DOCUMENTATION QUALITY APPRAISAL IN PUBLIC/PRIVATE PROJECT DELIVERY IN NIGERIA

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Abstract

The increasing rate of project failure, cost and time overruns is raising a wave of public concern in Nigeria. This study was aimed at comparative evaluation of documentation practices in private and public projects in Nigeria in order to unravel the quality of the documentation for infrastructural development projects. Ten (10) private and ten (10) public capital projects were surveyed. Fifteen (15) documentation quality variables (DQVs) that are key to project actors were used to measure the documentation implementation levels (DILs) and the index of project success (PSFS). The results showed a general low quality documentation and dismal level of project success, without any significant difference in achievement between public and private sector projects. The study recommended, among others, proper procurement documentation, balanced and collaborative professional design and construction team, which must admit inputs from work operatives, and the application of information

communications technology (ICT) in construction documentation to generate and manage quality construction databases at all stages.

Introduction

Construction projects depend on quality documentation to be effective because they require complex interactions of the multiple stakeholders and participants. All parties involved in ownership, use, design, estimation, construction, operation and maintenance have contributions to make in effective documentation of projects. Working as a team in a structured, organized and collaborative manner, the supply chain needs to provide authoritative project documentation as a sine-qua-non for project success.

Quality is defined in terms of zero defects and getting things right first time. The conceptual questions in documenting for project success are: (1) What level of quality is exercised in structuring project briefs/requirements by the client and user? (2) What level of quality is exercised in producing geotechnical, architectural, civil, structural, mechanical/electrical designs transformed into physical structures by contractors? (3) What level of quality is applied in documenting for contractors' and consultants' procurement?

How accurate and comprehensive are the project cost estimate / bills of quantities? Does planning for execution provide specific, accurate, real-time details on scope, work breakdown structure (WBS), schedule, networks, milestones, budgets, cash-flow analysis, labour and equipment requirements and safety/risk standards? Are there control/reporting system that provide for monitoring and feedback at all stages and which enables comparison of schedules, budgets and standard performance with actual

achievements and project goals? The level of implementation of these critical project documentation issues in public and private projects is what this study attempted to investigate.

Literature Review

Most projects require the use of basic contract documents. These include (IBRD, 1999; Langdon, 2007) articles of agreement, conditions of contract with all necessary deletions/amendments if standard form is used, drawings and/or specifications of work to be done, Cost estimates/priced Bills of quantities including, post-tender negotiation documentation, and contract programmes/progress charts. Other basic documentations required in projects include pre-tender documentation, early warning charts, quality performance charts, minutes of site meeting, instructions, valuations/certifications, among others.

There has been an increasing concern over declining quality of documentations and disregard of due processes that have contributed to decline in construction efficiency, resulting in increased project cost, time, risk, delay and dispute (Ajator, 2007, 2000 a, b; Project Documentation Certification Taskforce, 1997). Many researchers (Gallo, et al 2002; Tilley et al, 2000; 2002; Love et al, 2000, 1996) have identified the following issues associated with documentation failings and its manifestations: Design quality; inappropriate design and design checking, inexperienced design personnel, buildability problems, conservative design, legally/statutorily non-compliant design, quick-fix/rushed design. Documentation quality, inaccurate/unclear and untimely document, insufficient details, confusing and conflicting/voluminous documentation, low quality documentation, general co-ordination problems, insufficient

information, erroneous information, and conflicting information. Client-related problems include inadequate definition of brief and susceptibility to changes issues, expectation that designers can absorb the effects of changes to project requirements, design and documentation coordination/review often squeezed toward the end of the design process, documents issued with the knowledge that they may have deficiencies, a preference for designers to cease involvement at the conclusion of the design development stage with detailed design being undertaken by construction contractors, inequitable terms of engagement of professional design team / consultants and unwillingness to negotiate fair conditions and a perception by designers (that inadequate allowance is made for the time necessary for design processes, clients believe that tight project time frames can be overcome merely by adding staff to the design team, and clients are not prepared to pay design fees commensurate with the professional services required for quality out comes).

Designer-related problems have been noted in earlier reports to include (Ajator, 1996; 2000b) disregard of standard fee structure, designer firms bidding at fee levels too low to fully accommodate client expectations, cost estimating services not provided by professional quantity surveyor / cost engineer, selection of designers on the basis of lowest price, reluctance by clients to compensate for most costs of changes or variations arising from design and documentation failings of the consultants, environmental impact mitigations not reflected in the designs, role of designers limited to part of the project design function only (e.g. the concept design or the detail design stage), design coordination function not adequately recognized and not allocated as a responsibility of a particular party, drawings issued for tenders that are often incomplete/uncoordinated, restrictions on time and budget

precluding opportunity for the designer to propose innovative or other practical alternatives, construction constraints not identified in design and / or not adequately represented in project documentation, inadequate and untimely issue of documentation changes, discrepancy errors in drawings and divergent errors with other documents (e.g. inconsistencies between design concept drawings and shop drawings), multiple requests for information (RFIs) together with cumbersome and tardy process for their resolutions, lack of recognition of the need for an overall project manager role and for definition of the relationship of that role with all stakeholders, and inability to promote whole-life considerations, including total project cost aspects because of lowest initial capital cost approach.

Workshop detailing-related problems are tight time frame, excessive numbers of RFIs, and long response times to RFIs. Contractor-related problems are tendering practices which inhibit disclosure of innovation and other technical advantages; ambiguities, errors and shortcomings in project documentation creating time and budget difficulties; defensive and blame cultures; sub-optimal programming changes and sequencing of works; time and budget over-runs; and other adversarial behaviours leading to deterioration in project relationship.

Some of the causes of these declining documentation quality manifests are consequential on others, while some involve more than one stakeholder. A list of causes attributable to the various stakeholder groups reported by many researchers (Tilley et al 2002; Gallo et al, 2002; Love et al, 2000, 1996) include client-related causes, such as inadequate knowledge of the implications of their expectations, demands and directions; inadequate recognition of whole – life implications at briefing and design phases;

lowest price mentality in engagement of designers; unrealistic expectations about time and cost constraints; defensive approach to variations and claims for additional costs or time; failure to appoint an overall project manager; and reluctance to formally commit to a design at appropriate stages of a project. Designer-related causes are perceptions of constraints imposed by client expectations; focus on risk shedding rather than on targeting quality of documentation; short design times result in inadequate checking of details and insufficient reviews with relevant parties; inadequate design coordination between engineering, architectural and mechanical design disciplines; an apparent "design by crisis" operating mentality by designers, leaving design issues to be sorted out in the construction process; inadequate consideration of whole-life cycle and constructability issues including poor coordination between services and suboptimal sequencing of project activities; cumbersome (and even defensive) approaches to RFIs; incomplete documentation including inadequate detail; design documentation issued with known deficiencies; designs developed by many parts of the organization – lack of coordination; "Cut and paste" syndrome and ambiguities due to lack of integration and quest for economy of design time; erosion of expertise with design draftsmen being replaced with CAD operators; fewer "green field" and more retrofit projects lead to tighter tolerances and more interfaces – increased costs without corresponding recompense in fees; reluctance to allocate experienced staff to projects because of their high cost in an environment of inadequate fees; optimum design solution not adequately researched; and emphasis on minimum effort rather than on doing the job right first time.

Other causes related to tendering procedures are multiple "notices to tenderers" and question/answer steps erode document accuracy due to short time for amendments,

reluctance by tenderers to ask questions that might reveal competitive edge, extended and unduly complicated award processes, and reduced tender times. Contractor-related causes are seeking to re-apportion risks to other stakeholders, lowest price mentality in engagement of subcontractors, adversarial approach to RFIs, reluctance to seek clarification (especially during the tender phase) to protect competitive advantage, spurious claims submissions to recover losses arising from initial low bids, introduction of legal and insurance advice in order to cover perceived risks, and difficulties in maintaining skill levels. The general causes involving all parties are inadequate time for project planning; relevant parties not involved in project planning early enough, especially at concept and decision times; responses by clients and their agents to questions/queries from bidders, worsen rather than improve documentation quality; and adversarial attitude embedded in the procurement culture.

Cost estimate documentation problems/sources

Accuracy of cost estimates largely depends on the level and quality of project definitions and the use of bottom-up approach involving relevant executory personnel to analyse costs at the lowest possible work units. Cost estimate documentation for power plant projects appears to be the most critical of project documentation failings.

The accuracy of cost estimate of a power project is largely dependent on the quantity surveyor / cost engineer's understanding and experience of the terrain, the technologies, the various currencies/conversion rates, the duties, ports' charges, transport systems (both local and international) available and costs of finance and funding system. Apart from the problems of integrity of the analysed benchmark costs and factoring errors, there is the problem of improper planning/

non-inclusion of work items for which costs/prices must be allocated (Ajator, 1989, 1999; Aliyu, 2006).

The quantity surveyor / cost engineering efforts must go beyond rudimentary work measurement currently provided by robust design softwares to full financial engineering. The services must embrace arranging the financial relations between parties in a contract, arranging finances for projects, monitoring and costing delays, and projecting/modeling cost estimates. In estimating costs of power plants, consideration must be extended to funding of letter of credit (LC), to various manufacturers through one off-shore or multiple off-shore financial institutions representing the various component manufacturers located in parts of the world using various currencies and rates. For an investor, the conditions of LC will have an effect on the total cost of the project. Some manufacturers will insist that the LC be fully funded before they commence the manufacture especially for a plant meant for developing country like Nigeria. What this means is that the investor would have to pay fully, or raise a loan from a financial institution in full settlement, months ahead of shipping the basic plants (IBRD, 1999; Ajator, 1989; Aliyu, 2006). The varying currency exchange rates during the period of the contract would also have an effect on the total project cost. The quantity surveyor is, therefore, expected to consider these issues in preparing estimates for a power plant and other infrastructural projects.

Other important cost considerations include cost of shipping, stacking in the factory (demurrage charges by manufacturers), marine insurance, clearing costs at ports, duties, insurance, warehousing, local transport, among others. These are real costs which if omitted can cause failure. For instance, shipping costs are obviously the cost of transport from manufacturers' port or airport to the entry port of the

power-plant location. Should the project not be synchronized whereby preparatory works on the site are delayed and the manufacturer had to keep a fully manufactured machinery, then occupation of the factory may be charged. Sometimes, the charge results from non-payment of shipping costs component of the contract, which delays the machinery leaving the factory. Marine insurance is a premium for possible damages or lose on the sea which is calculated as a percentage of the cost of the machinery. There is no option of refusal, the insurance must be paid. Clearing costs are payments for off-loading and movement within the destination port. In Nigeria, a percentage of the cost of the plant is charged instead of weight and bulk (volume) of the equipment/machinery. Duty is usually government tax on the machinery which is adjusted for the various machinery/equipment from time to time as the Government deems fit. Insurance could cover manufacturing accident, local transport even initial tests on site. Premium could be charged appropriately for these. Ware-housing, could be a temporary accommodation for the machinery before final installation on site and can be located anywhere between the destination port and final installed position of the machinery. It could be rented or built for the project. And could serve as part of maintenance workshop where final coupling could take place before positioning of the machinery. Local transportation could be a nightmare especially in a third world country on two counts. Proper vehicle for transporting the machinery/equipment may not exist necessitating a reconfiguration of the plant before transporting to site or an expensive provision of proper vehicle by outright importation into the country. The transportation route, roads, rivers, bridges may need to be reinforced, overhead powerlines/overhead bridges removed, roads constructed

before transportation of the machinery or plant can be undertaken.

This is particularly important, as it constitutes a major difference in comparing plant installation cost in various locations in the world. Existence or non-existence of source of energy must be considered in terms of power evacuation facilities, terrain maps, and accurate geotechnical reports. To avert considerabe adverse effect on the cost of a large power plant, some very important information are necessary. Source of energy, such as gas source and cooling water source must be considered. Gas pipeline cost can be in the region of $500,000.00 to $2,000,000.00 per km, including pumping/flowstations along the route. The cost ultimately is dependent on the terrain it is to be laid and environmental issues which must be properly/accurately documented. If water for cooling is to be sourced from a river, piping and flow stations can cost over $2,000,000.00 per km. Where water for an hydro electric power station are to be collected from various sources (rivers), extensive civil and pipe laying can be undertaken including mechanical pumping of part of the water. These additions can run into millions of dollars. For power generated to be useful, it must be linked to consumers. The distance of the power plant to consumers and the transmission system available all have effect on cost of plant. The voltage level the power must be transmitted (11 KV, 33 KV, 132 KV, or 330 KV) will directly affect the cost of the equipment, largely the electromechanical installation on site. Electricity generated by large power plants is expected to be evacuated at 132 KV or 330 KV voltage levels being the transmission voltage in Nigeria. The generators usually generate at 15 KV which must be boosted to the required transmission voltage by a series of power transformers and other electromechanical arrangement known as switchyard.

These can cost about a quarter of the cost of power plant for a typical gas turbine system. The cost of boosting to 330 KV is naturally higher than that of 132 KV.

Contrary to the above which deals with installation of electromechanical within the site premises of the power plant, transmitting electricity through some distance is typically done on pylons spaced at 300 m to 500 m apart. These pylons have insulators mounted on them. These insulators in-turn support the conductors which actually carry the current from the generating plants. Typical double circuit (D/C) transmission line, with 2 x 350 mm^2 biscom conductors per circuit with optic fibre wire for control can cost in the region of $180,000 to $300,000 per km, depending on the locations. Along the transmission lines, transmission substations have to be built which can cost as much as three billion naira (₦3 bn) for a 150 MVA 330/132/33 KV and occurs within distances of 50 to 100 km of transmission lines. The transmission substations facilitate the conversion from one voltage level to another and also serve as an inter-phase for linking/combining electricity from various power plant sources. For hydropower plants, all sorts of costs that do not form part of the physical plant, in addition to the general ones outlined above, occurs right from the moment a decision to build is made.

Such costs include terrain mapping costs (activity usually carried out by specialist/experts using special tools/equipment) to determine the volume of water and hence the capacity of the plant, geotechnical studies to determine the subsoil conditions and other such work that determines the dam type to be designed and the position of facilities on the site, and relocation and compensation costs payable. Expert feasibility and viability studies/reports must expose these cost considerations and provide guide for appropriate selection of plants and cost of facilities, among others. The practice is for

investors in the third world to refuse to recognize costs of these important first step actions especially when the studies are packaged abroad. This results in project abandonment midstream with collosal waste of resources. Like the power plant costing issues exposed above, costing of other infrastructural development projects require detail planning and investigation to identify and document all activities to which accurate costs must be allocated.

Methodology

In 2009/2010, ongoing ten (10) public and 10 private infrastructural development projects were surveyed in Nigeria by the researcher and his team. The projects were physically observed and their documents were reviewed with the co-operation of the managing consultants, in order to ascertain the quality of the project documentation and its outcome in successful discharge of the contracts. Through incisive literature search various documentation quality issues were unveiled, reviewed and collapsed into 15 documentation quality variables DQVs, which were assumed to be relevant to the study. These were issued to fifty professionals of the construction industry to elicit their opinions as to the relevance or importance index (II) of the implementation of each documentation quality variable on the overall success of a project (see Table 2.1). Also, key project actors/stakeholders of each project were issued questions and interviewed to obtain data on the extent of implementation of the DQVs in their projects. The data are recorded as documentation implementation index (DII) in Table 2.2.

The project success factor (PSF) for each variable was ascertained (as the multiplicative value of importance index and document implementation index (II x DII) and recorded for both public and private projects in Tables 1.2 and 1.3

respectively. The PSFs are illustrated pictorially in bar charts for both public/private projects as Figure 2.1. Chi-square test was applied on the analysed data to establish whether there was any significant difference in documentation practice exercised by project actors in public and private projects, using the highest ranking/impacting variables for public and private projects (see Table 2.4).

Analysis, Findings and Discussion

Thirty six professionals of the construction industry rated cost estimating and bills of quantities documentation most sensitive in impacting project success, with highest score of 89 % and importance index of 32 (see Table 2.1). This was closely followed by design quality documentation, to which 33 consultants ascribed 80 % with relevance index of 26.

This result appears to contradict normal expectation, which adjudges estimate quality as a function of design quality and level of project definition. Design quality documentation paired with construction plan impacting index of 26, while change orders documentation ranked third with importance index of 23 (Table 2.1).

Tables 2.2 and 2.3 shows a general low level of documentation practice quality, going by implementation index scores or ratings of the surveyed public and private sector projects. Only very few projects achieved 50 % documentation implementation score line and in consequence the project success factors (PSFS) were generally below admissible threshold of 86 %. For public projects (Table 2.2) the highest scoring variable was cost estimate documentation with project success factor (index) of 74.2. This was closely followed by change order and design documentations with 65.5 and 64.4. project success indices respectively. Similar

results were obtained for private projects (Table 2.3) with PSFS of 69.1, 66.7 and 63.7, for cost estimating, change order and design documentations respectively.

Table 2.1: ***Importance Index (II) of Documentation Quantity Variables***

	Documentation Quality Variable (DQVS)	Weighted Rating		
		No of Resp. W	Score % S	Imp. Index WXS
1	Project Brief/Requirements Documentation	32	70	22
2	Project Design	33	80	26
3	Cost Estimating/BOQ Preparation	36	89	32
4	Construction Plan Documentation	35	75	26
5	Implementation Sequence Documentation	33	60	20
6	Budgeting/Cashflow Documentation	31	65	20
7	Earned Value Management Documentation	25	61	15
8	Labour/Plant/Equipment Statements	33	60	20
9	Control/Report System Documentation	25	56	14
10	Project Inspections/Site Meetings/ Minutes Documentation	26	58	15
11	Valuation/Certificates Documentation	30	62	19
12	Change Orders (variations) / Other Instructions Documentation	29	78	23
13	Price Fluctuation Documentation	26	50	13
14	Day Works Claims Documentation	18	50	9
15	Accidents/Force Majure/Weather Change/Dispute Documentation	16	45	7

Source: Field survey 2009/2010

Generally, the private projects show slight documentation practice edge, possibly because of the investment consciousness of private investors vis-à-vis social concern of government/stakeholders in public projects. What these results implicitly communicate is that inadequacies in the project design and costing documentations created high incident of change order / variation instruction practices at projects execution. This issue has remained one of the most

recurring sources of disputes and delays in the studied projects. It is also evident from Table 2.2 and 2.3 and Figure 2.1, that the projects exhibited poor budgeting/cash-flow documentations which resulted in dismal earned value success factors of 20.4 and 20.2 respectively for public and private projects. This is buttressed by the fact that earned value management process is yet to gain the desired popularity in Nigeria construction practice.

The foregoing analysis shows that there is no marked difference in documentation practices exhibited by project actors in the public and private projects, judging from their projects success factors depicted in Figure 2.1. Also the Chi-square comparison test (see Table 2.4) adjudged the observed differences as statistically insignificant.

Conclusion and Recommendations

Overall, the projects performed below the National Industrial Standards' documentation achievement benchmark for construction business of 86%. There is conspicuous failing in monitoring and control of construction activities. This was reflected in unacceptable level of budgeting and virtual absence of earned value system documentation that would anticipate, monitor and report performance failings for prompt corrective actions. In consequence the management of the projects were reactive with increased risks, time and cost overruns, reduced margins and performance quality. This presents great loss of expectations to the stakeholders and the economy at large.

Table 2.2: ***Degree of Application of Documentation Quality Variables (DQVS)/Analysis of Project Success factors (PSFS) (Public Projects)***

DQVS/Importance Index		Projects Doc. Implementation Index/Rating (%)										
		A	B	C	D	E	F	G	H	I	J	Total (PSFS)
1	22	11	5	12	14	15	15	10	11	20	19	27.3
2	26	20	15	30	31	20	22	27	32	30	21	64.4
3	32	23	10	35	30	30	15	21	20	26	22	74.2
4	26	15	12	30	24	27	16	20	24	20	21	55.6
5	20	0	5	10	15	15	5	10	14	12	10	19.2
6	20	14	10	12	17	15	10	11	18	15	11	26.6
7	15	05	15	10	11	16	19	10	20	16	14	20.4
8	20	18	35	11	34	15	29	14	33	29	12	46.0
9	14	10	25	12	30	11	26	12	30	31	15	30.3
10	15	20	40	28	38	20	35	15	37	42	20	44.2
11	19	21	39	32	40	22	40	26	29	28	22	56.8
12	23	27	40	20	35	18	37	20	35	29	24	65.5
13	13	28	50	30	35	31	40	28	30	33	28	43.2
14	9	18	41	35	40	21	43	26	39	40	30	29.9
15	7	40	25	27	39	40	42	31	43	41	37	25.5

Source: Field Survey 2009/2010

Key

Public Project Types:

A Univ. Campus facilities Dev. Project
B State Gas turbine power project
D Bridge Construction project
F Urban water treatment and Reticulation Project
H Federal High way
I State Road project

Other Mass housing projects.

The paper recommends for a procurement practice that would ensure thorough assessment and equitable allocation of project risks to all stakeholders. Full project definitions (where possible) by responsible, balanced, experienced professional design team who must partner overtly to achieve project success. And the allocation of accurate time and budgets to all phases of project development. The projects packaging should

involve work operatives at the lowest activity levels to ensure that all relevant costs are identified and included in the cost estimate. This will ensure the documentation of accurate project baselines for effective monitoring and evaluation of achievements at the projects' process phase.

Table 2.3: ***Degree of Application of Doc. Quality Variable (DQVs) / Analysis of Project Success factors (PSFS) (Private projects)***

DQVS/Importance Index		Projects Doc. Implementation Index/Rating (%)										
		A	B	C	D	E	F	G	H	I	J	Total PSFS
1	22	15	9	10	16	14	20	11	18	21	10	31.6
2	26	22	31	17	21	45	40	9	20	19	21	63.7
3	32	17	13	40	50	10	20	14	30	12	10	69.1
4	26	20	28	14	22	31	34	10	14	31	11	43.0
5	20	28	22	9	20	12	38	14	30	32	14	43.0
6	20	10	16	20	8	27	11	12	14	20	10	29.6
7	15	11	14	7	13	20	12	13	15	19	11	20.2
8	20	22	31	18	39	10	40	10	35	32	14	50.2
9	14	14	21	15	40	8	18	16	34	21	12	27.8
10	15	18	45	33	34	31	29	20	31	38	27	42.8
11	19	26	30	48	46	18	45	19	24	24	17	56.4
12	23	18	25	42	48	18	31	15	21	34	38	66.7
13	13	30	41	35	28	47	20	35	27	30	32	42.2
14	9	20	29	47	36	32	58	20	47	42	30	32.4
15	7	34	42	30	54	35	51	25	50	45	31	27.7

Source: Field Survey 2009/2010

Key

Private Project Types:

A Private Univ. Campus Project
B Private Gas turbine plan project
D Massive Box Culvert Projects
F Water Intake Works for Industrial Plant Project
H Private Estate Road Project
I Factory arterial Road project

Other Private Complex Housing projects.

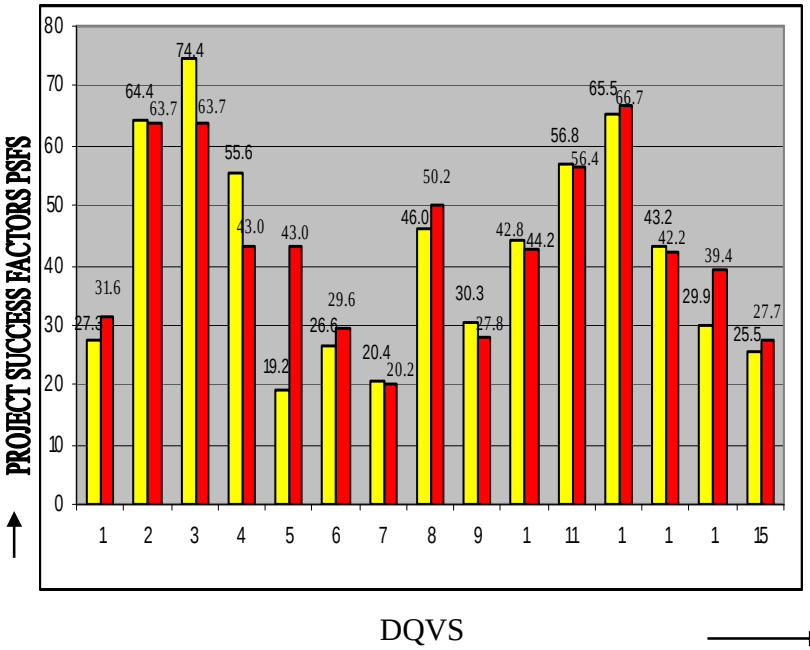

Figure 2.1: Bar Chart of Project Success Factors for Public/Private Projects.
Source: Authors' Documentation, Quality Surveys 2009/2010
Key: PSF public projects; PSF private projects.

The goal should be to aim at digitizing the entire spectrum of the construction process of; planning, design, costing, construction and management. This will facilitate the speedy generation and management of quality data- bases at all phases for effective monitoring and control of capital projects. Full application of ICT has become imperative for Nigeria to achieve the desired quality of documentation of her construction business.

Table 2.4: ***Chi-square comparison Test of Significant Difference in Documentation Practice in public/private projects***

Fo	Fe	Fo-Fe	$(Fo - Fe)^2$	$\frac{(Fo - Fe)^2}{Fe}$
74	72.20	1.80	3.24	.044
66	67.15	- 1.15	1.32	.019
64	64.63	- 0.63	0.39	.006
69	70.79	- 1.79	3.20	.045
67	65.84	1.16	1.35	.020
64	63.36	0.64	0.41	.006

Source: Documentation Quality Survey 2009/2010

X^2 cal = 0.545 < X^2 .05 crit 5.99, Accept Null Hypothesis

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