Layout of experimental design

Polluted Soil Sample	A	B	C	D	E	F
Vol. of crude oil in Liters/kg of soil	0	0.05	0.10	0.15	0.2	0.25
Variable monitored for ABCDEF was:	Soil Nitrogen					

The soil used in the study was collected from the Federal University of Technology Owerri (FUTO) Research Farm from 15cm to 20cm depth with a shovel. It was measured into containers and taken to the laboratory for treatment (greenhouse treatment).

The soil was air-dried for two weeks and sieved through 2.0cm sieve. The soil samples labeled B, C, D, E, F, each weighing 10kg were polluted with 0.5, 1.0, 2.0, 2.5 liters of crude oil (Bony light), respectively, and thoroughly mixed on a polythene sheet and put in a labeled container.

Sample A was not polluted and was used as the control. To maintain the moisture content of the soil, 50cl of water was sprinkled on each polluted soil sample at two weeks intervals.

The polluted samples were allowed to stay 14 days before the commencement of analysis. The representative samples from (A, B, C, D, E, F) containers were taken at two weeks intervals to the soil science laboratory of Department of Crop, Soil and Pest Management, School of Agriculture and Agricultural Technology, FUTO for analysis to determine the fate of soil nitrogen nutrient with time at various levels of pollution with crude oil. The concentration remaining after 14, 28, 42, 56, 70, 84, 98 and 112 days intervals were obtained.

Ten grams (10g) of air-dried soil sample was introduced into a dry 500ml macro-kjeldahl flask, and 20ml of distilled water was added and allowed to stand for 30 minutes after a little swirling. 30ml of concentrated. H₂SO₄ was annexed into the mixture and heated at low heat at the digestion stand. The mixture was allowed to boil for five hours. The digest was transferred carefully to a clean 750ml flask, and 50ml of H₃BO₃ indicator solution was added and placed under the condenser of the distillation apparatus. As distillation commenced, the condenser was kept cool below 30°C, allowing sufficient cold water to flow through and to regulate heat to minimize fronting and prevent suck-back. 150ml distillate was collected, and the distillation process was stopped. The Nitrogen (NH₄-N) in the distillate was determined by titrating 0.01N standard HCl

at 0.1ml intervals, and as the color changes from green to pink. The percentage of Nitrogen (%N) content of the soil was read and recorded. This process was repeated for various levels of crude oil pollution for the soil samples.

The Panel Data Computer Software called Stata 13 version was used to obtain the regression coefficients B₀, B₁, B₂, B₃ and B₄ and the model equation for soil nitrogen using the data obtained from the laboratory. The model equation for the soil nitrogen is expressed as:

$$Y_{it} = B_0 + B_1 C_{vit} + B_2 T_{it} + B_3 T_{it}^2 + B_4 \sqrt{C_{vit}} + U_{it} \quad (2.0)$$

Where,

Y_{it} = soilnitrogen

B₀ B₁, B₂, B₃ and B₄ = model coefficients

T_{it} = Number of days

C_{vit} = Crude oil volume in litres

U_{it} = Random error of the model

i = crude oil pollution levels (0, 0.5, 1.0, 1.5, 2.0)

t = contact time for pollution (days)

III. RESULTS AND DISCUSSIONS

Table 2: The Variation of soil nitrogen values with time after pollution

Time (days)	Pollution level (liter)/10Kg of soil					
	0	0.5	1	1.5	2	2.5
14	0.287	0.143	0.123	0.115	0.121	0.126
28	0.285	0.148	0.128	0.120	0.127	0.128
42	0.291	0.150	0.133	0.125	0.130	0.134
56	0.300	0.152	0.136	0.128	0.127	0.140
70	0.298	0.154	0.138	0.130	0.134	0.142
84	0.300	0.158	0.14	0.133	0.140	0.143
98	0.300	0.159	0.14	0.134	0.140	0.144
112	0.300	0.159	0.14	0.134	0.137	0.144

Table 2 shows the soil nitrogen remaining in the soil after any given time (t = 14 to 112 days), for values of soil samples with crude oil pollution volume ranging from 0 to 2.5L per 10Kg of soil.



Table 3: Regression Model Coefficient for the proposed model

L RESULTS				Number of Obs = 48		
source	ss	df	Ms			
Model	0.172198	4	0.43049	F(4, 43) = 599.75		
Residual	0.004704	43	0.00011	Prob > F = 0.0000		
Total	0.176902	47	0.00376	R-Squared = 0.9824		
				Adj R-Squared = 0.9808		
				Root MSE = 0.06255		
N	Coef	Std Err	t	P > t	95% Conf.	Interval
Conc	0.112373	0.005989	18.76	0	0.100294	0.1244519
time	0.000414	0.000217	1.91	0.063	-2.3E-05	0.0008518
time ²	-2.01E-06	1.68E-06	-1.2	0.237	-5.40E-06	1.38E-06
conc ^{1/2}	-0.27537	0.009769	-28.29	0	-0.29507	-0.25567
_cons	0.1927	0.006827	40.39	0	0.261974	0.2895091

The R² for the determination of the proposed model is 0.9824, with a root mean square error of 0.06255, as shown in table 3. The root mean square error is small; hence the adopted model fits (Chang, 2015). The P-value of 0.00 shows that there is a strong relationship between soil nitrogen and concentration of crude oil spilled at any given time. The equation for prediction of soil nitrogen fate in crude oil contaminated soil is therefore

$$N = 0.1927 + 0.1124C_{vit} + 0.0009T_{it} - 2.102eT_{it}^2 + 0,2754\sqrt{C_{vit}} + 0.06255$$

The model was checked and adjusted using another set of experimental data. The model validation is represented in fig 1 and table 4, respectively. The values indicate the closeness of the predicted values with the observed values, thus confirming the validity of the model developed (Essington, 2005).

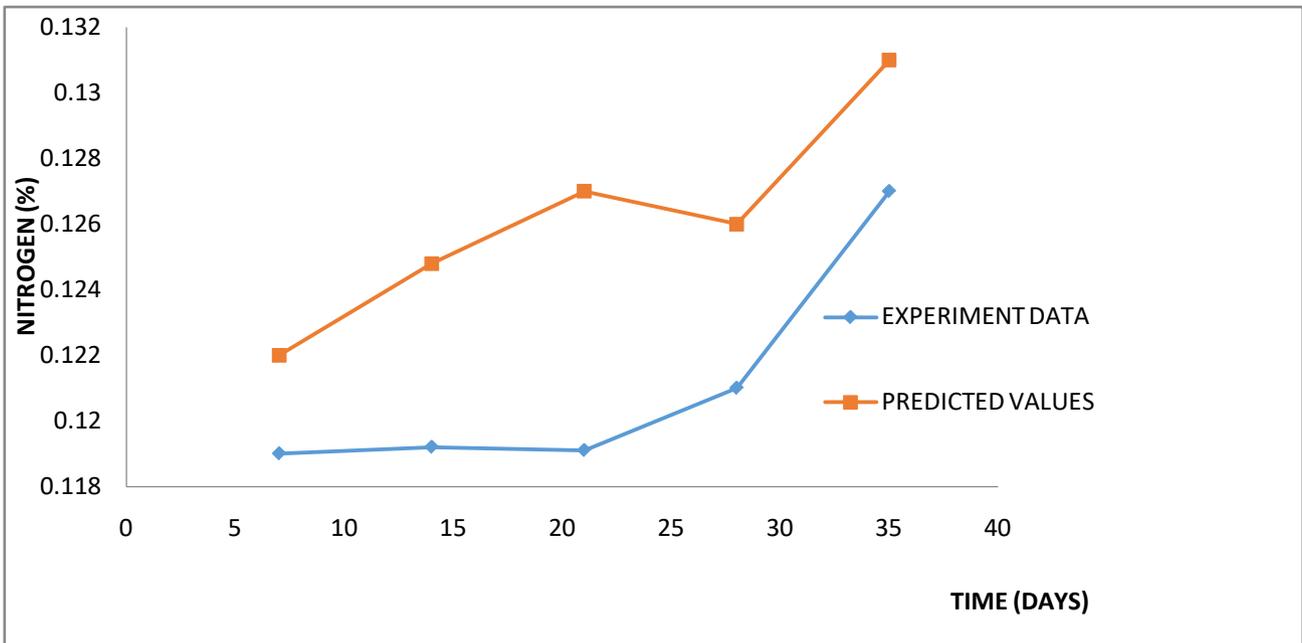


Fig. 1: Experimental and predicted soil nitrogen over time

Table 4: Experimental and Predicted Values for Soil nitrogen over Time

Time/Day	Experimental Data (ED)	Predicted Value (PV)	Percentage Difference
7	0.119	0.122	2.50
14	0.1192	0.1248	5.10
21	0.1191	0.1270	4.40
28	0.1210	0.1260	4.10
35	0.1270	0.1310	1.50

Table 5: Experimental and Predicted values of Soil Nitrogen at various pollution levels using model equation

TIME	COV	ED for N	PV for N	% Difference
14	0	0.287	0.281146199	2.039652249
28	0	0.285	0.285761297	-0.267122925
42	0	0.291	0.289586693	0.485675427
56	0	0.300	0.292622387	2.459208073
70	0	0.298	0.294868439	1.050861862
84	0	0.300	0.29632479	1.225074084
98	0	0.300	0.296991438	1.002858043
112	0	0.300	0.296868414	1.043866037
14	0.5	0.143	0.142616615	0.268103978
28	0.5	0.148	0.147231698	0.653370589
42	0.5	0.150	0.151057094	-0.704961653
56	0.5	0.152	0.154092804	-1.376844432
70	0.5	0.154	0.156338841	-1.518724677
84	0.5	0.158	0.157795191	0.129626446
98	0.5	0.159	0.158461854	0.338457064
112	0.5	0.159	0.15833883	0.540932135
14	1	0.123000002	0.118149087	3.943833426
28	1	0.128000001	0.12276417	4.090492609
42	1	0.133000001	0.126589566	4.819875774
56	1	0.135999997	0.129625276	4.687294834
70	1	0.137999986	0.131871313	4.441067734
84	1	0.140000001	0.133327663	4.765955445
98	1	0.140000001	0.133994326	4.289767554
112	1	0.140000001	0.133871317	4.377631186
14	1.5	0.115	0.112447582	2.219496083
28	1.5	0.120	0.117062658	2.447762651
42	1.5	0.125	0.120888054	3.289551246
56	1.5	0.128	0.123923771	3.192116903
70	1.5	0.130	0.126169801	3.020902324
84	1.5	0.133	0.127626151	4.040488128
98	1.5	0.134	0.128292814	4.259094149
112	1.5	0.134	0.128169805	4.422214726
14	2	0.121	0.116460115	3.751970786
28	2	0.127	0.121075191	4.665207292
42	2	0.130	0.124900587	3.922621935
56	2	0.127	0.127936304	-0.737243726
70	2	0.134	0.130182341	2.849001867
84	2	0.140	0.131638691	5.972364094
98	2	0.140	0.132305354	5.496176202
112	2	0.137	0.13218233	3.516543661



14	2.5	0.126	0.126680404	-0.619859946
28	2.5	0.128	0.131295487	-2.574596719
42	2.5	0.134	0.135120884	-0.836495537
56	2.5	0.140	0.138156593	1.316723681
70	2.5	0.142	0.14040263	1.124906562
84	2.5	0.143	0.141858965	0.867246761
98	2.5	0.144	0.142525643	1.092511955
112	2.5	0.144	0.142402619	1.109295959

Where

COV = Crude oil Volume

ED for N = Experimental Data for soil Nitrogen

PV for N = Predicted value for soil Nitrogen

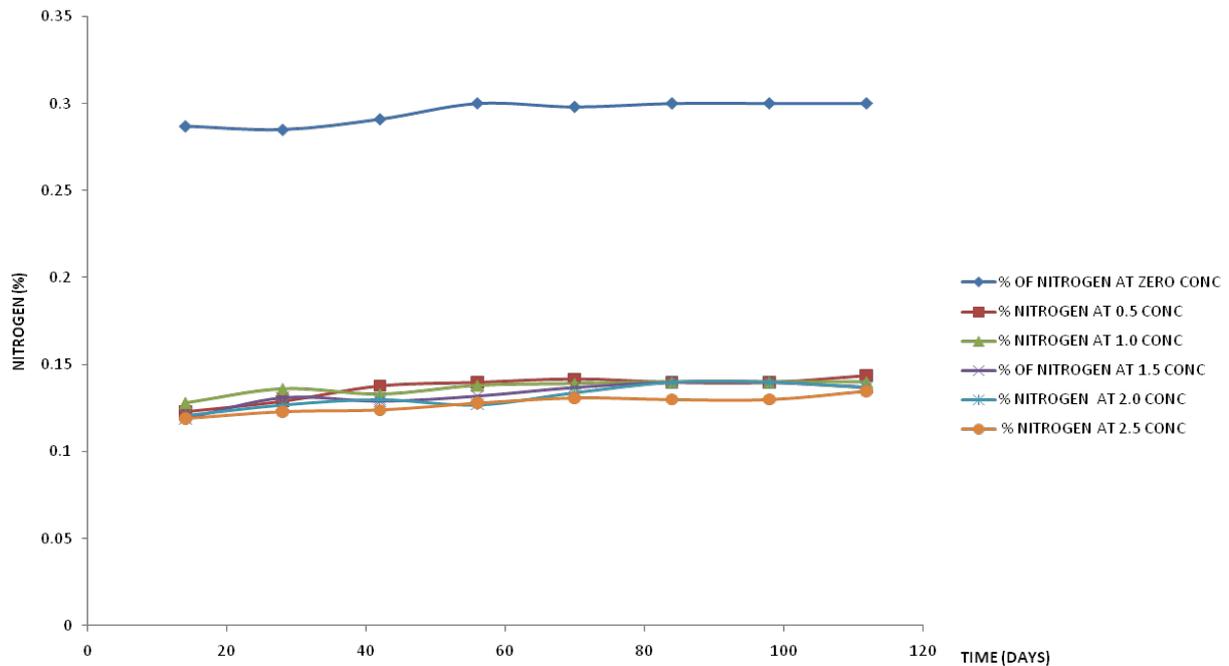


Fig. 2: Soil Nitrogen at various crude oil levels with time

Figure 2 shows the graph of the control sample in comparison with the soil nitrogen at various levels of crude oil pollution with time.

Nitrogen content of the soil at various levels of crude oil pollution varied with time of pollution as shown in Fig. 2. In control (no crude oil added), soil nitrogen increased with time of pollution up till sixty (60) days and remained almost constant till 112 days after. Best soil nitrogen concentration at 60 days of pollution was 0.315%, with the fluctuation in value before and after this time (60 days). This could be ascribed to Nitrogen transformation processes, especially mineralization and immobilization (Catherine et al., 2004).

At 0.5 liters (equivalent to 629 barrels per hectare), of crude oil pollution, N concentration increased with time up till 70 days and then decreased,

before a second increase at 112 days. The trend for the 1.0-liter rate of pollution was an increase to 84 days and a second decrease up to 112 days. Values of Nitrogen (N) for the 14, 28, 42, 84 and 112 days of pollution were 0.12, 0.13, 0.13, 0.14, 0.135% respectively. The nitrogen content at 1.5 liters of crude oil pollution increased with time up till 84 days after pollution until a decrease from the 84 to the 112 days of pollution. Values of Nitrogen (N) varied as 0.12, 0.13, 0, 0.135, 0.129, 0, 0.132, 0.137, 0.140, and 0.136 at 14, 28, 42, 56, 70, 84, 98 and 112 days after pollution respectively. Values of N at 2.0 and 2.5 liters of crude oil pollution increased with time of crude application.

Fluctuations in Nitrogen (N) content with time for various crude oil pollution rates could be attributed to differences in Nitrogen mineralization and immobilization

processes. Generally, soil nitrogen content, averaged over time of crude oil pollution, was three times higher at the control than other rates of crude oil pollution. The low concentrations of N at various crude oil application could be due to reduced microbial activity and depressed nitrogen mineralization, occasioned by toxic and damaging effects of crude oil on soil organism. This bad influence decreased with time of application resulting to improved nitrogen concentration with time.

The percentage of soil nitrogen content at all levels of crude oil pollution with time was below 0.15%, which is the critical nitrogen limit for soils of southeastern Nigeria (Enwezor et al., 1990). This shows that despite crude oil pollution at various levels, the nitrogen content of the soil was low and could hardly sustain crop production.

IV. CONCLUSION

The impact of crude oil pollution on the physicochemical properties of soil about soil fertility in the Niger Delta Region of Nigeria has been reviewed. Modeling of soil nitrogen in crude oil contaminated soil over a period was carried out. The soil nitrogen value for various crude oil levels of pollution increased with time being lowest at 14 days.

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Identification of Environmental Impacts on Duplication and Restoration of BR-401/ RR

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Abstract- With the growth of cities, it is becoming increasingly necessary to expand the number of roads, consequently increasing the generation of environmental impacts. This article aims to verify the considerations about the negative and positive impacts caused by the pavement of the Highway BR-401 / RR. It has by methodology the application of questionnaire and case study, through a qualitative, exploratory approach of bibliographical and documentary character. It is concluded that the results obtained during the study are very relevant for the improvement of the duplication and restoration projects of BRs.

Keywords: *environmental impacts, road construction, duplication and restoration of highways.*

GJRE-E Classification: FOR Code: 090599



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Identification of Environmental Impacts on Duplication and Restoration of BR-401/ RR

Identificação Dos Impactos Ambientais Na Duplicação E Restauração Da BR-401/RR

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Raimundo Jean Tavares de Luna ^ω & Lucas Matos de Souza [¥]

Abstract- With the growth of cities, it is becoming increasingly necessary to expand the number of roads, consequently increasing the generation of environmental impacts. This article aims to verify the considerations about the negative and positive impacts caused by the pavement of the Highway BR-401 / RR. It has by methodology the application of questionnaire and case study, through a qualitative, exploratory approach of bibliographical and documentary character. It is concluded that the results obtained during the study are very relevant for the improvement of the duplication and restoration projects of BRs.

Keywords: *environmental impacts, road construction, duplication and restoration of highways.*

Resumo- Com o crescimento das cidades, torna-se cada vez mais necessário a expansão do número de estradas, conseqüentemente o aumento da geração de impactos ambientais. Este artigo tem por objetivo verificar as considerações sobre os impactos negativos e positivos causados pela pavimentação da Rodovia BR-401/RR. Tem por metodologia a aplicação de questionário e estudo de caso, através de abordagem qualitativa, exploratório de caráter bibliográfico e documental. Conclui-se que os resultados obtidos durante o estudo são bastante relevantes para melhoria dos projetos de duplicação e restauração de BRs.

Palavras-chave: *impactos ambientais, construção de estradas, duplicação e restauração de rodovias.*

1. INTRODUÇÃO

No Brasil onde predomina o transporte rodoviário, a construção de rodovias assume especial relevância, sua ausência implica em perdas de produtos perecíveis, além de impactar na exportação de produtos. Exemplo disso foi durante a greve dos

caminhoneiros quando houve interrupção das rodovias provocando escassez de combustíveis, gás de cozinha e outros produtos.

Diante dessa tendência mundial na expansão na construção de estradas, relevantes impactos ambientais devem ser sentidos. Torna-se assim, essencial procurar formas de se prevenir ou, ao menos, minorar os impactos negativos (REZENDE e COELHO, 2015). As construções de estradas melhoram o tráfego entre as cidades circunvizinhas, trazendo benefícios econômicos para a população local, facilitando o transporte de mercadorias, aumentando a geração de renda e novas oportunidades de emprego. Sendo assim, a ampliação e restauração da Rodovia BR-401/RR é de extrema importância para melhoria da qualidade de vida da população roraimense, além de subsidiar o desenvolvimento dos aspectos socioeconômicos.

Mesmo com todos os benefícios citados, a rodovia causa impactos que afetam o meio ambiente, principalmente na área de seu entorno por meio antrópico. Mas sabe-se que para inicialização de qualquer rodovia é importante realizar um levantamento dos impactos ambientais abrangentes, a fim de verificar os possíveis danos que a pavimentação irá causar ao meio físico, biótico e antrópico, antes da implantação do empreendimento.

Pensou-se na BR- 401/RR, devido a realidade socioeconômico, dos principais impactos encontrados, que estão relacionados às alterações nas atividades econômicas das regiões por onde a trajetória da rodovia transcorre, ocasionando mudanças nas condições de emprego, e, conseqüentemente, na qualidade de vida dos habitantes. Além dos impactos no meio biótico que estão ligados aos atropelamentos de animais na pista, que podem também acarretar em situação de perigo aos motoristas, sem falar na redução da cobertura vegetal presente na faixa de domínio da via. E no meio físico, problemas na instabilidade de cortes e taludes ao longo da pista.

Diante disso, o objetivo deste trabalho foi verificar as considerações sobre os impactos negativos e positivos causados pela pavimentação da rodovia BR-401/RR. Além disso, em específico propõe identificar os principais impactos ambientais decorrentes da

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duplicação e restauração; propor medidas mitigadoras e remediadoras com intuito de garantir que a intervenção humana seja a menor possível para o meio ambiente; e avaliar as expectativas da população do entorno da rodovia quanto à duplicação e restauração.

a) *Implantação de rodovias em Roraima*

Rocha (2015) relata à Confederação Nacional do Transporte (CNT) que divulgou os resultados da Pesquisa de Rodovias (2015), onde apontou que 74,6% (731 km) da extensão avaliada no Estado de Roraima, nas BRs 174, 210, 401 e 432, apresentam algum tipo de deficiência, sendo o estado geral classificado como regular, ruim ou péssimo. Somente 25,4%, ou seja, 249 km tiveram classificação ótima ou boa. A Pesquisa da Confederação Nacional do Transporte percorreu 980 km no estado e, em todo o Brasil, foram mais de 100 mil km avaliados.

Em 2018 foi perceptível mudanças na malha rodoviária do estado, segundo informações do DNIT exposto na folha de Roraima, onde diz que atualmente o estado está com 90% de sua malha rodoviária coberta por contratos de manutenção e cerca de 96% em condições boa ou regular. No entanto a capacidade de mobilidade de produtos está seriamente comprometida, devido ao péssimo estado de conservação das rodovias, tendo como consequência um subdesenvolvimento que compromete o equilíbrio socioeconômico regional.

b) *Rodovia: BR – 401/ RR*

O estado de Roraima concretizou um sonho de mais de 50 anos com restauração e melhoramento da BR-401, no trecho que vai da Capital Boa Vista até o acesso ao Município de Bonfim (Folha de Boa Vista, 2018). Em 2018 o Ministro dos Transportes, Portos e Aviação, Maurício Quintella, e o Secretário Nacional de Transportes Terrestres e Aquaviários, Luciano Castro, estiveram no Estado para entregar os 90 quilômetros concluídos da rodovia.

“Tenho a grata satisfação de entregar à população de Roraima esse trecho pavimentado e sinalizado. Em breve, estaremos concluindo o restante da obra, que vai melhorar a qualidade de vida do povo roraimense”, afirmou o ministro, que lembrou que, para a conclusão do trecho, ainda serão investidos mais R\$ 56 milhões (FOLHA DE BOA VISTA, 2018).

Além disso, a obra inclui construções de novas galerias para suportar o fluxo de água durante o período das chuvas, devido a ocorrência de alagamento nos anos de 2011 e 2017, a restauração inclui duplicação da rodovia em dois seguimentos além de melhoria e construção de acostamento, beneficiando assim a população em geral (CORREIA, 2018).

c) *Impactos gerados na implantação de uma rodovia*

Com o crescente aumento da população urbana de Boa Vista, há uma íntima relação entre

desenvolvimento socioeconômico e a existência de rodovias. É notório que a construção de rodovias implica em relevantes impactos ambientais, por isso tornou-se fundamental analisar o meio impactado: biótico, físico e socioeconômico.

Além disso, Santangelo (2003) diz que a disposição inadequada dos materiais de bota-fora, a exploração inadequada das jazidas e das caixas de empréstimo, poderá causar carreamentos de sólidos e assoreamento da rede de drenagem e de corpos d'água. E a supressão de vegetação nativa encontra-se diretamente associada às etapas de topografia e cadastro, abertura das vias e da faixa de domínio, implantação de canteiros e alojamentos, desmatamento das matas ciliares que causa assoreamento, em consequência disso às substâncias acumuladas por esse processo provoca redução da profundidade do corpo de água e o seu volume.

Para Coelho et al. (2011) desde a extração do material, passando pelo serviço de pavimentação nas obras até a duração do uso do asfalto, implicará em risco de contaminação ambiental, devido sua composição química e física. Isto fica mais evidente durante o processo de produção do asfalto, quando as usinas se tornam fontes poluidoras, contaminando o solo, a água superficial e subterrânea, o ar, além de gerar adensamento e compactação do solo. Gerando assim menor qualidade de vida do planeta e dos homens.

Com o surgimento do tráfego nas rodovias construídas é comum ocorrerem atropelamentos de animais silvestres, esse é um problema ambiental especialmente preocupante devido a grande frequência em sua ocorrência. Há estimativa de que 14,7 milhões de animais são atropelados a cada ano no Brasil (MOTTA, 2013). A perda de ambientes naturais, mesmo que degradados, bem como a retirada da cobertura vegetal, gera um número elevado de animais em situação de fuga e busca de novos abrigos mais seguros, potencializado a ocorrência de atropelamentos nas estradas.

Já Rezende e Coelho (2015) relatam que a interferência com a qualidade das águas superficiais e subterrâneas poderá ocorrer durante a fase de construção, como efeito do carreamento de sólidos, assoreamento da rede de drenagem, além da utilização de banheiros, cozinhas, refeitórios e outras estruturas de apoio às obras como as usinas de asfalto e centrais de britagem. Possível, ainda, acidente com vazamentos de cargas nas proximidades dos cursos de drenagem, que podem provocar a contaminação das águas superficiais e subterrâneas.

d) *Leis vigentes*

Sabe-se que estradas são vitais para o crescimento da economia do estado de Roraima, contudo, os impactos ecológicos causados por

estradas têm sido considerados por muitos autores acima citados um dos principais fatores responsáveis pela perda da biodiversidade. Neste sentido, nota-se como o projeto torna-se relevante em identificar esses impactos e adequar a sua construção aos conceitos de consciência ambiental.

No Art. 1º da Portaria DNIT 1.705/2007, publicada no Diário Oficial da União (D.O.U),

Art. 1º Fica determinado que obras de Implantação e Construção de Infraestrutura Aquaviária, Ferroviária e Rodoviária, com ou sem pavimentação, somente podem ser licitadas após a realização de Estudos de Viabilidade Técnica, Econômica e Ambiental – EVTEA (DNIT, 2016).

Nota-se a importância deste trabalho, quando se pensa no lado socioeconômico ao idealizar os benefícios da duplicação da BR 401/RR. Porém é importante dar ênfase à questão ambiental e seguir as recomendações dos Órgãos Ambientais, que exigiu que as empresas vencedoras das concessões implantassem o Sistema de Gestão Ambiental, dando assim um salto de qualidade e eficiência com relação ao tratamento e proteção dos recursos naturais, garantindo maior conforto, segurança e satisfação ao usuário da Rodovia.

II. METODOLOGIA

A pesquisa foi realizada na obra de duplicação e restauração da BR-401/RR, no trecho: Entroncamento BR-174/RR (Boa Vista/RR) - Fronteira Brasil/Guiana (Bonfim/RR), de caráter qualitativo, bibliográfico, documental e de campo, onde foram aplicadas técnicas de coleta de dados como: visitas, diálogo participativo com a comunidade e observações in loco.

A fim de identificar os principais impactos nos meios: físico, biótico e socioeconômico na duplicação da BR 401/RR, utilizou a matriz de interações proposta por Leopold (1971), adaptada por Dagoni (2003), que permitiu identificar os impactos na fase de implantação e operação do empreendimento possíveis de serem afetadas (BRAGA et al., 2002).

Com o intuito de propor medidas mitigadoras e remediadoras para a duplicação e restauração da BR-401/RR, utilizou o método de superposição de cartas, na Figura 1. Conforme Braga et al. (2005) com o avanço da tecnologia, este método tem ganhado valor na mesma proporção, visto que sua utilização além de evoluir para um formato mais preciso, torna-se menos complicada.

Classificação de Impactos				Valoração de Impactos Impacto total = C.(P+I+O+E+D+R)	
Caráter (C)	Positivo (1)	Negativo (-1)	Neutro (0)	Severo	Abaixo de -15
Perturbação (P)	Importante (3)	Regular (2)	Escassa (1)	Relevante	Entre -15 e -9
Importância (I)	Alta (3)	Média (2)	Baixa (1)	Aceitável	Acima de -9
Ocorrência (O)	Muito provável (3)	Provável (2)	Pouco provável (1)		
Extensão (E)	Regional (3)	Local (2)	Pontual (1)	Alto	Acima de +15
Duração (D)	Permanente(3)	Média (2)	Curta (1)	Médio	Entre +15 e +9
Reversibilidade (R)	Irreversível (3)	Parcial (2)	Reversível (1)	Baixo	Abaixo de +9

Fonte: CONTRERAS (2008) adaptado pela autora (2019).

Figura 1: Valorização de impactos

Para apresentar as expectativas da população do entorno da rodovia quanto a duplicação e restauração da BR-401/RR, será aplicado um questionário na área supracitada.

III. RESULTADOS E DISCUSSÕES

Para avaliação e identificação dos principais impactos ambientais decorrentes da duplicação e restauração da BR-401/RR, foram estabelecidas

correlações entre os diversos fatores ambientais diagnosticados e as diversas atividades previstas para o empreendimento, nas suas diferentes fases. E na figura 2 apresentaram-se os impactos negativos no meio físico, biótico e antrópico na fase de implantação e operação na área de estudo e suas medidas mitigadoras e compensatórias.

Aspectos Ambientais	Meio físico					Meio biótico	Meio Antrópico				
	Solo		Ar		Água		Vizinhança				
	Provável redução da capacidade de permeabilidade do solo	Contaminação do solo	Geração de resíduos e durante as obras;	Alteração da qualidade do ar	Alteração dos níveis de ruídos	Alteração da qualidade das águas superficiais e subterrâneas	Interferência na flora local	Interferência na fauna local	Alteração na rotina dos usuários da rodovia	Desapropriações	Aumento na probabilidade de trânsito e acidentes
Implantação	x	x	x	x	x	x	x	x	x		
Operação				x						x	x

Fonte: Adaptado pela Autora (2019).

Figura 2: Matriz de influências de rodovias (DEGANI, 2003)

- *Provável redução da capacidade de permeabilidade do solo*

O processo de compactação do solo favorece o escoamento superficial e a instalação de processos erosivos, devido às ações geradoras de limpeza e desmatamento, movimentação de veículos e movimentação de pessoas. Como medida mitigadora deve-se remover a cobertura arbustiva do solo apenas onde for estritamente necessário. Tendo com remediação a recomposição da vegetação e recuperação das áreas degradadas.

A retirada da cobertura vegetal na área implicará na valorização do Impacto: $-1(2+2+3+1+2+1) = -11$ (Negativo – Relevante), ocorrência muito provável da modificação da qualidade do solo devido a área descoberta, e influência direta, com perturbação regular, importância baixa ou média, dependendo do tipo de pavimento a ser empregado. Estas ações tiveram extensão local, duração média com efeito cumulativo devido à limpeza da área para a execução tanto dos estudos geotécnicos, e instalação do canteiro de obras, sendo este impacto reversível.

- *Contaminação do solo*

As características do solo podem ser afetadas caso não sejam tomados cuidados na disposição de óleos lubrificantes utilizados pelo maquinário. Como forma de mitigar deve-se realizar manutenção dos veículos em local apropriado, e uma técnica viável é a biorremediação que envolve a utilização de microrganismos de ocorrência natural ou cultivados, para degradar ou imobilizar os contaminantes.

Na fase de implantação das obras, ocorreu a movimentação de veículos pesados e demais equipamentos, devido às escavações e cortes de grandes espessuras, movimentos de terra, pavimentações, etc. Estas atividades geram gases poluentes e particulados, de importância média, ocorrência pouco provável, extensão local que se depositam sobre as superfícies próximas, cuja valorização do Impacto total: $-1(2+2+1+2+1+1) = -9$ (Negativo – Relevante). Porém durante o período de exposição dos solos pelas obras de terraplenagem, as chuvas podem carrear material fino para os canais de drenagem, cuja a perturbação é regular, duração curta e reversível.

- *Geração de resíduos durante as obras*

Os resíduos são compostos pelo acúmulo de lixo e de sucatas nos alojamentos, e áreas de apoio às obras (pedreiras, jazidas, areais, centrais de britagem, usinas de asfalto e outras). A falta de destinação adequada destes materiais pode atuar como um agente de atração de espécies, dentre as quais se incluem ratos que atuam como vetores de diversas doenças. Os resíduos devem ser separados e descartados conforme sua classificação.

A alteração topográfica resultou na aquisição de materiais de empréstimo, de importância média e extensão local, necessários para a substituição de solos moles e construção de aterros. Sendo assim, as escavações foram necessárias para a substituição de material do subleito, que geram sedimentos a serem dispostos em áreas de bota-fora. Na implantação da

obra a valorização do impacto total é de: $-1(2+2+3+2+1+1) = -11$ classificado como negativo – relevante com perturbação regular que resultou em passivos ambientais, devido cavidades e áreas de disposição de entulhos.

No entanto as modificações no relevo são de ocorrência muito provável, a ser deflagrado na área de influência direta do empreendimento. Esse impacto terá duração curta e reversível, mediante recuperação, sendo função da empresa responsável pelas obras.

- Alteração da qualidade do ar

Devido a terraplenagem e construção de aterros, ocorre o aumento dos níveis de poeira em suspensão, e também o lançamento de material particulado e gases resultantes do funcionamento de motores a óleo diesel das máquinas e caminhões utilizados para a construção do corredor de transporte. A remediação neste local deverá ser feita mediante a proteção do material extraído com a utilização de lonas. Além do controle da velocidade de veículos, diminuindo a contribuição de poeiras para o ar, durante os períodos de estiagem; bem como manutenção periódica das máquinas e veículos, contribuindo para a diminuição da liberação de gases para a atmosfera.

O deslocamento de equipamentos para a área do empreendimento ocasionou uma valorização de impactos: $-1(2+2+3+2+1+1) = -11$ (Negativo – Relevante) de perturbação regular, importância média, ocasionando alteração da qualidade do ar pela emissão de gases gerados pelos motores dos veículos, bem como geração de material particulado e aumento do nível de ruídos. E ocorrência muito provável porque os ruídos emitidos poderão ocasionar o afugentamento temporário da fauna das áreas vegetadas contíguas à área da obra. Porém um impacto adverso de pequena magnitude, de curta duração, extensão local e reversível.

- Alteração dos níveis de ruídos

Durante a implantação da obra é utilizado máquinas e equipamentos que geram ruídos, como: escavadeiras, caminhões, rolo compactador, betoneiras e outros. A geração destes ruídos no local de estudo foi variável de acordo com a fase evolutiva do empreendimento. Isso também foi observado no estudo realizado por Rodrigues (2010). E na remediação deve evitar trabalhos junto às áreas residenciais em horário noturno e controlar emissão de ruídos gerados por máquinas mal reguladas, além de conservar espaços livres com arborização, a qual funcionará como barreiras naturais, minimizarão a propagação dos sons. O intenso tráfego de veículos na região resultou na valorização do impacto total: $-1(2+1+3+2+1+1) = -10$ classificado como negativo – relevante, de perturbação regular devido à utilização de máquinas e equipamentos geradores de ruídos, importância baixa,

ocorrência muito provável, de extensão local, duração curta e reversível.

- Alteração da qualidade das águas superficiais e subterrâneas

A interferência na qualidade das águas superficiais e subterrâneas poderá ocorrer como efeito do carreamento de sólidos, assoreamento da rede de drenagem, além da utilização de banheiros, cozinhas e refeitórios, possível, ainda, acidente com vazamentos de cargas, nas proximidades dos cursos de drenagem, que podem provocar a contaminação das águas superficiais e subterrâneas. A remediação varia de acordo com a qualidade da água afetada, através de procedimentos como: remoção de contaminantes heterogêneos da água, eliminar misturas de bactérias patogênicas, entre outros.

A geração de sedimentos e o assoreamento de corpos hídricos são processos sempre presentes em empreendimentos que envolvam serviços de movimentação de terras, cuja valorização deste impacto: $-1(2+2+2+2+1+1) = -10$ foi de classificação negativa – relevante, devido ação erosiva da água da chuva sobre o solo nu ou desagregado. Este impacto de ocorrência provável devido à geração e carreamento de sedimentos ao interior dos corpos d'água transpostos pelo empreendimento, bem como dos dispositivos e obras de arte destinadas à drenagem do empreendimento. Cujas intensidade deste impacto de perturbação regular, importância média, está condicionada pelo regime de chuvas no local da obra, pela quantidade do material mobilizado, e pelo tipo de solo e declividade natural do terreno, além, conforme já exposto, da efetividade das medidas preventivas adotadas.

-Interferências na flora local

A supressão de vegetação nativa está associada às etapas de topografia, abertura das vias e da faixa de domínio. Assim deve ser compensada por meio do plantio de mudas de espécies arbóreas nativas da região, de modo a promover a recuperação de alguns fragmentos atingidos pelo empreendimento. Sendo assim, a valorização do Impacto total foi de: $-1(2+3+3+2+2+2) = -14$ considerado negativo – relevante, pois ocorreu perturbação regular, importância alta, devido à destruição de habitats, afugentamento da fauna, perda de biodiversidade, com ocorrência muito provável e cumulativa, de pequena magnitude. Os efeitos prognosticados são temporários, reversíveis, locais e de media duração, uma vez que após a desmobilização do canteiro as áreas degradadas serão recuperadas.

- Interferências na fauna local

Com a duplicação da BR 401/RR observou a perturbação da fauna em decorrência do trânsito de veículos, pessoas e da geração de ruídos, bem como

será elevado o risco de atropelamentos de animais, e de colisão de veículos. Este resultado condiz com Mota (2013) que o surgimento do tráfego nas rodovias construídas é comum ocorrerem atropelamentos de animais silvestres, onde estima-se que 14,7 milhões de animais são atropelados a cada ano no Brasil. A remediação pode ser feita com a construção de passagens de animais sob a pista, a fim de preservar a fauna. Além disso, sugere-se a implantação de uma tela de arame, de modo a evitar a circulação de animais, direcionando-os para as passagens.

A valorização do Impacto total: $-1(2+3+2+2+3+2) = -14$ (Negativo – Relevante), foi de perturbação regular, importância alta, ocorrência provável, pois poderá sofrer perdas significativas à biota local, extensão local, duração permanente e parcial, devido ao plano de resgate da fauna.

- Alteração na rotina dos usuários da rodovia

A preparação da área, construção de pontes, terraplenagem acompanhados pelo maior trânsito na área do trecho modificou a rotina da população local cujas propriedades coincidam com o trajeto do empreendimento. Além do aumento do nível de ruído provocado pela passagem e movimentação de pessoas, máquinas e equipamentos, acarretando em transtornos às pessoas que moram próximas à obra. Deve-se alocar placas de sinalização em locais estratégicos e visíveis para assim evitar acidentes.

A valorização desse impacto é de: $-1(2+2+3+2+1+1) = -11$ considerado negativo – relevante, de perturbação regular devido aos ruídos provocados pelo maquinário, além da alteração no fluxo de trânsito devido a passagens de materiais e bloqueios da via, importância média, ocorrência muito provável, a extensão desse impacto se dá no local da obra, com duração curta e reversível.

- Desapropriações

A implantação da BR 401/RR implicou na desapropriação de áreas e deslocamento de populações rurais e urbanas. A remediação seria vistoria, medição e demarcação das áreas indicadas. E para compensar pagamentos de indenização, cadastro socioeconômico e de imóveis.

Portanto a valorização do Impacto total: $-1(1+1+2+2+3+3) = -12$ (Negativo – Relevante), de média magnitude, perturbação escassa, importância baixa, ocorrência provável, de extensão local, duração permanente e irreversível.

-Aumento na probabilidade de trânsito e acidentes

Com os desvios da pista da via por conta das obras e dos acessos às faixas laterais ficaram estreitos e a passagem de pedestres e veículos tornou-se perigosa e confusa, fruto da presença de máquinas e das obras. Para a remediação recomenda-se sinalização adequada e suficiente para evitar ao

máximo a ocorrência de acidentes nos trechos em obras, por meio de placas e fitas durante o dia e por objetos geradores de luminosidade à noite.

As obras de duplicação irão ocorrer em áreas de densa ocupação e de tráfego intenso, tais impactos, a serem deflagrados na fase de implantação do empreendimento, cuja valorização do impacto total: $-1(3+2+2+2+1+1) = -11$ (Negativo – Relevante), ocorrência provável, com perturbação importante, de ocorrência provável devido faixas laterais mais estreitas, passagem constante de máquinas, com extensão local, duração média e reversível.

Diante dos resultados desse trabalho, pode-se dizer que os impactos foram significativos, bastante relevante na melhoria dos projetos, com a minimização dos impactos negativos e a maximização dos positivos. Neste sentido, propõe-se um estudo mais aprofundado de documentos de cada EIA/RIMA, bem como planos de controle e monitoramento ambiental implantados na área de estudo. A fim de melhorar a segurança aos moradores ali presentes, e reduzir os transtornos à população próxima.

Através dos resultados obtidos é possível estabelecer medidas de remediação, mitigadoras e valorização dos impactos. O DNIT (2016) ainda ressalta a importância de elencar os programas ambientais necessários para uma correta implantação e operação desta rodovia, dentre eles: Plano ambiental de construção – PAC, Plano de recuperação de áreas degradadas e recuperação de passivos – PRADRP; Programa de educação ambiental – PEA; Programa de monitoramento e qualidade da água – PMQA; Programa de monitoramento de atropelamento de fauna.

A fim de analisar o grau de importância da duplicação e restauração, aplicou-se um questionário há 50 moradores mais próximos a área de domínio da BR-401/RR, no gráfico 1 analisou-se o grau de importância da duplicação e restauração da BR-401/RR aos moradores, onde 48% relatam que a obra foi importante, pois trará melhoria de condições de drenagem, novos negócios e melhoria no tráfego diário; 30% acham importante, pois facilitará escoamento dos produtos agrícolas da região; 12% relatam que é pouco importante, não suporta tráfego intenso em pontos críticos, como beira dos morros; 10% acham pouco importante porque daqui algum dia estará cheia de buraco, devido asfalto ruim; 2% acreditam ser sem importância, pois afetará o meio ambiente.



Fonte: Autora (2019).

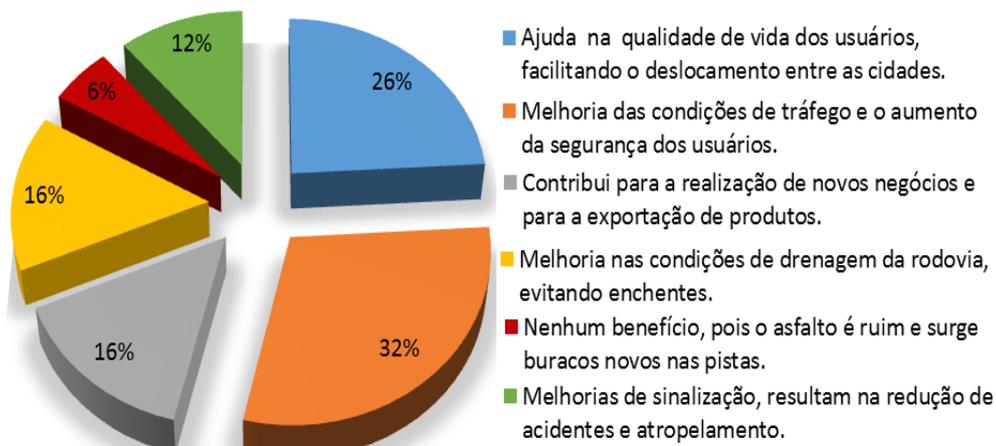
Gráfico 1: Grau de importância da BR-401/RR para os moradores

Pode-se dizer que a duplicação do trecho do empreendimento em análise irá proporcionar maior segurança e facilidades de trafegabilidade, na medida em que permitirá o deslocamento em duas faixas, evitando a necessidade de ultrapassagens pela contramão, além de afastar fisicamente as pistas opostas, evitando o cruzamento de uma para a outra.

E de acordo com o Dnit (2016) a rodovia encontra-se em processo de duplicação e restauração visando à segurança dos motoristas, visto que uma das principais queixas dos usuários era a ausência de acostamento, aliada ao fato da via ser muito estreita e possuir abismo em ambos os lados.

Em busca de avaliar as melhorias no gráfico 2, questionou sobre o maior benefício que a obra

proporcionará aos usuários, onde 32% relatam que haverá melhoria das condições de tráfego e o aumento da segurança dos usuários; 26% dos entrevistados acredita que irá ajudar na qualidade de vida dos usuários, facilitando o deslocamento entre as cidades; 16% na contribuição para a realização de novos negócios e para a exportação de produtos; outros 16% acreditam na melhoria nas condições de drenagem da rodovia, evitando enchentes, 12% creem nas melhorias de sinalização, resultam na redução de acidentes e atropelamento; e 6% dizem que a obra não trará nenhum benefício, pois o asfalto é ruim e surgem buracos novos nas pistas.



Fonte: Autora (2019).

Gráfico 2: Benefícios proporcionados pela obra da BR-401/RR

As rodovias são parte indispensável para evolução de uma região, segundo Laurence (2014) e traz diversos impactos positivos, dentre eles: aumento da produtividade agrícola; contribui para o aumento da arrecadação pública, do comércio legal, para o aumento da demanda de bens e serviços; ajuda na qualidade de vida de seus usuários com a facilitação do deslocamento entre as cidades; facilita o escoamento

dos produtos da região, evita a perda de produtos perecíveis; além de contribui para a realização de novos negócios e para a exportação de produtos roraimenses. E Rezende e Coelho (2015) abordam que mesmo indiretamente, o meio ambiente é beneficiado pelo desenvolvimento econômico, com mais recursos orçamentários pelos setores públicos e sua reversão em prol da população, com a melhoria na infraestrutura

de uma cidade e dos entornos circunvizinhos. Acordado com Lima (2018), cabe aos profissionais responsáveis à análise correta dos impactos e a proposição de medidas eficientes, e ao órgão ambiental a avaliação e monitoramento do EIA. A população deve opinar a respeito do projeto por meio de consulta pública, visando em conjunto para que o crescimento seja sustentável.

IV. CONSIDERAÇÕES FINAIS

Conclui-se que a duplicação e restauração da BR-401 trará benéficos inquestionáveis, facilitando o tráfego aos usuários, contribuindo para a redução de acidentes e elevando a qualidade do transporte rodoviário na região. Porém é necessário ressaltar sobre os impactos de ordem ambiental, econômico e social provocados pela sua construção, é importante construir de forma a prevenir ou limitar os impactos ambientais negativos. Se bem projetada, nos locais adequados e com a realização das necessárias medidas preventivas e mitigatórias, contribuirá para a efetividade do desenvolvimento sustentável da população.

Por fim, pode-se dizer que os resultados apresentados neste trabalho podem ser bastante relevantes para a melhoria dos projetos em duplicação e restauração de outras BRs no estado, com à minimização dos impactos negativos e a maximização dos positivos. Neste sentido, propõe-se um estudo mais aprofundado de documentos de cada EIA/RIMA, a fim de verificar o grau de segurança do empreendimento, visando à viabilidade do mesmo.

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The Construction Industry and Modernization-Applying Change Concepts

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Abstract- Globalization has fully taken its course in no other sector more apparent than in the rapidly growing construction industry. The industry is being forced to change at an unprecedented pace. Nigeria and other developing countries are not exempted as they witness a fast-growing rate of construction activities also. The industry must adapt to a global trend and a sense of camaraderie to meet the huge demands, reduce risks involved; thus, safeguarding quality and profitability. Change is an enormously complex issue but the industry must take cognizance of the change demand to gain competitive advantages. The aim of this study is to examine the effect of change application on the modernization of the construction industry. This paper presents the results of a literature review carried out on change application in modernization of construction industry. It examines the issues that will cause change, reviews the available literature to find how change can be managed and controlled, and develops a model for guiding change programmes in the construction industry. Interviews and questionnaire surveys were adopted tools in getting data and analyzed to achieve the research aim.

Keywords: *change, construction industry, globalization, management and modernization.*

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Keywords: change, construction industry, globalization, management and modernization.

I. INTRODUCTION

Change is defined by ¹ as “the act or an instance of making or becoming different, an alteration or modification”. There are many different reasons and sources for change which is inevitable. Since changes will never disappear, the best option is to manage them to prevent negative consequences. The impacts and consequences of changes on an

organization and people varies. It depends on the type and nature of changes, but most importantly on how they are managed. The changes are to be managed to maximize the benefits, minimize the penalties, and ensure that both benefits and penalties are distributed equitably². Change occurs in construction industry globally because:

- Global technological advancement
- Successful invention
- Significant shift in the world markets or exchange rates
- Surges in the world or regional demand
- Political decisions by foreign governments
- Project complexity
- Improvement in clients' satisfaction and meeting project objective
- Ensure effective cost management and control
- Meeting with climatic change/wars and act of nature

On a world-wide level, changes are occurring at a rapid pace, particularly in information technology. The increasing number of computer based applications that are now available to construction companies is changing the nature of the business which we carry out. Research projects funded by the European Union into the area of information technology are showing how we can reuse construction design information and how we can access information generally throughout the industry³. Society is now facing an “information technology revolution” which will bring a period of change he has likened to that of the Industrial Revolution. If this is the case, then all organizations must recognize that survival in business will be dependent on their ability to adapt to changing circumstances⁴. The industry must therefore adapt to a global trend to fit in and ensure risks reduction thereby improving quality of project delivery; meeting the target cost and time; thus, ensuring sustainability. This study therefore examines the effect of change application on the modernization of the construction industry in Nigeria. Different areas where change can be applied and effect were identified including change management and control.

II. REVIEW OF RELATED LITERATURE

Change is not just about how people act, but it is also about how they think and this perspective forms a basis for the link between CM in organizations and internal communication with the people responsible for

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making those changes happen⁵. Change occurs in construction at two levels: organizational and project level. Throughout a project, construction organizations are faced with many changes, most of which are design changes. Project changes are inevitable even if there had been detailed studies during the design development, and prior to the construction stage. Besides handling changes at project level, construction companies are sometimes required to implement changes at organizational level related to management, technology, people and cultural issues⁶. Change can be introduced in several ways depending on the aim of the change programme. In establishing how to approach a change situation, the effect of change throughout the organization must be assessed at all levels of activity. The four main levels of activity have been defined as:

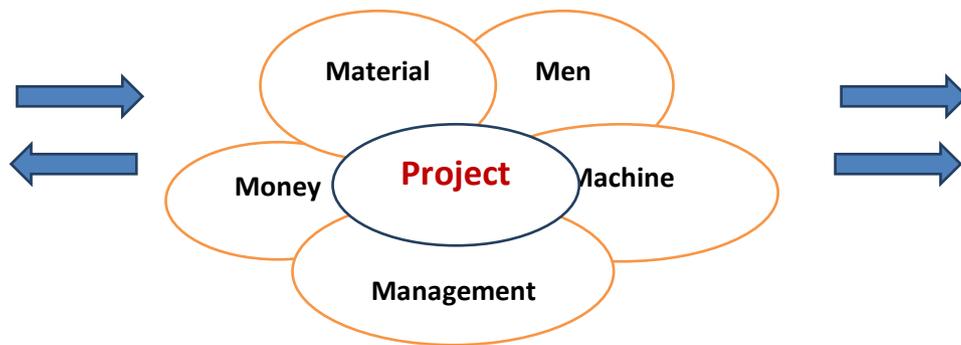
- Task Level - at which individual actions take place as part of a process

- Process Level - at which a series of tasks are carried out
- System Level - at which number of processes are integrated and managed
- Organizational Level - at which decisions are made and actions are taken to determine the strategy of the organization.

These levels are tied together with a complicated series of interfaces through which individuals interact with those in their own organization and in other organizations.

a) *The construction industry*

The industry is subject to the law of elastic and return which can be either way depending on the scope and the nature of the project.



Source: Researcher, 2020

Fig. 1: Indicators of Project delivery

The model in fig 1 indicates that the project's nature or complexity will determines the reactions of other factors or indicators. Therefore, if the project core expands, the support systems must grow to meet the needs of the projects. On the other hand, if the workload contracts, the systems will be downsized to match the demand. It is this dependence on the project core and the cyclical nature of construction activity that brings about a constant state of change in the supporting systems. However, it is also this constant state of change that prevents meaningful attempts at change management in the supporting systems, as the status of the systems is regarded as temporary and any effort to manage the change could be impeded by a change in the project core. Construction organizations can readily apply the latest management concepts and new technology in the context of the project but appear to be reluctant to apply the same principles in an organization wide context. From this perspective, we can see why a construction organization has difficulty with planning for and coping with change. To cope with change, a construction organization must take a more global view of its operations, shifting emphasis from a project

approach to a more entrepreneurial approach. Information Technology (IT) is evidently the most strategic means of effecting change in construction system. IT is currently used to a limited extent in: Design; Financial Management; Planning; Monitoring; communication and Reporting. The change includes many existing software packages designed in compatibility with the area. IT thus ensures;

- Time saving
- Automate tasks and thereby cut payroll costs
- Proper organization and radically improve the way work is done
- Avoid waste and use less paper.

The most likely underlying cause of the failure to change in the instance of IT implementation is therefore that those managing the change have attempted to implement a change without due regard for the other tasks and processes that would be affected. To avoid this situation, it is necessary to understand the effect of one task or process on another. For change to be effective, the educational curriculum must be adjusted to cope with the change. This is the reason while it seems the standard of education is falling; especially in



developing countries. There is no fall in the standard but the standard should be redesigned to accommodate the expanded change. Previous work by ⁷on change management on Irish construction discovered that; even the smallest of changes can affect the working environment of a significant proportion of those who work in the organization This matrix shows that no single change approach will be suitable in all situations. Most changes, will require action at one or more interfaces, along with action at one or more activity levels, a combination of at least two of the approaches will be required to achieve the expected change. He thus concludes that Change is an enormously complex issue, which is possibly one of the reasons for the high failure rates of some change programmes.

b) *IT as a Change tool in Nigeria construction industry*

The level of technological change in every industry continues to gather pace and the construction industry is no exception. New equipment and methodology has contributed to an increase in productivity, safety and quality of project delivery. Technology has a major role to play a in the change concepts transformation. Changes in designing to construction patterns drive the creation of new technologies necessary for sustainability and their adoption and diffusion at the desired pace. Success in bringing about these changes require substantial reorganization of the industry to accommodate new views and methodologies. Training and financial incentives for the creation and adoption of new technologies will be needed which may include innovative policy reforms. The potential uses of Information Technology (IT) in the industry are enormous. For example:

- Buildings can now be designed and costed electronically thereby facilitating a greater re-use of design and cost information and realizing savings in design costs. Comparative analysis is easily carried out using information technology.
- Planning carried out using computers allows quick comparisons of the time and resources required to complete different designs and shows the effect of design changes on the remainder of an existing project
- Immediate access to technical information held in a computer at a remote location
- Use of e-mail to distribute documents and correspondence
- Electronic bill tendering (e-tendering), e-marketing and so on
- Sourcing of materials and services using Internet style search engines
- Electronic commerce (e-commerce) now allows the ordering of and paying for materials to be carried out electronically
- Meetings can be held using video-conferencing

- Communication are effectively carried out using media channels like whap, you tube etc
- Documents and drawings can be viewed/ recorded / stored / distributed / updated and printed using computers; information gathered on previous projects can be accessed and used to make cost savings on new projects.

Further advances are now occurring on almost daily basis, bringing newer and easier ways to tap the enormous potential of these machines. All of this has caused greater challenges for the management of construction companies. Companies grow and cope with new technology at a rate which could not have been envisaged in few years back. These same companies now face even more challenges in an ever changing construction environment. Now, an individual can use Computer Aided Drawing (CAD) software to draw, for example, a door. The lines and layers of the drawing can be copied and moved within the drawing or between drawings but to the computer they are still a series of lines and layers. It can also have other types of information attached to it such as its cost, availability and any other information required by any party who in any way encounters this door at any stage of the project. The use of Object Oriented Technology promotes a profound change in construction, as it enables different applications to make use of information in a way that has not previously been possible. Internet on the other hand is basically a series of computers in several different locations all over the world that are connected to each other across standard and high speed telephone lines. As computers share information with each other, the greater number of computers connected, the more information is available. The information is held on websites, which may be accessed through any computer connected to the Internet.

However, IT is often seen as a complex field best understood by young minds and many of the directors/managers/chief executives of Nigerian construction companies may not have had the time or the patience to keep up with the rapid pace at which this technology has been developing. Many may therefore not be aware of the direction in which IT is developing. This should be addressed by developing an organization-wide IT strategy to plan and control the increasing use of computers within the industry. New processes must be devised, implemented, monitored and improved where necessary. Changes must first be made where they will have the most noticeable effect thereby convincing all involved that the new processes are to the benefit of everyone.

c) *Change for effective cost savings*

A change in attitude may be needed by companies to keep trained staff and obtain maximum return for the investment in training. Experience from

other industries should be drawn upon and approaches to staff retention might be considered- for example the Japanese policy of increasing the benefits to the individual as length of service increases. Human resources management must face the challenge of finding and retaining the staff necessary to fulfil the aims of the corporate plan. Plans must be developed and administered to ensure that the company utilizes its staff to full capacity and potential. At Systems level, the promotion of innovation, team working, delegation of authorities and an emphasis on quality must be encouraged to improved workers' performance and productivity to the advantage of the company. Ever since the Latham Report (1994) cited by ⁷stated that UK construction costs to the client could be reduced by 30%, the search has been ongoing to find where such savings could be made. Nigerian construction industry too has not relapsed in their efforts to cut down construction cost in the country. Materials management has subsequently emerged as an area worthy of examination in the search for such savings. 'In Sweden (Laage-Hellman & Gadde 1996), Finland (Wegelius-Lehtonen 1995) and in the UK (Dawood 1997), materials management has been identified as an area where some savings could be made. Each of these pieces of research approached materials management in a changed way. Laage-Hellman & Gadde gave an account of the progress made by Swedish construction company Skanska in its attempts at introducing Electronic Data Interchange (EDI) into its purchasing system. The cost of processing an invoice was found to be SEK 300 (approximately US\$45). Laage-Hellman & Gadde state that this cost can be reduced by 90% by using EDI. The possibility of use of the suppliers' expertise in relation to availability, handling, etc., is not often examined. Such involvement can lead to a 10% reduction in construction times (Agapiou, Flanagan, Norman and Notman, 1998) and is now widely accepted in other countries such as Denmark, Sweden and Japan' ⁸. ⁹noted that the simplification of the materials management process also led to:

- Closer co-operation of the supplier and the contractor
- A higher quality of the information between contractor and supplier resulting in fewer ordering errors
- An increase in the speed of the materials handling process and in the ease with which information could be transmitted.

These factors in turn resulted in increased cost effectiveness in the construction chain.¹⁰objective was to discuss and introduce a new strategy for materials management for the construction industry with a view to minimizing wastage. He observed current practices and discovered that wastage accounts for 8-10% of project costs. By making a few basic changes to some aspects

of the building process and by introducing a computer based materials management system. He estimated that construction costs could be reduced by at least 10%. These savings would occur because of reduced wastage, fewer project delays, early selection of suppliers leading to lower prices and greater certainty of availability of materials, greater understanding of the type and amount of materials needed thereby eliminating late and in accurate ordering, and a reduction in on-site overheads. The process of doing things in a changed and new way is termed 're-engineering'. ¹¹defines re-engineering as:"... discontinuous thinking...recognizing and breaking away from the outdated rules and fundamental assumptions underlying operations. These rules of work design are based on assumptions about technology, people, and organizational goals that no longer hold." Deevy argues that an organization is a living system capable of self-organization and self-renewal- if the right conditions are created. This living system, if allowed, is capable of continuously adapting to the needs of the marketplace and to changes in the business environment. Reengineering the processes should, therefore, be preceded by a major cultural change in the organization. That made ¹²agrees that up to 70% of BPR projects fail and he identifies the biggest obstacles to successful re-engineering as:

- Lack of sustained management commitment and leadership
- Unrealistic scope and expectations
- Resistance to change.

d) *Value Engineering*

The search for improvement is also present in the concept of Value Engineering (also known as the Value Method, Value Analysis or Value Management).¹³state that the true value of an activity or product is its relationship to its perceived worth as opposed to its life-cycle costs. In Value Method terms: Value = Worth/ Cost. When an item has a value greater than 1.0, it is perceived to be fair or good value; when an item has a value less than 1.0, it is perceived to be poor or bad value. The opportunity to improve the value of a project is greatest at project inception. This shows that, to maximize savings, value engineering should commence at the earliest opportunity in the development of the design brief. It can continue up to and including the procurement of trade contractors.

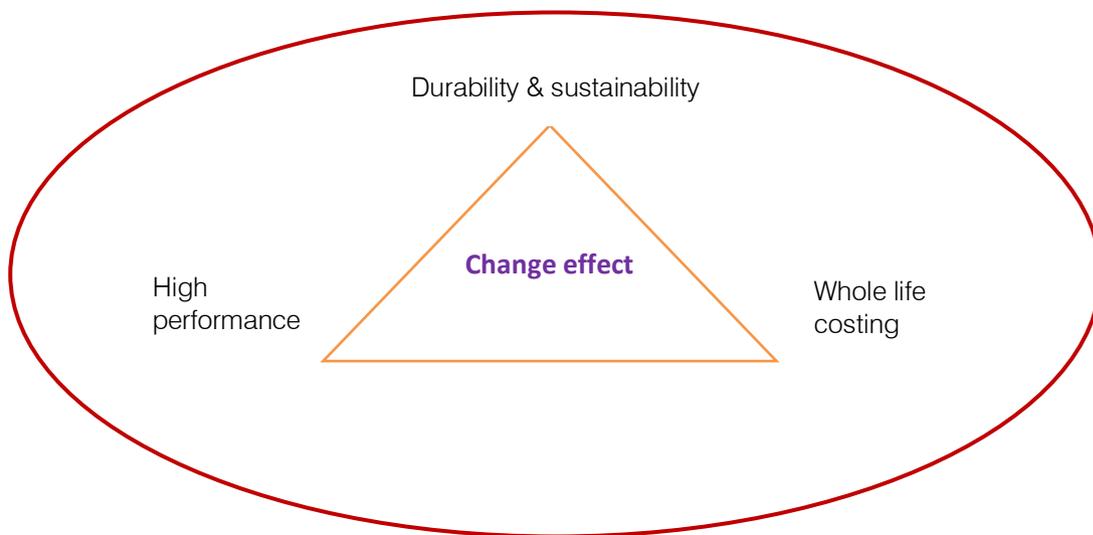
There are many ways to approach change and the technique used will depend on the type of challenge that the organization is facing. Process re-engineering is used to achieve drastic improvement in the efficiency of part of an organization and is often used when new technology potentially makes an existing process obsolete. Value Engineering has produced its best results to date when applied as early in the design process as possible and consequently is generally

viewed as a project specific application. The potential rewards of applying change in materials management are considerable. Change techniques related to levels of activity in the industry requires strategic approach. Whatever approaches are used, their success depends on the following factors:

- The change must be fully thought out and meticulously planned.
- The highest level of management within the organization must fully understand and be totally committed to the change process.
- Lines of communication must be opened and maintained across as many levels as possible within the company.
- Training in all aspects of the new systems and all in all of the skills required by the new systems must be given to all of those involved.

- Change is dynamic; therefore, the change process itself must adapt to suit any new circumstances in which their organization finds itself.
- Once the change programme has been implemented, the process of change must continue if competitive advantage is to be maintained.

The major hindrance to organizational growth are the managers in change process. The inability of the operators to change their attitudes and behaviour as rapidly as their organizations require; slow down the pace of expected change. Change Management which is the deployment and manipulation of financial, technological, natural and human resources efficiently and effectively to accomplish set goals and objectives.



Source: Researcher, 2020

Fig. 2: Effect of change application

Summarily, the application of change concepts as shown in figure 2 ensures project durability and sustainability, it increases performance and ensure whole life costing of construction projects.

III. METHODOLOGY

The research methodology was used to achieve the objectives of the project. Basically, we can identify the following steps.

a) *Sample selection*

The method of the data collection was through a questionnaire survey. The questionnaire was distributed among construction industry professionals working in the building construction industry.

b) *The survey*

Survey questionnaire was divided in to three sections. The first, section was titled "Questions

regarding the experience and the about company". The second section of survey was titled "Questions regarding the impact of change on construction project delivery". These questions attempted to find out whether the company had adopted an innovation in their working system and identified the benefits of the change methodology in their organization. The questionnaire survey was carried out using three methods. The questionnaire form was distributed among construction industry professionals by hand and via email. Face to face interviews were conducted with selected project managers, site managers and site engineers on a several projects.

c) *Analysis of responses*

After the survey responses were received, analytical examination was carried out. The questionnaire results were ranked according to Likert



scale. The rank results were analyzed relatively to the mean value calculation using equation:

$$\begin{aligned} \text{Mean value} &= \Sigma (n_i \times x_i) / \Sigma n_i \text{ equ} \\ x_i &= \text{Likert scale for item, where} \\ l &= 1, 2, 3, 4, 5 \\ n &= \text{frequency of item} \end{aligned}$$

IV. RESULTS AND DISCUSSION

Extracted information from questionnaires and direct interview can be present as follows.

Survey questionnaire was designed in three sections. The first section included questions regarding the experience and background of the respondent and his company. This section helps to get an idea about responder's position in this field. According to above result most of responders work as consultants while lesser number as contractors were reached. This is because the consultants are key to ensure new adaptability and monitoring. Working experience in construction industry responders experience was most effecting factor when doing this kind of survey. The

highest number of responder are above 15years in practice, hence, given credibility to the information supplied.

a) Identified benefits of change in construction industry

Six key benefits of change were ranked by the respondents. As shown in table 1; the construction consultants such as the Architects, Engineers and Quantity Surveyors who make use of this change tools identified effective cost savings with RII of 0.81 as the most importance benefit, earlier completion and improved performance were ranked second and third with RII of 0.80 and 0.78 respectively. This was not too far from the contractors who identified improved performance as the highest benefits derived from change application with RII of 0.82 while effective cost savings ranked second with RII of 0.80. On the average rankings; effective cost savings came first with RII of 0.81. improved performance of RII of 0.80 and earlier completion with RII of 0.78 were ranked second and third respectively.

Table 1: Benefits of change in construction industry

IDENTIFIED BENEFITS	CONSULTANTS		CONTRACTORS		TOTAL SAMPLE	
	RII	RANK	RII	RANK	AV/GROUP RII	GROUP RANK
Improved Performance	0.78	3	0.82	1	0.80	2
Earlier completion	0.80	2	0.77	3	0.79	3
Effective cost savings	0.81	1	0.80	2	0.81	1
Risk reduction	0.68	4	0.74	5	0.71	4
International acceptability	0.67	5	0.72	4	0.70	5
Global competitiveness	0.60	6	0.64	5	0.62	6

Source: Researchers work, 2020

Finally, this paper assessed the acceptance level for change and modernization among construction stakeholders. This is to give credit to change implementation and promotion within the industry. The acceptance level was divided into two main factors such as "Change related to meeting client's needs in terms of cost, quality, time of delivery and sustainability" and "change related to risk reduction, international acceptability and competitiveness". The level of acceptance was based on the scale of:

- Low acceptance level if score less than 5; and
- High acceptance level if score more than 5.1.

Result from the questionnaire analysis show that the level of acceptance is high for both categories as shown in table 2.

Table 2: Level of acceptance by construction stakeholders from questionnaires

S/N	CATEGORY	SCORE
1	Client's satisfaction	8.5
2	International acceptability and competitiveness	7.8

Source: Researchers work, 2020

The score of 8.5 in table 2 shows that construction stakeholders have highly accepted change which is the key driver for improving client's relationship. Cost of construction are executed as targeted; project delivered to time and at required quality and sustainability. Change ensures time maximization, risk reduction securing project completion date. The score

level of 7.8 indicates that the construction stakeholders have high level of acceptance towards ensuring international acceptability. The world is a global village. Nigeria and other developing countries should operate in an accepted standard. The change application also gives room for the companies with Nigeria background to measure up and compete with their foreign counterparts.

V. CONCLUSION

Modern methods of construction change the risk profiles of construction projects. Some development risks become less significant in terms of likelihood of occurring and potential impact. Examples include price fluctuations during the construction process and delays due to bad weather. Other risks become more significant. Examples of these include unpredictable planning decisions and designs that are not suitable to the construction method. The changes necessary to achieve this position include: a value engineering approach applied to the process of materials management in order to minimize the tasks in the process; a re-engineering approach to the tasks that remain in the process; a total quality management approach, with continuous improvement being actively sought in interface areas in the system; a strategic approach with a view to developing partnering arrangements within the industry and an innovative and open-minded approach to be taken to the potential of the use of new technology. If these are put in place, the identified benefits such as effective cost savings, improvement in job, earlier delivery period and so on would be made possible.

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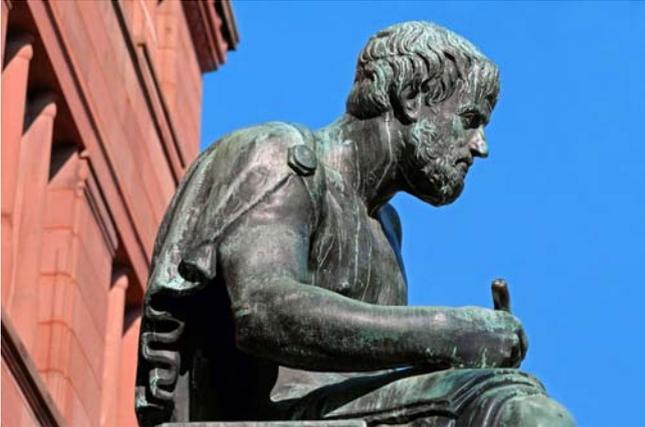
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Career

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Exclusive

Reputation

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Credibility

Reputation

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Credibility

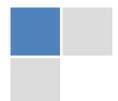
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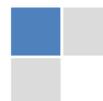
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ASSOCIATE OF ENGINEERING RESEARCH COUNCIL is the membership of Global Journals awarded to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Associate membership can later be promoted to Fellow Membership. Associates are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Associate Members.



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Associates receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

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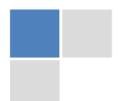
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<p>\$4800 lifetime designation</p> <hr/> <p>Certificate, LoR and Momento 2 discounted publishing/year Gradation of Research 10 research contacts/day 1 GB Cloud Storage GJ Community Access</p>	<p>\$6800 lifetime designation</p> <hr/> <p>Certificate, LoR and Momento Unlimited discounted publishing/year Gradation of Research Unlimited research contacts/day 5 GB Cloud Storage Online Presense Assistance GJ Community Access</p>	<p>\$12500.00 organizational</p> <hr/> <p>Certificates, LoRs and Momentos Unlimited free publishing/year Gradation of Research Unlimited research contacts/day Unlimited Cloud Storage Online Presense Assistance GJ Community Access</p>	<p>APC per article</p> <hr/> <p>GJ Community Access</p>



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Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

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Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

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2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s) names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

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- Writings
- Diagrams
- Graphs
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- Graphic representations
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- Electronic material
- Any other original work

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2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

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Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.



Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

- a) A title which should be relevant to the theme of the paper.
- b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
- c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
- d) An introduction, giving fundamental background objectives.
- e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
- f) Results which should be presented concisely by well-designed tables and figures.
- g) Suitable statistical data should also be given.
- h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

- i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
- j) There should be brief acknowledgments.
- k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.



FORMAT STRUCTURE

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.



Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

PREPARATION OF ELECTRONIC FIGURES FOR PUBLICATION

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

TIPS FOR WRITING A GOOD QUALITY ENGINEERING RESEARCH PAPER

Techniques for writing a good quality engineering research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of research engineering then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.



21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.

- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

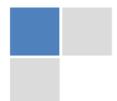
- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.



Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.



Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

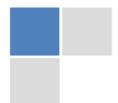
The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.



Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	C-D	E-F
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<i>Introduction</i>	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
<i>Methods and Procedures</i>	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
<i>Result</i>	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
<i>Discussion</i>	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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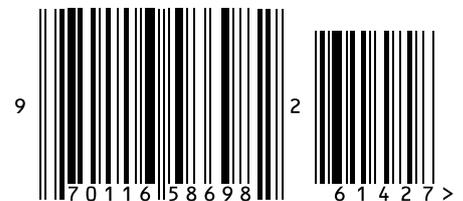


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