



Building Design Team Communication: Implications for Project Success in Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author AEI designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author ACO managed the literature searches and some aspects of analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

Within building design team, communication has increasingly become multifaceted. Yet, despite the fast increasing communication modes and the introduction of design tools, most projects are still delivered below expectations. This study investigated the implication of design team's communication on project success using a mixed research method (Quantitative and Qualitative approaches). Eighteen completed projects were randomly selected from five public organizations in Ibadan, Nigeria. Participants were drawn from the design professionals and client representative involved in each of the project (N=102). The quantitative data collected were analyzed using descriptive statistics and Pearson correlation coefficient analysis while qualitative data from semi-structured interviews were subjected to content analysis. Adequate participation of team members in meetings, provision of adequate information and appropriate use of design tools emerged as the key communication qualities which affect the project success. Based on these findings, recommendations were made towards improving design team effectiveness.

Keywords: *Building; communication; design team; project success.*

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1. INTRODUCTION

Over the years, there has been an increase in design complexity in modern buildings due to increased competitiveness in the building industry. Pressure has also been on project stakeholders to improve design quality and project success in terms of time, cost, quality, functionality, innovation, aesthetics and other aspects. Yet, the complexity associated with the nature of the design process, the volume of information as well as the dynamic nature of project stakeholders make it somewhat difficult to achieve the required success [1]. The evidences from previous studies suggest that large scale defects in building projects arise through design actions and decisions [2,3]. Likewise, Ibrahim and colleagues [4] found that poor design information and communication usually have a very significant impact on the level of construction efficiency.

In the bid to improve design process efficiency, ICT tools have been developed and adopted which has redefined the professional profile of contemporary design professionals. There has been transition from hand-made drawings to computerized digital drawings and more recently the model-based design. These changes came with growing demand for different IT design tools and web-based communication to enhance design process as well as propel dynamic communication mediums. Contemporary design communication methods are increasing fast over various scales, across disciplinary teamwork as well as wider national and international scale. As such, communication skills have become an essential prerequisite for contemporary professionals. Today, design teams often collaborate over the internet using various means of communication including email, video conferencing, GoToMeeting, Dropbox amongst others. Distance no longer remains a barrier as professionals now undertake collaborative design over geographical area.

Despite improvements in Information and Communication Technology (ICT), poor communication remains one of the critical issue affecting performance design and construction processes [5,6]. Erratic and uncoordinated communication delivery style usually results in the poor design output with other associated challenges during the construction period [7,1,2]. Researchers [e.g. 4,8,9] observed that most design team focus predominantly on information transfer to the contractors within a timeframe

without considering other essential interaction procedures. This practices usually results in poor information management, poor design quality and substandard building products. While it is important to appreciate different ways of communicating design information nowadays, it is likewise important to consider the inherent challenges and how this aid project success.

Evidence is emerging that despite the immense potentials of modern communications techniques which allow working in geographically-distributed scale, multidisciplinary team communication is still characterized with significant challenges. For instance, Dossick and Neff [10] found that the building information modelling (BIM) technologies do not fully support knowledge synthesis during collaborative interaction; hence, they argued for active, informal and flexible media to enhance problem solving process in a virtual team. Similarly, Soetanto et al. [6] argued that IT tools should be complimented with the use of multiple communication modes such as discussion in online meetings, emailing, 3D BIM models to further aid collaborative interaction in the virtual team. Some scholars [e.g. 11,3] observed that lack of adequate interaction, presence of conflict among members, low levels of trust, and cohesion is still persistent among project teams and all are highly associated with communication and social interaction challenges. Soetanto et al. [6] noted that although communication technologies receive most of the blames, yet, the main cause of project problems could be linked to communication methods and social issues among project teams.

In the face of this growing evidences, Svalestuenta and colleagues [3] found that most research on collaborative design focuses mostly on technology driven aspects such as tools, methods and web-based managing methods. As a result, most referred literatures on design communication focuses largely on ICT related aspects with few to face-to-face interaction or other forms of knowledge exchange during design process. Abadi [12] noted that to successfully address design issues, solve design problems, build relationship, and resolute conflicts, face-to-face communication is crucial. Likewise, Becerik-Gerber, Ku and Jazizadeh [13] found that distance collaboration is often less successful when compared to face-to-face meetings. Owing to the aforementioned, it is not very clear how design team communication impact project success.

Although, some studies have considered ICT based communication issues and its social concerns, yet, majority lack of empirical evidence on the relationship between communication and project success. This constituent major weakness of existing literatures in construction management, a field where the performance is critical. In this regard, this research aims to examine how design team communications affect project success in Nigeria. The objectives are thus to;

- a) identify various communication mode, design tools and communication qualities among design team in study area; and
- b) examine the relationship between design team communication and project success.

The following sections present the research methodology, data presentation, discussion of findings as well as the recommendations. Conclusions were drawn based on the findings, and the limitations as well as areas of further research were highlighted.

2. METHODOLOGY

The mixed research approach (quantitative and qualitative) was employed in order to address the research objectives. The quantitative aspects entails a questionnaire survey of selected project participants' while the qualitative aspect involved semi-structured with some professionals. For the quantitative study, the research takes the position that design participants have their own opinions on communication activities, as such can judge the qualities of the communication that exist during the design process. These opinions could be measured by asking the team members (i.e. the participants) to express their view against a series of statements on a specific attitudinal scale. Data retrieved from the participants could then be subjected to series of statistical analysis to generate new knowledge. In doing so, questionnaire survey was developed and copies were distributed to selected professionals and client representatives on the eighteen (18) projects completed between 2015 and 2017 in Ibadan, Nigeria.

The questionnaire survey sought: (i) participants' background information (including professions, work experience, size of organization, average project value of organization and role on the project), (ii) communication modes (such as face-to-face, telephone conversation, emailing, social media, video conferencing, (iii) design tools

(CAD, BIM, Physical Models and hand-made drawings). (iv) aspects of communication qualities (meeting adequacy, information adequacy, meeting participation, decision-making, prompt responses and design tools) (iv) aspect of project deliver success (quality, time, budget, innovative result, no litigation and client satisfaction).

On the aspect of communication, the respondents were asked to express their level of agreement against a five-point scale from 1 to 5 where 1 indicates 'not at all'; 2 'a little'; 3 'averagely'; 4 'Much'; and 5 'to a great extent'. The statements on communication quality include; V1= "Meetings were adequate facilitated", V2= "The team member provided adequate information during design activities", V3= "Consultants and client participated adequately and satisfactorily in design meetings", V4= "decision making process enhances issues resolution during meetings", V5= "Consultants/clients responded to emails and letters promptly", V6= "The design tools (e.g. AutoCAD, BIM etc.) aided the quality of the project". Also, statements on project success include; V7= "The cost target of the project was achieved", V8= "project was completed with high quality", V9= "project was completed within the time scheduled", V10= "Client were highly satisfied with the project", V11= "The design showed exceptional innovative quality", V12= "project meets technical requirement", V13= "Project meet technical requirement", V14= "No litigation/conflict among stakeholders" and V15= " I am willing to work with the team again" (team survivability).

This study was carried out in Ibadan, Southwest, Nigeria. The choice of Ibadan as the study area was based on the fact that Ibadan is the third most populated in Nigeria after Kano and Lagos. More importantly, Ibadan have considerable number of medium-sized design firms as well as good numbers of corporate organizations including ministries, educational institutions and research organizations. Also, due to the level of economic activities within the city, large numbers of public building projects are being executed in the city in recent time.

After due consultation with public and corporate organization within the city, a total of 38 projects were identified as public projects completed within the city between 2015 and 2017, out of which 18 projects were randomly selected across five public organizations. A minimum of 6 and maximum of 8 members of the design team on

each of the project were reached. In total, 122 questionnaires were distributed to eligible participants in their offices, there were 106 returned, out of which 102 were found fit and were subsequently statistically analyzed. Using SPSS 20 software, the descriptive statistics (frequency, percentages, standard deviation and ranking) while Pearson correlation test was used to identify if there were any relationship between communication qualities and project success.

To allow for a robust research outcome, semi-structured interviews were conducted in the second wave of the study to obtain the qualitative data. The qualitative method was adopted to identify communication practices and challenges using semi-structured interviews. A major weakness of interview is the ability to achieve adequate focus and probing of research themes. Therefore, to achieve proper focus during the interview, authoritative texts [such as 14 & 15] were consulted in formulating and executing the research interviews as applicable within the context of engineering and architectural research. Apart from the general question about the participant's experience and career, four main interview questions addressed the impact of team communication on project success. For instance, a statement read thus; "how does communication affect the project delivery?"

During the interview, the researcher identified and discussed key issues arising from the deliberations. This did not only enhance the strength of identification and analysis, but also minimized bias. The participating team members were interviewed on one-on-one bases in their offices. Each interview was recorded and this lasted for 30 minutes to one hour. Ten (10) recordings (7 professionals and 3 clients' representatives) were obtained. The information obtained from the interviews were subjected to content analysis. These separate analyses enabled triangulation of the outcomes and provide supporting evidence for results. In sum, these two data sets provided diverse research findings, allowing triangulation of the results, and thus, satisfying the research objectives.

3. RESULTS AND DISCUSSION

3.1 Characteristics of Respondents

Of the 102 respondents, only 14 (14%) were female while 88 (86%) were Male with the following educational status; Higher National Diploma (HND) 25% had Bachelor of Science

(BSc) and equivalent, 38%; Masters of Science (MSc) and equivalent 34%) with only 3% Doctor of Philosophy (PhD) degrees holders. The professional qualification and affiliations are as follows; 27% registered Architects with ARCON (Architects Registration Council of Nigeria); 31% registered Engineers with COREN (Council of Registered Engineers Nigeria); 25% registered Quantity Surveyor with NIQS (Nigerian Institute of Quantity Surveyors) while 18% respondents refused to give this information. The work experience of the respondents as at the time of the study shows that about half 49% had above 10 years' experience, 32% between 6 and 10 years whereas only 19% had less than 6 years' experience.

Of all the participants, 29% were client's representatives on the selected projects while 72% were consultants. Also, majority of the respondents 70% were from private organizations, 12% from public service whereas 19% were from academic institutions. The profile of the respondents in terms of educational background, professional qualifications, work experience, duty on projects and their various organizational backgrounds suggests that the information obtained from the participants may be relied upon in determining the design team communication and project success in the study area.

3.2 Assessment of Design Team Communication Modes

Table 1 shows the assessment of various types of communication modes used by the participants during the design process. Majority of the participants 66% indicated that most times they engaged in face-to-face meetings during design process. As a result, "face-to-face" meetings had the highest mean score (M= 4.56) indicating that a high level of physical interaction among the project team. This is followed by "telephone conversation" M=4.17, then Emails ranked third with mean score M=4.08 and exchange of letters (M=3.96). However, "social media" and "video conferencing" had the lowest mean scores (M=2.62) and (M=1.91) respectively, this may be due to the limited level of technology availability and affordability in Nigeria.

3.3 Assessment of Design Tools

The study also examined the extent of usage of design tools among design team members. As

indicated in Table 2, about half 48% indicated that Computer Aided Design (CAD) was the mostly used design tool and thus, ranked first with a mean score $M=4.18$. Ranked second was Building Information modelling (BIM) with mean score $M=3.18$, while physical models ranked third with mean score $M=2.66$. The least ranked was manual drafting with a mean score $M=2.39$. These suggest that CAD was still predominantly used in the study area although BIM usage is fast gaining application in Nigeria.

3.4 Assessment of Design Team Communication Qualities

The result as shown in Table 3 indicate that more than half of those surveyed 57(56%) opined that design tools had enhanced the quality of their designs, thus, design tools ranked first among the six communication variables ($M=4.40$, $SD=0.799$). Ranked second is effective decision-making process ($M=4.38$) followed by information adequacy ($M=4.28$) and meeting adequacy ($M=4.24$) respectively. Meeting participation ($M=4.03$) ranked fifth while the least ranked was prompt responses ($M=3.80$).

3.5 Evaluation of Project Success

The extent of project success in term of completion to budget, time, specified quality, client's satisfaction, absence of litigation, functional requirement, and innovative / aesthetic result amongst others was evaluated. Respondents were asked to rank the project success based on their experience on the selected projects. The result is as shown in Table 4.

Absence of litigation or conflict among project team ranked first with a mean score of $M=4.23$, $SD= 0.595$, followed by team survivability (i.e. willingness to work together on other projects in future) with mean score $M=4.16$, $SD= 0.728$, then client satisfaction was ranked third, with a mean score of $M=4.05$, $SD=0.776$. Completion to specified quality ($M=3.92$, $SD=0.1191$), innovative result ($M=3.92$, $SD=0.817$), technical requirement ($M= 3.82$, $SD= 0.587$), and budget ($M=3.61$, $SD= 1.082$) ranked next respectively. The least ranked project success factor was "completion to time", with a mean score of ($M=3.32$, $SD=1.007$). This implies that most of the projects were not complete their project to time, to budget and their required technical standards.

Table 1. Assessment of communication modes

Modes	Scale					Mean Score	SD	Rank
	1	2	3	4	5			
Face-to-face	0%	2.0%	5.9%	26.5%	65.7%	4.56	0.698	1 st
Telephone conversation	0%	7.8%	16.7%	26.5%	49.0%	4.17	0.976	2 nd
Emails	2.0%	3.9%	18.6%	35.3%	40.2%	4.08	0.961	3 rd
Exchange of letters	3.9%	3.9%	22.5%	31.4%	38.2%	3.96	1.062	4 th
Social Media	17.6%	26.5%	38.2%	11.8%	5.9%	2.62	1.090	5 th
Skype/Video conferencing	37.3%	43.1%	14.7%	1.03%	3..9%	1.91	0.955	6 th

Note: Judgment were made on 5-point: 5= To a great extent, 4= Much, 3= Averagely, 2= A little and 1= Not at all

Table 2. Design tools

Modes	Scale					Mean Score	SD	Rank
	1	2	3	4	5			
Computer Aided design (CAD)	4.9%	2.0%	11.8%	33.3%	48.0%	4.18	1.048	1 st
Building Information Modelling	17.6%	12.7%	22.5%	20.6%	22.5%	3.18	1.417	2 nd
Physical models	20.6%	22.5%	39.2%	5.9%	11.8%	2.66	1.215	3 rd
Manual drafting	29.4%	29.4%	21.6%	11.8%	7.8%	2.39	1.244	4 th

Note: Judgment were made on 5-point: 5= Most times, 4= sometimes, 3= Not sure, 2= Rarely and 1= Not at all

Table 3. Assessment of communication qualities

Variables	Scale					Ranks
	1	2	3	4	5	
Effective design tools usage (Mean=4.40, SD= 0.799)	-	4(3.9%)	8(7.8%)	33(32.4%)	57(55.9%)	1 st
Effective decision making (Mean=4.38, SD=0.718)	-	-	14(13.7%)	35(34.3%)	53(52.0%)	2 nd
Adequate information (Mean=4.28, SD=0.709)	-	-	15(14.7%)	43(42.2%)	44(43.1%)	3 rd
Adequate meetings (Mean= 4.24, SD= .747)	-	1(1.0%)	16(15.7%)	43(42.2%)	42(41.2%)	4 th
Adequate meeting participation (Mean=4.03, SD=0.838)	-	5 (4.9%)	19(18.6%)	46(45.1%)	32(31.4%)	5 th
Prompt responses (Mean=3.80, SD= 0.821)	-	6(5.9%)	28(27.5%)	48(47.1%)	20(19.6%)	6 th

Note: Judgment were made on 5-point: 5= To a great extent, 4= Much, 3= Averagely, 2= A little and 1= Not at all

Table 4. Assessment of project success

Variables	Scale					Ranks
	1	2	3	4	5	
No Litigation/Conflict (Mean=4.23, SD=0.595)	-	-	8.8%	59.8%	31.4%	1 st
Team Survivability (Mean=4.16, SD=0.728)			19.6%	45.1%	35.3%	2 nd
Client Satisfaction (Mean=4.05, SD=0.776)			27.5%	40.2%	32.4%	3 rd
Functional Requirement (Mean=4.03, SD=0.895)	2.0%	-	26.5%	36.3%	35.3%	4 th
Completion to specified quality (Mean=4.03, SD=0.895)	5.9%	7.8%	15.7%	29.4%	41.2%	5 th
Innovative design (Mean=3.92, SD=0.817)	-	3.9%	25.5%	45.1%	25.5%	6 th
Technical Requirement (Mean=3.82, SD=0.587)	2.0%	3.9%	20.5%	49.1%	26.1%	7 th
Completion to budget (Mean=3.61, SD=1.082)	2.9%	13.7%	26.5%	33.3%	23.5%	8 th
Completion to time (Mean=3.32, SD=1.007)	4.9%	12.7%	39.2%	31.4%	11.8%	9 th

Note: Judgment were made on 5-point: 5= To a great extent, 4= Much, 3= Averagely, 2= A little and 1= Not at all

3.6 Design Team Communication and Project Success

It is relevant to examine the nature of the relationship between the communication qualities and project success indicators as shown in the research objectives. Associations between variables can be determined using a bivariate correlation. Therefore, the Pearson correlation was used to determine if there is a linear relationship design communication quality and project delivery success. Table 5 shows the Pearson correlation coefficient, r , of the variables used in this study.

There is a positive correlation between the project success and team communication factors. For instance, completion to budget and adequate meeting participation were highly correlated ($r = .329$, $p = <.01$), also completion to budget were highly corrected with prompt responses ($r = .414$, $p = <.01$). Some other variables that were highly correlated includes "meeting participation" and "completion to functional requirement" ($r = .567$, $p = <.01$), "meeting participation" and "innovative result" ($r = .553$, $p = <.01$) and "prompt response" and "completion to budget" ($r = .414$, $p = <.01$). In all, "meeting participation" positively and significantly

correlate with the entire project success factors. This indicates that the level of participation of team member in meetings has a great influence on project success. Adequacy of meeting and adequacy of information also correlate significantly and positively with most of the success factors. Generally, all the fifteen variables were moderately correlated (typically at around $r = .4$) as shown in the Table 5. This suggests that largely communication quality has great influence on the project success.

3.7 Analysis of Qualitative Data

In the second wave of this research, the research objectives were further subjected to qualitative analysis using semi-structured interviews. The interviews were conducted with the 10 randomly selected participants among the identified projects' participants. Findings indicate that most of the interviewees acknowledged that the advances in Information and Communication Technology (ICT) have enhanced design team communication; however, they argued that communication still calls for a lot of improvement during design phase. Most often, the absence of design review meetings usually results in variations, extension of time, poor design quality and design changes during construction phase. One of the interviewees stated thus;

“Design team meeting and attendance is essential at the commencement of the project while periodic review meetings are equally germane”.

The first main theme identified from the interviews is the importance of meeting participation during design process. As observed, most of the respondents found adequate participation of design team in design meeting as a valuable method of harmonizing the concept and project information. The interviewees suggest that meeting should be held as frequent as possible. Most participants opined that such design review meetings should be held during preliminary design and production drawings stages, as this is a valuable forum to raise issues and address challenges. Missing details, workability of design and functionality amongst other issues can also be authenticated during such review meetings.

Largely, the interviews validate the result of the quantitative analysis on meeting participation even as various authors have affirmed similar position. For instance, Smulders Lousberg and Dorst [16] suggest that “stakeholders must take

the time to communicate their ideas in a realistic and clear manner rather than leaving their knowledge concealed in the perceptual domain” (p. 213). Also, Soetanto et al. [6] state that the quality of information will lead to better communication between stakeholders. The foundation of successful building process is the strength of the generation, clarification, dissemination, harmonization, organization, and storage of design information [7,17]. As noted by Norouzi and colleagues [17] successful building projects only originates from time-consuming negotiations and compromises. Thus, building design process requires effective communication in order to meet required quality while satisfying today's highly demanding clients.

The second theme identified during the interview dwells on early integration of all design professionals. Most of the interviewees argued that the coordination of building project must be taken seriously right from the beginning of the project. They lamented that some professionals are not integrated during the preliminary stage of the design process. A participant noted

“as of today, only two consultants carry out stage one (that is Architects & Quantity Surveyors) even though all consultants are paid for stage one. Hence, clients need to ensure that other professionals carry out the preliminary design accordingly to ensure better project success”.

Another major issue stressed during the interview concerns the method of operation during the design phase which was highly criticized. One of the interviewees lamented that one major hindrance to project performance is the sequence of operation of design team. He noted thus;

“After preparation of sketch design by the architect, the sketch design should be worked upon by the service engineer before requesting for the input of the structural engineers”.

He noted that if this sequence of operation is simply followed, the cases of soft conflicts between service engineers and structural engineers as regards placement of service pipe within structural components would be reduced to barest minimum. According to Svalstuena and colleagues [3], one possible framework for managing communication problems that could be categorized as social in nature is the development of practices to allow the participation of users in every step of the design process.

Table 5. Summary of Pearson's correlation coefficient

Variables	Design Communication quality					
	V1 Meetings Adequacy	V2 Information Adequacy	V3 Meetings participation	V4 Decision making	V5 Prompt responses	V6 Design tools
Project success						
V7 Budget	.093	.069	.329**	.066	.414**	.035
V8 Quality	.163	.132	.379**	.046	.055	.200*
V9 Completion to time	.279**	.161	.505**	.201*	.281**	.341**
V10 Client satisfaction	.322**	.389**	.546**	.253*	.357**	.367**
V11 Innovative result	.389**	.261**	.553**	.128	.287**	.155
V12 Functional Requirement	.306**	.221*	.567**	.093	.399**	.017
V13 Technical Requirement	.443**	.407*	.373**	.412**	.051	.068
V14 No Litigation	.283**	.386*	.503**	.280**	.213*	.016
V15 Team survivability	.358**	.354*	.447**	.186	.185	.075

Note **correlation is significant at 0.01 (2-tailed)

*correlation is significant at 0.05 (2-tailed)

On the assessment of design tools and performance, findings indicate that the introduction of ICT into design process is an improvement well appreciated by most interviewees. Someone noted,

“Nowadays a job that would have taken ten days can now be done within two days”

Another participant stated

“it makes architectural expression a lot easier..... you can sell your design to a client with conceptual expression including material choices, colours, finishes in a most realistic way”

However, the interviewees call for caution such that the excitement of application of ICT as a design tool will not erode the importance of knowledge and understanding of basic principles of design. As noted by a structural engineer;

“Apparently laziness is setting-in especially for young professionals who are not thorough or patient enough to understand the rule of thumb guiding engineering designs”

Another interviewee noted;

“Computer is garbage-in, garbage-out, hence, wrong input will also generate wrong output, therefore, senior professionals should always establish a means of validating design output through proper checking and cross-checking of every details”.

Most participants argued for regulation of minimum experience acceptable for professional practice in Nigeria. One of the interviewee stated;

“Computer is like a pencil, and anybody can work with a pencil..... what is important is that the minimum experience of a person working on a building project (regardless of the medium such individual is using) must be regulated”.

3.8 Discussion

In today's ICT world, many design teams now adopt various communication modes and tools to facilitate design activity in order to achieve competitive design outputs. However, this wide adoption of communication techniques is yet to deliver its anticipated level of quality on building products in Nigeria. As observed in this study, communication qualities such as adequacy of information, meeting participation and prompt responses were ranked lower than the use of

design tools. These findings tend to have implication for project success since some authors [12,18,1,4] have identified team participation as core indicators that enhance practices within design and construction team. Specifically, Ibrahim et al. [4] found that process characteristics of the team, including communication are strongly related to team effectiveness.

In this study, the correlation analysis point towards the importance of communication in design quality and project success. Although, the descriptive analysis shows that the respondents ranked “meeting participation” low among the variables examined, yet, the Pearson correlation coefficient showed high positive correlation between meeting participation and all project success variables. This suggests that one root cause of low project performance could be associated to inadequate participation of design team in design stage meetings. This result thus strengthens existing literatures which that suggest that team participation is a strong determinant of team's performance. One example is Coughlan & Macredie [19] which indicated that participation of stakeholders through interactive and communication activities as well as adoption of necessary design tools and techniques enhances team's performance. As for Forques and Koskela [20], achieving collective decision making requires that all team members have their “voice” heard and that all ideas are open to discussion.

Design team meetings create the scenes were practitioners meet in person, to talk and interact in face-to-face situations, as such, enhances design quality [7,1,17]. These meetings usually help in synergizing experiences, skills and expertise organized and to discuss the design issues between designers with different knowledge and disciplinary expertise. Meanwhile, scholars [e.g. 21,7,1] also suggest that another veritable platform for information sharing is design workshops. Emmitt [1] suggest that beside the dialogues that happens during informal and formal meetings, design workshop is another scene that could enhance participation. Design workshops can be valuable tool for the development of integrated design process, which is one of the main goals of teams within a design and building process. Therefore, to develop an effective design team, participation in design meetings and workshops are crucial as these platforms create opportunities for harmonizing ideas and decisions.

In addition, this qualitative data suggests that advances in information technology had made a profound impact on the building design process, yet, significant challenge of proper information management still persist. The use of ICT propels quick communication between stakeholders, aiding project speed up, as such less time is wasted, however, managing design information still remains a challenge for practitioners. More so, the amount of information that has to be managed during the design process has predominantly increased; yet, the time required to complete projects has decreased. As that instant, an effective combination of technology and human management approach is the only means by which anticipated result can be guaranteed.

4. CONCLUSION AND RECOMMENDATIONS

This research has examined issues pertaining to design team communication and its relevance to project success. At a time when building industry is tackling incessant project challenges, larger multidisciplinary team is taking increasing responsibility for design process, and projects demanding faster completion and high level of quality delivery. This research has identified key processes that are the foundations for an improved design process and demonstrated the ability of effective team's communication to increase design quality and project success.

It is seemingly imperative that all practitioners involved in a building project especially collaborative design must team up, and participate in information and knowledge exchange to achieve the set project goals. Design process should be viewed much wider than creating form and spaces, but as a process, organization, communication, teamwork, negotiation, and decision making exercise, thus requiring adequate managerial approach. In particular, design must be seen as a social process, rather than technical process alone, thus, requiring adequate communication and interaction among project stakeholders.

Through an empirical investigation, this research has demonstrated that design team communication is a key factor in project success. Specifically, it has shown that meeting participations among design team has a significant relationship and positive correlation with project success. In addition, this study affirms that advances in technology had made

profound impact on building design process and project success, however, increasing amount of design information requires effective and painstaking coordination by practitioners. The true importance of combing technology and managerial approaches in solving design challenges is thus vindicated.

Overall, this research has made significant findings; it has also identified further questions, avenues for exploration and limitations of the exercise. There are several recommendations for further work, both academic, and building industry. It is noteworthy that this research has been principally conducted within a city with predominantly medium sized consultancy firms, hence, future research should explore the experiences of a more urbanized city with larger design and construction firms. More importantly, further research is required to test the design communication constructs in order to identify their strength, further validate their deployment, as well as their ability to monitor design communications and project performance.

It should be borne in mind that the foundation of a successful building project is strongly connected to preliminary activities and qualities of the construction documents, it is therefore important that design team practitioners approach their commissions with high sense of thoroughness and professionalism through adequate participation and effective communication during the design stages. Furthermore, the whole project team, design supply chain and client representatives should be integrated early into the design process. In particular, design meeting, design workshop, periodic reviews, preliminary investigations, reconnaissance survey with adequate participation of stakeholders should be considered as a prerequisite for design quality and project success. The lessons learnt from this study suggest that design professionals should acquire necessary managerial skills to complement their technical skill especially in the deployment of design and communication tools.

CONSENT

As per international standard or university standard guideline participant consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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