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EFFECTS OF COMMUNICATION AMONG PROFESSIONALS ON BUILDING PROJECTS DELIVERY IN NIGERIA

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ABSTRACT

Purpose: Effective communication is an essential ingredient that can help in achieving the set goal of a construction project. Therefore, the study aimed at assessing the effects of communication among the professionals on building project delivery with a view to developing models for determining the effects of communication on completion time, cost, client satisfaction and project management.
Design/methodology/approach: A questionnaire survey that discuss the problem that may arise as a result of informal communication among the construction professionals, was conducted on in-house consultants and external contractors who had been involved on building projects at the Ministry of Housing, Lagos State in the past five years (2011-2016).
Findings: The results demonstrated that answers all questions asked is the most important characteristic of effective communication while specification is the most used communication mechanism. The results also show that the four topmost effect of communication are time, client satisfaction, project management and cost.
Research limitations/implications: The limitation of the study is that data was collected from participants that were involved in construction projects executed by a Ministry in Lagos State in the last five years. This implies that the research is a case study of an establishment. Future study could be extended to cover the whole State in particular or Nigeria in general.
Originality/value: The characteristics of an effective communication and most effective communication mechanisms established through the study will improve construction stakeholder's delivery strategies of building projects. The models developed will also assist in predicting accurately the communication mechanisms that are germane to completion time, client satisfaction, project management and cost of building projects.

Keywords: Client satisfaction; communication mechanisms; completion time; cost; project management

1. INTRODUCTION

Construction project requires effective collaboration and coordination among diverse construction professionals and participant (client). As such coordination and

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collaboration helps to achieve quality standards and cost maximisation (Villagarcia and Cardoso, 1999). Construction project participants include client, project managers, architects, quantity surveyor, contractors, government representative and community amongst other. The numbers of construction participants involve on a project depend on the type of contract. Regardless of the type of contract that is being undertaken, Goh, Goh, Toh and Peniel-Ang (2014) opined that effectiveness of communication between the client and contractor will determine the time and quality of the construction project. Alshawi and Ingirige (2002) opined that effective communication, evaluation and feedback to project team at each stage of construction project could help to achieve project goal. Calvert, Bailey and Coles (2003) observed that construction projects involve great number of people interacting to achieve set goals which is heavily dependent upon inflow and outflow of information. Knipe (2002) identified different communication tools used in construction industry. They include; specifications, reports, manuals, schedules, calculations, drawings, site photographs, agenda's and minutes of meetings. These communication tools are used by different construction professionals at various stage of construction.

Tipili, Ojeba and Sa'adiya-llyasu (2014) observed that during a project, communication can occur in various directions depending on who is communicating. They concluded that there are three channels of communication which includes lateral or horizontal, upward and downward channel in construction projects. (Huczynski and Buchanan (2001) submitted that though managers in different industries and sectors undertake diverse tasks and activities, it was observed that most managers' task hovers around communication. The communication activities could include engaging in conversations; listening to colleagues; networking; collection of information; directing subordinates; writing letters or transferring information through electronic devices such as telephones and/or computers. Communication is germane to all business activities; it is an integral part of any construction process. Inter-organisation and intra-organisation communication contribute to construction project success and possible improve morale of the participants and level of understanding of job's requirement (Mehra, 2009).

Communication can therefore be seen as one of the important factors that could contribute to overall success of any construction project. Communication is crucial to the running of any construction project and for successful accomplishment of construction project, Olarewaju, Tan and Kwan (2017) observed that well-communicated information on project location, type, class and type of clients pre-empts overruns on both cost and time, would help to improve the project performance in terms of quality, sustainability and comfort. Dainty, Moore and Murray (2006) opined that communication is multifarious and complex term, which could mean different things in different context and situations. Aiyewalehinmi (2013) opined that construction productivity is directly related to the quality of information that flows between the people who are managing and those that are doing the work. Andrew, David and Michael (2006) also observed that regardless of much effort put into design and planning process, construction work related issues arise which often calls for urgent attention. Olarewaju, Tan and Kwan (2017) explained that poor communication affects ordering and payment with material suppliers. In such working environment with probability of production problems due to non-availability of communication patterns that are dynamic, spontaneous and often informal. In an attempt to solve the problem that could arise in informal passage of information among construction professionals, the study set to assess the effect of communication among construction professionals on building project delivery in Nigeria.

2. LITERATURE REVIEW

Building projects are always multidisciplinary, often large, and require participation of many parties during execution phase. Building project often arise with uncertainty of the number of professionals and participants that would be involved. The uncertainty increases with the size of the project. The size of large projects and the desire to shorten the duration of the delivery process always require simultaneous communication on the project. During execution stage of construction, some activities may be undertaken simultaneously, requiring major efforts in terms of coordination and communication between the participants (Shohet and Frydman, 2003). Emmitt and Gorse (2003) lamented the failure of construction industry to focus on improving human communication which is critical to success of a construction project. The study concluded that efforts were always concentrated on process and production improvement at the expense of improving complex inter-organisational and interpersonal relationships that define the industry's culture. Gomez-Ferror (2017) concluded that the most relevant problem is to work with documents that are not updated and the subsequent loss of time and money that involves correcting errors on site.

In recent years, the value of effective human and organisational communication has been recognised with establishment of alliance structures within organisations. Project Management Institute (2013) found that construction businesses that emphasise communication perform five times better compare to those that did not prioritise effective communication. Businesses that communicate effectively compete more than 80% of their construction projects within budget, on time, in high quality, and achieve other client value systems (PMI 2013). According to Gayeski and Russell (2005), communication could be regarded as a professional practice, where appropriate rules and tools could enhance utility of information. Heath and Palenchar (2008) viewed communication as a tool that fall into different zones of meaning that enable interaction between organisations. The people in the organisations translate the meanings, disseminate, comprehend, receive and utilise the information (Checkland and Howell, 2003). Clearly, it is essential that organisations have established and proven business processes that could support effective and efficient inter and intra-organisational communication alliance structure. Information is a general term and embraces meanings such as knowledge, processed data, skills, technology, etc. Inter-organisational relationships are used to improve the flow of information, and share knowledge, learning and experience.

Emmitt and Gorse (2003) explored interpersonal communication during construction progress meetings. The study explained further that management and design team interaction is task-based that is capable of inculcating emotional interaction which could influence group behaviours are not available. The study also concluded that individualized nature of communication dynamics is common within the construction sector, and the propensity of people within the industry to act in ways which do not necessarily support interaction requirements. Loosemore (2000) observed the patterns of behaviour that occurred during crises and unforeseen events within the construction industry are in complex patterns of communication which are unnecessary or counterproductive. Therefore, there is need for a study on the effect of this complex communication pattern on project delivery.

3. RESEARCH METHODOLOGY

The research design adopted for the study was survey method. Table 1 shows the population for this study which includes in-house consultants (quantity surveyors, architects, engineers and builders) and external contractors who had been involved on building projects at the Ministry of Housing, Lagos State in the past five years (2011-2016). The study population for this study is finite and it falls within manageable size. Therefore, census method was adopted. Census means that the entire population was used as sample. In this case, the sampling frame constitutes the sample size. The census method is superior to all other sampling methods in that it virtually eliminates sampling error and provides data on almost all the population components. Fifty-five comprehensive copies of questionnaire were administered, fifty-two copies of questionnaire (representing 95% of administered questionnaire) were returned which was found suitable for analysis.

Percentile was used to assess demographic distribution of respondents. Mean Score was used to assess characteristic of effective communication and effect of communication on delivery of construction project. Friedman test was used to assess level of usage of communication mechanism among professionals and test the mean rank between communication mechanisms. Friedman test ranking is peculiar in that it ranked assessed variables higher than the likert scale used. Multiple regression analysis was used to develop models for the four topmost affected construction project delivery variables by communication.

Table 1: Sample Frame of Respondent

S/N	In-House Consultants/External Contractor	Population
1	Architects	8
2	Quantity Surveyors	11
3	Builders	13
4	Engineers	13
5	Contractors	15
	Total	55

Source: Ministry of Housing, Lagos State (2016)

4. DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1. Demographic distribution of respondents

Background information of the respondents reveals that majority of the respondents 40 (76.9%) works in a public organization while the remaining 12 (23.1%) works in a contracting organization. 40 (76.9%) of the respondents are construction professionals (quantity surveyors, architects, builders and engineers) and 12 (23.1%) are contractors. 10 (19.20%) of the respondents have between 1-5 years working experience, 19 (36.5%) have between 6-10 years working experience, 23 (44.2%) of the respondents have working experience of over 10 years. 7.7% of the respondents are OND holders, 21.2% are Higher National Diploma holders, 40.4% are holders of Bachelor in Degree and 30.8% are Master's degree holder. No respondent have Ph.D. academic qualification. Furthermore, 46.15% of the respondents are graduate member of a professional body, 40.38% are corporate members while 13.46% are fellows of professional bodies. This could be due to the established fact that being professionally qualified is rated higher in determining promotion in construction firms than having postgraduate academic certificates.

Considerable percentage of the respondents had handle over 20 construction projects. This demographic distribution of the respondents makes the data collected fit for analysis as the respondents are all educated, professionally qualified and have practical experience of construction work.

4.2. Characteristics of effective communication

Table 2 shows response of respondents on the characteristics of effective communication. The table reveals that the most important characteristic of effective communication is answers all questions asked with a mean score of 4.37. This is followed by give something extra when desirable and includes only relevant statements with mean score of 4.15 and 4.08 respectively. The least of the characteristics of communication is choose non-discriminatory expression with a mean score of 3.62. All the variables in table 2 have a mean score of above 2.5; this implies that each of the variables is an important characteristic of effective communication.

Table 2: Characteristics of effective communication

Characteristics of Communication	Mean	Rank
Answers all questions asked	4.37	1
Give something extra when desirable	4.15	2
Include only relevant statements	4.08	3
Avoid unnecessary repetition	4.04	4
Achieve appropriate readability	4.02	5
Emphasis on pleasant facts	3.98	6
Include examples. illustrations and other visual aids when desirable	3.96	7
Choose vivid, image-building words	3.90	8
Use specific and accurate works, facts and figures	3.88	9
Apply integrity and ethics	3.87	10
Choose short, familiar, conversational words	3.85	11
Be sincerely tactful, thoughtful and appreciative	3.83	12
Achieve appropriate readability	3.83	13
Use the right level of language	3.75	14
Show interest in the reader	3.71	15
Omit expressions that irritate, hurt or belittle	3.63	16
Maintain an acceptable writing mechanisms	3.63	17
Choose nondiscriminatory expression	3.62	18

4.3. Level of usage of communication mechanisms

Table 3 shows the level of usage of communication mechanisms as ranked by respondents. The table reveals that the most used communication mechanism is specification with mean score of 12.21 followed by project plan and report with mean score of 12.04 and 11.01 respectively. The least communication mechanism used is gestures with mean score of 3.56. Less used communication mechanisms are facial expression, postures,

pitch, pacing of voice and gestures are with mean scores of 5.78, 4.75, 4.45, 3.89 and 3.56 respectively.

Table 3: Level of usage of communication mechanisms

Communication Mechanisms	Mean	Rank
Specification	12.21	1
Project plan	12.04	2
Report	11.01	3
Memos	10.80	4
Presentation	10.65	5
Metric	10.47	6
Speeches	9.92	7
Conversations	9.68	8
Site meetings	9.64	9
Note	8.58	10
E-mail	8.56	11
Facial expressions	5.78	12
Postures	4.75	13
Pitch	4.45	14
Pacing of voice	3.89	15
Gestures	3.56	16

4.4. Effects of communication on building projects delivery

Table 4 shows the effects of communication on building projects delivery. Time is ranked first, with a mean score of 4.54 while client satisfaction, project management was ranked second and third respectively with a mean score of 4.48 and 4.19 respectively. Cost is the fourth ranked effect with mean score of 4.12.

Table 4: Effects of communication on building projects delivery

Variables	Mean	Rank
Time	4.54	1
Client satisfaction	4.48	2
Project management	4.19	3
Cost	4.12	4
Sustainability	3.73	5
Quality	3.71	6
Health and safety	3.54	7
Functionality	3.50	8
Maintainability	3.35	9

Communication mechanisms were further analysed using regression analysis to predict the probable time, client satisfaction, project management and cost to construction project. Since these variables (time, client satisfaction, project management and cost) were ranked best with mean score of above 4.00.

4.5. Effect of communication mechanisms on the completion time of building projects

Table 5 shows the multiple regression model summary and overall fit statistics. R with value of 0.661 can be considered to be a measure of the quality of the prediction of time of completion of building project. This indicates a good level of prediction. The adjusted R^2 of the model is 0.179 with R^2 (coefficient of determination) = 0.437. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 43.7% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), is 1.631. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting residual variables to be correlated. This further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 5: Model summary of the effect of communication mechanisms on completion time of building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.661	0.437	0.179	0.633	1.631

4.5.1 Test of Hypothesis

$H_0$1: Communication mechanism is not a significant determinant of the completion time of building project.

H_A1: Communication mechanism is a significant determinant of the completion time of building project.

Decision Rule: Reject H_0, if p-value is less than 0.05.

Table 6 shows the F-ratio test to indicate whether the overall regression model is good/fit for the data. The multiple regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words $R^2 = 0$). The F-test shows that the independent variable statistically predicts the dependent variable, F (16, 35) = 1.695, p-value = 0.004 < 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in the model.

Table 6: ANOVA table for completion time

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Regression	10.880	16	0.680	1.695	0.004
Residual	14.043	35	0.401		
Total	24.923	51			

Table 7 shows coefficients of the independent variables on time with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

From Table 7, metric, facial expression and site meetings have p-value that is less than 0.05. These three communication mechanisms are significant variables in predicting effect of building project delivery in terms of time. Thus, the general form of the model to predict the effect of communication mechanisms on completion time of building project delivery from pacing of voice, speeches, specification, note, site meetings, metric, presentation,

gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is:

MODEL 1: COMPLETION TIME = 4.376 + (0.309*Metric***) + (0.391****Facial expression***) + (0.443****Site meetings***)**

Table 7: Coefficients of the independent variables on completion time

Communication Mechanisms	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant)	4.376	1.234		3.545	0.001		
Project plan	0.047	0.214	0.040	0.220	0.827	0.480	2.084
Specification	-0.046	0.239	-0.032	-0.191	0.849	0.563	1.777
Report	-0.358	0.223	-0.337	-1.605	0.117	0.365	2.743
Metric	0.309	0.173	0.301	1.787	0.012*	0.567	1.763
Presentation	0.161	0.175	0.163	0.919	0.364	0.512	1.951
Speeches	-0.030	0.129	-0.037	-0.232	0.818	0.635	1.575
Memos	-0.191	0.186	-0.189	-1.029	0.311	0.475	2.104
E-mail	-0.174	0.188	-0.195	-0.928	0.360	0.366	2.735
Note	0.326	0.193	0.367	1.693	0.099	0.344	2.911
Site meetings	0.443	0.253	0.421	1.748	0.017*	0.278	3.599
Conversations	0.411	0.344	0.335	1.197	0.239	0.206	4.858
Facial expressions	0.391	0.219	0.424	1.783	0.023*	0.285	3.511
Postures	0.088	0.166	0.120	0.528	0.601	0.311	3.218
Gestures	-0.143	0.129	-0.220	-1.116	0.272	0.414	2.418
Pitch	-0.336	0.198	-0.451	-1.692	0.100	0.226	4.418
Pacing of voice	-0.007	0.211	-0.008	-0.031	0.975	0.248	4.039

4.6. Effect of communication mechanism of client satisfaction on building projects

Table 8 shows the multiple regression model summary and overall fit statistics. R with value of 0.493 can be considered to be one measure of the quality of the prediction of client satisfaction. This indicates a good level of prediction. The adjusted R^2 of the model is 0.103 with R^2 (coefficient of determination) = 0.243. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 24.3% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), is 1.813. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting that considered residual variables are correlated. It further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 8: Model summary of the effect of communication mechanism of client satisfaction on building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.493	0.243	0.103	0.673	1.814

4.6.1 Test of hypothesis

$H_0$2: Communication mechanism is not a significant determinant in building project delivery in term of client satisfaction.

H_A2: Communication mechanism is a significant determinant in building project delivery in term of client satisfaction

Decision Rule: Reject H_0, if p-value is less than 0.05

In Table 9, the F-ratio test whether the overall regression model is a good fit for the data. The multiple regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words R^2 = 0). The F-test shows that the independent variables statistically significantly predicts the dependent variable, F (16, 35) = 0.703, the p-value (0.011) is less than 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in the model.

Table 9: ANOVA Table for Client Satisfaction

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	5.105422	16	0.319089	0.703	0.011
Residual	15.87535	35	0.453581		
Total	20.98077	51			

Table 10 shows coefficients of the independent variables on client's satisfaction with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

From Table 10, postures and gestures have p-value that is less than 0.05. These two communication mechanisms are significant variables in predicting effect of building project delivery in terms of client satisfaction. Thus, the general form of the model to predict the effect of building project delivery in terms of client satisfaction from pacing of voice, speeches, specification, note, site meetings, metric, presentation, gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is;

MODEL 2: CLIENT SATISFACTION = 4.78 + (0.01**Postures***) + (0.28****Gestures***)**

Table 10: Coefficients of the Independent Variables on Client Satisfaction

Communication Mechanisms	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
(Constant)	4.78	1.31		3.64	0.00		
Project plan	-0.08	0.23	-0.07	-0.35	0.73	0.48	2.08
Specification	-0.09	0.25	-0.07	-0.37	0.71	0.56	1.78

Report	-0.12	0.24	-0.12	-0.49	0.63	0.36	2.74
Metric	0.023	0.18	0.02	0.13	0.90	0.57	1.76
Presentation	-0.01	0.19	-0.01	-0.05	0.96	0.51	1.95
Speeches	0.05	0.14	0.07	0.38	0.71	0.63	1.58
Memos	0.07	0.20	0.08	0.38	0.71	0.48	2.10
E-mail	0.13	0.20	0.16	0.67	0.51	0.37	2.73
Note	-0.04	0.20	-0.04	-0.18	0.86	0.34	2.91
Site meetings	-0.20	0.27	-0.20	-0.73	0.47	0.28	3.60
Conversations	0.25	0.37	0.23	0.70	0.49	0.21	4.86
Facial expressions	0.26	0.23	0.31	1.11	0.27	0.28	3.51
Postures	-0.01	0.25	-0.01	-0.04	0.01*	0.31	3.22
Gestures	0.28	0.13	-0.48	2.08	0.03*	0.41	2.42
Pitch	-0.12	0.21	-0.18	-0.58	0.56	0.23	4.42
Pacing of voice	0.01	0.22	0.01	0.03	0.97	0.25	4.04

4.7. Effect of communication mechanism of project management on building projects

Table 11 shows the multiple regression model summary and overall fit statistics. R with value of 0.530 can be considered to be one measure of the quality of the prediction of project management. This indicates a good level of prediction. The adjusted R^2 of the model is 0.048 with R^2 (coefficient of determination) = 0.281. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 28.1% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), is 1.586. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting that considered residual variables are correlated. It further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 11: Model summary of effect of communication mechanism on project management of building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.53	0.281	0.048	0.759	1.586

4.7.1 Test of hypothesis

$H_0$3: Communication mechanism is not a significant determinant in building project delivery in term of project management

H_A3: Communication mechanism is a significant determinant in building project delivery in term of project management

Decision Rule: Reject H_0, if p-value is less than 0.05

In Table 12, the F-ratio test whether the overall regression model is a good fit for the data. The linear regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words $R^2 = 0$). The F-test shows that the independent variables statistically significantly predicts the dependent variable, F (16, 35)

= 0.85, p-value = 0.02 < 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in the model.

Table 12: ANOVA table for project management

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	7.89	16	0.49	0.85	0.02
Residual	20.19	35	0.58		
Total	28.08	51			

Table 13 shows coefficients of the independent variables on project management with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

Table 13: Coefficients of the Independent Variables on Project Management

	Unstandardized Coefficients		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	4.24	1.48		2.86	0.01		
Project plan	-0.20	0.26	-0.16	-0.76	0.45	0.48	2.08
Specification	-0.17	0.29	-0.11	-0.60	0.55	0.56	1.78
Report	0.09	0.27	0.08	0.35	0.73	0.36	2.74
Metric	-0.03	0.21	-0.03	-0.16	0.88	0.57	1.76
Presentation	0.07	0.21	0.06	0.32	0.75	0.51	1.95
Speeches	0.13	0.15	0.15	0.85	0.40	0.63	1.58
Memos	-0.05	0.22	-0.05	-0.24	0.81	0.48	2.10
E-mail	0.55	0.23	0.58	2.44	0.02*	0.37	2.73
Note	0.43	0.23	-0.45	-1.86	0.07*	0.34	2.91
Site meetings	-0.04	0.30	-0.04	-0.13	0.89	0.28	3.60
Conversations	0.04	0.41	0.03	0.09	0.93	0.21	4.86
Facial expressions	0.38	0.26	0.39	1.44	0.16	0.28	3.51
Postures	-0.14	0.20	-0.18	-0.68	0.50	0.31	3.22
Gestures	-0.13	0.15	-0.19	-0.85	0.40	0.41	2.42
Pitch	-0.05	0.24	-0.06	-0.20	0.84	0.23	4.42
Pacing of voice	-0.03	0.25	-0.03	-0.11	0.91	0.25	4.04

From Table 13, email and note have p-value that is less than 0.05. These two communication mechanisms are significant variables in predicting effect of building project delivery in terms of project management. Thus, the general form of the model to predict the effect of building project delivery in terms of project management from pacing of voice, speeches, specification, note, site meetings, metric, presentation, gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is:

***MODEL 3: PROJECT MANAGEMENT = 4.24 + (0.55 * *E-mail*) + (0.43**Note*)**

4.8. Effect of communication mechanism on construction cost of building projects

Table 14 shows the multiple regression model summary and overall fit statistics. R with value of 0.664 can be considered to be one measure of the quality of the prediction of cost for building project. This indicates a good level of prediction. The adjusted R^2 of the model is 0.185 with R^2 (coefficient of determination) = 0.440. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 44.0% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), d= 1.848. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting that considered residual variables are correlated. It further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 14: Model summary of the effect of communication on cost for building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.664	0.44	0.185	0.495	1.848

4.8.1 Test of hypothesis

$H_0$4: Communication mechanism is not a significant determinant in building project delivery in term of cost

H_A4: Communication mechanism is a significant determinant in building project delivery in term of cost

Decision Rule: Reject H_0, if p-value is less than 0.05.

In Table 15, the F-ratio test whether the overall regression model is a good fit for the data. The linear regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words $R^2 = 0$). The F-test shows that the independent variables statistically significant predicts the dependent variable, F (16, 35) = 0.85, p-value = 0.022 < 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in our model.

Table 15: ANOVA table for cost

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	6.743	16	0.421	1.722	0.022
Residual	8.565	35	0.245		
Total	15.308	51			

Table 16 shows coefficients of the independent variables on cost of building project with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

Table 16: Coefficients of the independent variables on cost

Communication Mechanisms	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	3.159	0.964		3.277	0.002		

Project plan	0.486	0.167	0.531	2.911	0.006	0.480	2.084
Specification	-0.033	0.186	-0.030	-0.179	0.859	0.563	1.777
Report	0.020	0.174	0.024	0.112	0.911	0.365	2.743
Metric	0.288	0.135	0.358	2.131	0.040	0.567	1.763
Presentation	-0.081	0.137	-0.105	-0.592	0.558	0.512	1.951
Speeches	0.143	0.101	0.225	1.415	0.166	0.635	1.575
Memos	0.004	0.145	0.005	0.027	0.979	0.475	2.104
E-mail	0.226	0.147	0.322	1.541	0.132	0.366	2.735
Note	-0.250	0.151	-0.358	-1.658	0.106	0.344	2.911
Site meetings	0.041	0.198	0.050	0.210	0.835	0.278	3.599
Conversations	-0.162	0.268	-0.168	-0.602	0.551	0.206	4.858
Facial expressions	-0.147	0.171	-0.204	-0.859	0.396	0.285	3.511
Postures	0.194	0.130	0.340	1.498	0.143	0.311	3.218
Gestures	-0.044	0.100	-0.086	-0.438	0.664	0.414	2.418
Pitch	-0.120	0.155	-0.206	-0.774	0.444	0.226	4.418
Pacing of voice	0.268	0.165	0.413	1.627	0.113	0.248	4.039

Table 16 project plan and metric have p-value that is less than 0.05. These two communication mechanisms are significant variables in predicting effect of building project delivery in terms of cost. Thus, the general form of the model to predict the effect of building project delivery in terms of cost from pacing of voice, speeches, specification, note, site meetings, metric, presentation, gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is:

$$\textbf{*MODEL 4: COST} = 3.159 + (0.486 * \boldsymbol{Project\ plan}) + (0.288 * \boldsymbol{Metric})$$

5. DISCUSSION OF RESULTS

5.1. Characteristics of effective communication

The essential characteristics of an effective communication are answers all questions asked, give something extra when desirable, include only relevant statements, avoid unnecessary repetition and achieve appropriate readability. This result corroborates Asemah (2011) conclusion that for meaningful communication among persons or groups, there has to be an agreed signs or symbols that is comprehended by all actors particularly, between the sender and receiver of the message. Completeness of a communication lies in ability to give all needed answers to a receiver at a go with clear stated instructions and illustrations. The willingness to give additional information at the point of request spiced communication. These are critical to regarding a communication to be complete.

5.2. Level of usage of communication mechanism

Specification and project plan which are classified as formal writing were ranked highest among the communication mechanisms that are often used among construction professionals. Report and memos were ranked high also. While presentation which is classified as formal verbal communication mechanisms was ranked next to the

aforementioned. The findings above are corroborated by Maslej (2006) submission that, scope of work and details of construction are communicated by means of drawings, contract document addenda and specifications. There are various ways and methods of communicating information in the construction industry, which could be formal or informal. Mailabari (2014) also reported that though a vast majority of information is exchanged verbally and delegated, most data is exchanged in written format either as hard copy or electronically. Both verbal presentation and formal means of communication are essential in actualizing fruition of construction projects. In construction site, most communication are written down for record purpose, contractors also ensure that client or client's representative verbal instruction are made formal in the instruction book for record purpose and for effective communication of financial implication of such verbal instruction.

5.3. Effects of communication mechanisms on building projects delivery

This study examined the effect of communication mechanisms on building projects delivery. The findings show that time, client satisfaction, project management and cost were highly ranked variables and has an important effect on project delivery. Clients' satisfaction is a function of the project being finished to quality specified, time and budgeted cost. These are critical factors that constitute success of any construction project. As stated by Mehra (2009), communication is very essential in project execution as it plays vital role in all stages of construction. Based on these high ranked effect of communication mechanisms on building project delivery, regression analysis was carried out to develop models for future use.

Model one (1) predicts effect of communication mechanisms on completion time of building projects is based on metric, facial expression and site meetings. This result is in consonance with the observation made by Wofford, Gerloff and Cummins (1977) that, construction professional communicate informally under some conditions. Also, Furst, Abrams, MacKenzie, Tissue and Citrin (2002) opined that facial expressions help the recipient(s) of a message to interpret that message as the speaker intends it on time. However, according to Davis (2014), facial expressions are very important part of communication. Though nothing is said verbally, much could be passed across and understood. Bowden and Thorpe (2002) also submitted that construction personnel transfer information on paper based files (drawings, data collection forms, correspondences, progress information and specifications) at site meetings.

From Model 2, effect of communication on client satisfaction for building projects is predicted by posture and gestures. According to Jacklyn (2011), posture and gestures are attached view which allows the professionals to take actions the way a client wants. This assertion is reinforced by Block (2004) that consultants and clients make influence on each other by sharing information, emotions and feelings. As a matter of fact, it forms particularly diverse and complex clients-consultants relations, which can be determined as the transfer and reception of information for finding the best possible solution, for making influence on each other, changing attitudes, feelings and behaviour in the process of consultation.

Model 3 predicts effect of communication mechanisms on project management for of building projects to be through e-mail and note. This result is in conformity with Handy (1999) opinion that communication through e-mail can provide substantial benefits to the project team in terms of productivity and management of building projects.

Model 4, shows the effect of communication mechanisms on cost for of building projects, the prediction rest on project plan and metric. According to (Kamara Anumba and Evbuomwan, 1996), in order to satisfy client's needs in terms of cost and ensure that the design is constructable, the project plan must not only have the client's requirements as input, but also information about construction and the operation and maintenance of the facility. This assertion is also reinforced by Rajhans (2013) that, arranging the documents of the construction contract, negotiating with the qualified design professionals, providing the qualified design professionals with the needed information, updating and reviewing design documents, negotiating contract price with qualified contractor, interpreting and clarifying ambiguities in the contract documents etc. are important communication activities.

6. CONCLUSION

The study was conducted with an intention to assess the effect of communication on building project delivery. Deducing from the results of the questionnaire survey and data analysis, the results of this study clearly reflect that efficiency in communication plays a key role in successful implementation of building projects and also affects performance of the entire life cycle of construction projects. The most effective characteristic of communication is that sender answers all questions asked. Completeness of communication will help receiver understand the expectation of the giver and also helps in carrying out professional task expected by all participating professionals on the project. To be able to perform the expected communication functions, specification is the most used communication mechanisms among professionals for successful building projects delivery. Specification must be complete, clearly stating all expected qualities of all items of work in appropriate clauses and avoidance of any ambiguity.

Communication has effect on time, client's satisfaction and cost. All these variables helped to achieve the stated quality expected. Cost, time and quality of work done are the main target for success of construction project. Client's satisfaction is regarded to base on fulfillment of expected quality that birthed the project. Uncertainty in any communication mechanism (working drawing, specification etc.) if not clarified could lead to delay and delay claims. Overall quality of the work could also be affected as enthusiasm of workers when working with poor communication mechanism or medium on any aspect of work could be reduced. The study recommended that the application of communication mechanisms model would ensure successful building projects delivery to time, project cost and client's satisfaction. Further study can be carried out to cover Lagos State in particular and the Nigeria in general.

REFERENCES

Aasrum, J. (2016). Communication in Building Design Management: A Comparative Study of Norway and Germany. *Unpublished M.Sc. Thesis,* Norwegian University of Science and Technology, Trondheim.

Aiyewalehinmi, E.O. (2013). Factor Analysis of Job Satisfaction in the Construction Industry, *IOSR Journal of Engineering,* 3(7), 16-24.

Alshawi, M. & Ingirige, B. (2003). "Web-enabled project management: an emerging paradigm"

Andrew, D., David M. and Michael, M. M. (2006).*Communication in construction*: Theory and practice, Taylor & Francis, Oxon.

Asemah, E. S. (2011). *Principles and practice of mass communication*, Great Future Publisher, Jos, Nigeria.

Block, D. (2004). Globalization, transnational communication and the Internet. *International Journal on Multicultural Societies*, *6*(1), 13-28.

Bowden, S. and Thorpe, A. (2002) 'Mobile communications for on-site collaboration', in Proceedings of ICE, Civil Engineering, 150, November, Paper 12989, 38–44.

Calvert, R.E., Bailey, G and Coles, D. (2003). *Introduction to Building Management.* Butterworth - Heinemann. Oxford; Great Britain.

Checkland, P. & Holwell, S. (2003). *Information, Systems and Information systems – Making Sense of the Field*. Chichester: Wiley.

Dainty, A., Moore, D. and Murray, M. (2006) *Communication in Construction: Theory and Practice*. London, Taylor & Francis.

Davis, D (2014). Making a case for virtual healthcare communication: Mayo Clinic's Integration of World Virtual Communities in Their Social Media Mix, *Journal of Case Studies in Strategic Communication* 3, 7.

Emmit, S. & Gorse, C. (2003), *Construction communication*, Blackwell publishing LTD.

Furst, D. I., Abrams, M. A., MacKenzie, R. C., Tissue, E. B., & Citrin, W. I. (2002). *U.S. Patent No. 6,338,011*. Washington, DC: U.S. Patent and Trademark Office.

Gayeski, D. M., & Russell, J. D. (2005). Managing Learning and Communication Systems as Business Assets.

Goh, K. C., Goh, H. H., Toh, S. H. & Paniel-Ang, S. E. (2014). Enhancing Communication in Construction Industry through BIM, *Proceeding of the 11th Conference on Innovation and Management*, 17-19 November, Vaasa, Finland.

Gomez-Ferror, A.P. (2017). Communication Problems between Actors in Construction Projects. *Unpublished M. Sc. Thesis*, School of Engineering, Aalto University, Greater Helsinki, Finland.

Handy, C. (1999). *Understanding Organisations* (4th Ed.), Penguin

Heath, R. L., & Palenchar, M. J. (2008). *Strategic issues management: Organizations and public policy challenges*. Sage Publications.

Huczynski, A. A. and Buchanan D. A. (2001). *Organizational Behaviour*: *An Introductory Text*, (4th ed.), Financial Times Prentice Hall, Harlow Essex.

Jacklyn, W. (2011). Importance of construction communication. Microsoft Encarta Online Encyclopedia 2011. Retrieved June 20, 2011, from http://www.stonemarkcm.com/bartmendel.htm#education

Kamara, J. M., Anumba, C. J., & Evbuomwan, N. F. (1996). *A Review of Existing Mechanisms for Processing Clients' Requirements in the Construction Industry*.Construction Research Unit, School of Science and Technology, University of Teeside.

Knipe, A. (2002). *Project Management for Success*. Sandown: Heinemann Publishers.

Loosemore, M. (2000). *Construction Crisis Management*, American Society of Civil Engineers, New York.

Mailabari, H. K (2014). Assessment of Barriers to Communication in the Nigerian Construction Industry, Unpublished M.Sc Thesis in Quantity surveying, Department of Quantity Surveying, Faculty of Environmental Design Ahmadu Bello University, Zaria, Nigeria

Maslej, M. (2006). *Communication in the Construction industry*. Technical Thesis project(Diploma), U.S.A, George Brown College

Mehra, S. (2009). Project communication Management. Accessed from the website: http://www.scribd.com/doc/7875707/Project-CommunicationSummary-by-Sachin-Mehra.

Olarewaju, A., Tan, S. Y. & Kwan, L. F. (2017). Roles of Communication on Performance of the Construction Sector. *Procedia Engineering*, 196 (2017) 763 – 770.

Project Management Institute (2013). The high cost of low performance: The essential roles of communication. PMI.

Rajhans, K. (2013). Role of Communication in the Large-scale Construction Projects in India. http//www/vslir.iima.ac.in.OS_PP311_Role_of_Communication_in_the_Large_scale _Construction_Projects_in India_274_Rajhans_b.pdf. Retrieved on 06/07/2016.

Rajhans, N. R., and Ahuja B. B. (2005). Analyzing decision factors for redesigning a plant layout using analytical hierarchical processing."*IE (I) Journal (86)*

Shohet, I.M., Frydman, S. (2003). Communication Patterns in Construction at Construction Manager Level, *Journal of Construction Engineering and Management*, 129(5), 570-577.

Tipili, L. G., Ojeba, P. O. & Sa'adiya-llyasu M. (2014). Evaluating the Effects of Communication in Construction Project Delivery in Nigeria. *Global Journal of Environmental Science and Technology*, 2(5), 48 – 54.

Villagarcia, S. and Cardoso, F. (1999). New Supply Chain Network in Brazil's House Construction Industry, *Proceeding of 7th Annual Conference of International Group for Lean Construction*, IGLC-7, 26-28 July 1999, University of California, Berkeley, CA, USA, 171 – 180.

Wofford, J.C., Gerloff, E.A. and Cummins, R.C. (1977) *Organizational Communication: The Keystone to Managerial Effectiveness*, McGraw-Hill, New York.