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COST IMPLICATION OF BUILDING DESIGN ON PROJECT PERFORMANCE.

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Abstract

The near recessive economy in Nigeria has created a challenge for all the built environment professionals to take collective responsibility in addressing issues of cost sustainability and building projects performance. Cost of buildings is influenced by a variety of interrelated factors. Thus remodeling designs to have a little less space on circulation elements can result in appreciable economicgains. This paper aims at demonstrating the cost implications that can accrue in buildings due to circulation space. It seeks specifically to determine the difference in the cost of lighting and power points in circulation spaces in two similar buildings. The methodology adopted is based on desk review of literature and actual comparative analyses of

Introduction

Attaining economic sustainability has become paramount considering the state of Nigerian economy. The challenge is for clients and managers to search for ways of reducing construction costs. The design of building is one major area where significant cost savings can be made in projects. Design influences not only material costs, but the overall project performance in terms of design complexity, perimeter of walls to be constructed, setting out and excavation cost, drainages and the cost of roofing complicated shapes.

The key elements of project performance (cost, time and quality) are influenced by a variety of factors right from planning, design to the project execution stages. According to Cunningham, (2013), the control of cost related factors can be achieved more effectively at the preliminary stages of a

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The cost implications of lighting fittings in the circulation spaces in the ground floors of two similar architectural designs. The priced BOQ was prepared for the two different designs and the cost implication of each of the circulation space determined. The findings showed savings of N22,300(Twenty thousand, three hundred) from lighting and power points only. The study concluded that building clients, designers and constructors need to adopt a rudimentary cost benefit approach in the choice of design variables in order to obtain a suitable balance between cost, aesthetics and functionality. The study recommended that clients and designers need to be made more aware of the additional costs and duration that can arise in project execution, and the additional energy consumption in operating and maintenance of buildings due to seemingly minor design variables such as circulation space.

***Keywords**: Awareness, circulation space, cost implications, lighting fittings, recession.*

project when cost estimation is performed using schematic designs that indicate the plan shape, size of building and spaces required, wall to floor ratio, the type of materials and their specifications, storey heights and degree of circulation spaces (Cunningham, 2013). Other special construction requirements and accessibility requirements including the urgency of completion of work would also have implication on cost.

The contribution of the construction industry to national economic growth necessitates improved efficiency by means of cost effectiveness and timeliness (Isa, Jimoh and Achuenu, 2013). The high cost of living and acute shortage of funds have made majority building developers to insist on projects being designed and executed to give maximum value for money.It is vital to operate effective cost control during the design stage of a project to keep the total cost of the scheme within the client's budget. Seeley(1997) in Saidu (2015) noted that building clients' need are becoming more complicated, with more consultants being engaged. This makes the estimation of probable costs become more difficult. More so, project resourcing level have dropped significantly since the onset of the recession (Brooks, Spillane, Tansey & Hendron, 2016).

Okoye, Ngwu, Fidelis & Stanley (2016) recommended positive construction policies within the construction sector that have the potentials for improving

and growing the national economy and which will enable recovering the economy from recession. To achieve higher performance without an increase in product cost and time, Okoye, et al (2016) emphasized the need to identity measures and to articulate the cost implications of major design variables in execution of building projects and its operational life. In the same vein, Safiki, Solikinand Sahid (2015) noted thatin order to find solutions for all design related constraints such as funds, resources, time and technology, the design team should make adjustment on a variety of issues, especially on how best the project could be delivered without compromising its performance and quality. This approach results in the need of the concept of modeling costs. This means considering the different ways the project can be designed and constructed, with each alternative attracting different cost. Hence the assessment of different design alternatives to produce better solutions on achieving a particular project becomes imperative.

Tansey, Meng and Cleland (2013) observed that during economic recession, many clients become cost focused which makes the market gets tighter and tighter. Tansey, Meng and Cleland (2013) advised that cost minimizationis a necessary survival tactic in recession. Lowes and Moroke (2010) pointed out that the failure rate for construction companies' doubles that of other types of companies during a recession. Furthermore, Lowes and Moroke, (2010) and Tansey, et al (2013) have stressed that cost leadership must appraise all design variables if significant cost reduction must be achieved. It is to this end, that this paper seeks to demonstrate how building costs could be reduced with simple changes in circulation space without compromising its performance and quality.

METHODOLOGY

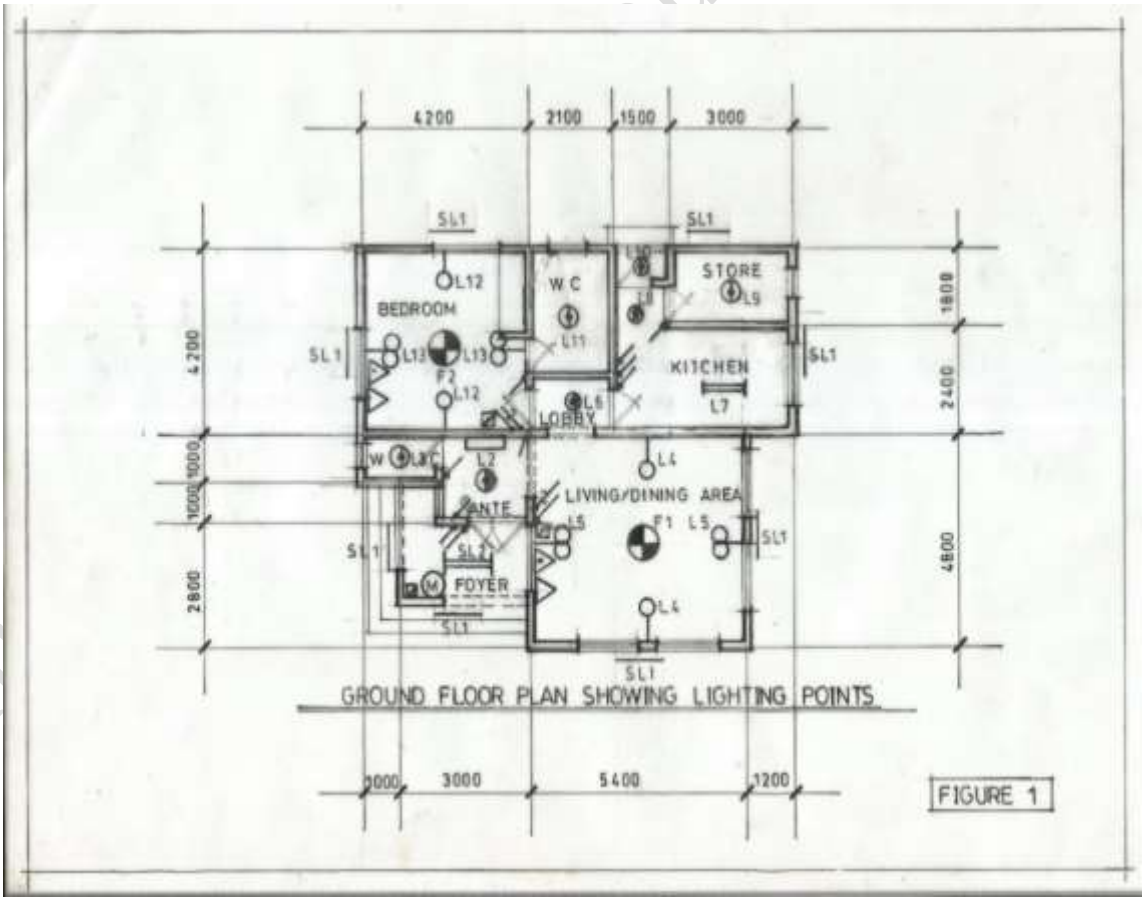
The methodology adopted for this paper is based on desk review of literature and actual comparative analyses of the cost implications of lighting fittings in the circulation spaces in the ground floors of two similar architectural designs. The priced BOQ was prepared for the two different houses and the cost implication of the building with greater circulation space determined. The study has employed the use of the definitions of the US General Service Administration (2012) where circulation space is defined as the route connecting the building core and common spaces, such as elevator lobbies, exit stairs, toilets and aisles between individual and support spaces. The

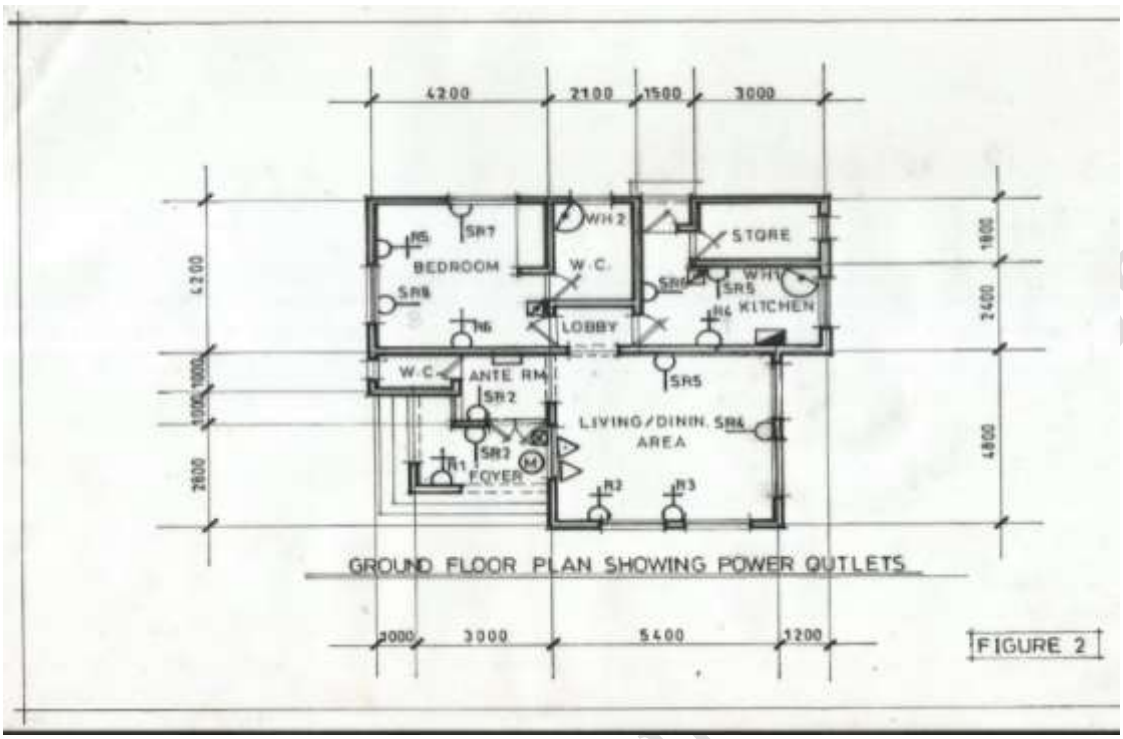
definition of Hamer (2016) is also relevant because circulation space is defined to include pathways taken through and around a building or around urban built environ in general.

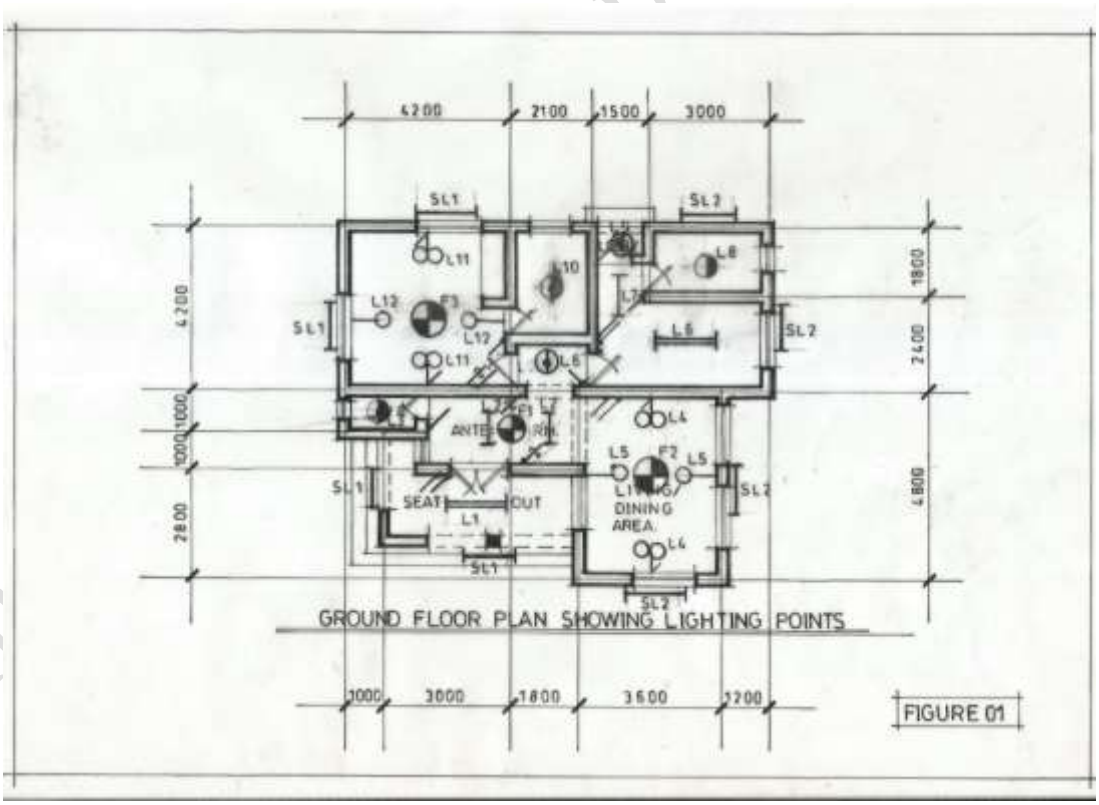
PRESENTATION OF DESIGN ALTERNATIVES AND THE COST IMPLICATION

Figure 1shows the lighting point details, while Figure 2 shows the power outlet details for the same design referred to as House A. House A has a gross floor area of 61.38m^2 and a total circulation space of 14.44m^2.The same houses re-designed maintaining the same gross floor area of 61.38m2, but with a reduced circulation space of 12.2 m2 and is referred to as House B. Figure 01 and Figure 02 shows the details of the lighting point and details of power points for House B respectively. The priced Bill of Quantities (BOQ) for house A is prepared and presented as Table 1, and the priced BOQ for house B is prepared and presented in Table 2.

Source: Designed by Architect Rahila Dosho







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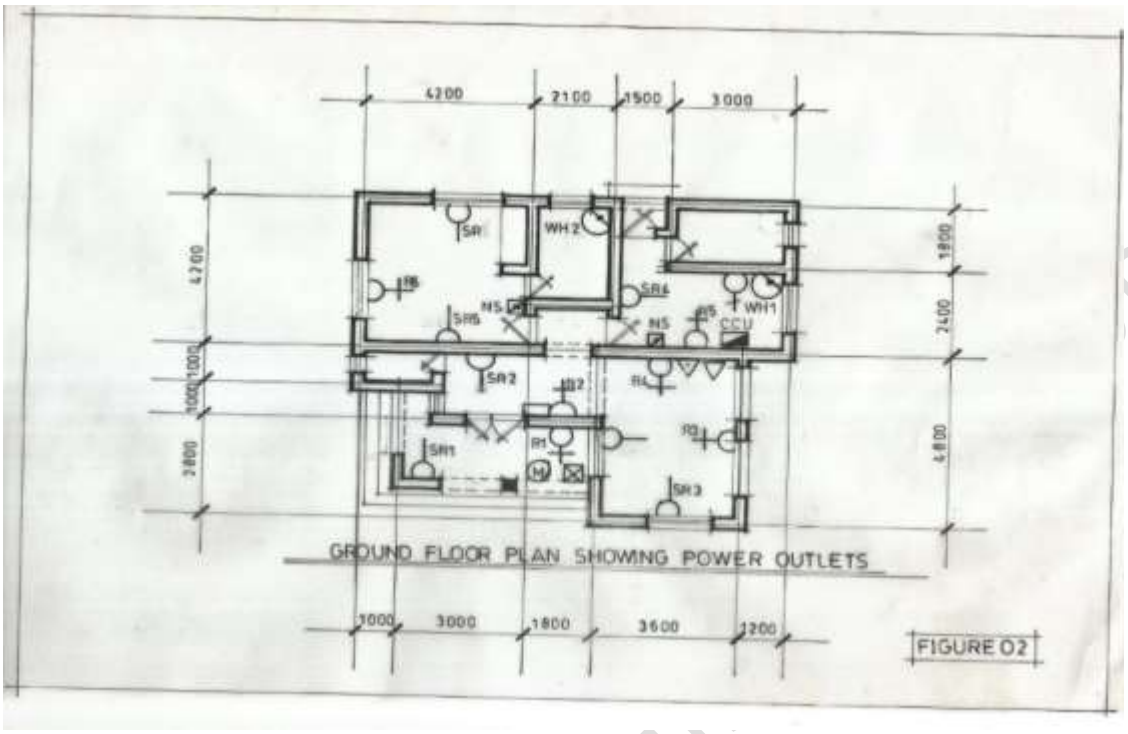

Table 1: Priced Bill of Quantities for House A

ITEM	DESCRIPTION	QTY	UNIT	SUPPLY, INSTALL AND CONNECT	
				RATE (N)	**AMOUNT (N)**
1.00	CONDUITING AND WIRING USING 20MM PVC CONDUITS				
1.01	Lighting Points using 1.5mm^2 cables and earth.	24	No.	5,454	130,896.00
1.02	Lighting Switches using 1.5mm^2 cables and earth	11	No	5,454	59,994.00
1.03	Ceiling Fan points using 1.5mm^2 cables and earth	2	No	5,454	10,908.00
1.04	13A socket outlet points using 2.5mm^2 cable and earth	8	No	11571	92,568.00
1.05	15A socket outlet points using 2.5mm^2 cable and earth	6	No	16000	96,000.00

1.06	100mm UPVC pipe in foundation for in-coming supply power cables	50	No	25066	1,253,300.00
	Subtotal C/F				1,643,666.00
2.00	LIGHTING AND POWER POINTS ACCESSORIES				
2.01	1-gang, 1-way light switch.	8	No	3410	27,280.00
2.02	1-gang, 2-way light switch	3	No	5510	16,530.00
2.03	13A single switch Socket outlet.	8	No	1378	11,024.00
2.04	15A single switch socket outlet	6	No	2200	13,200.00
2.05	Ceiling Fan c/w multi-stage regulator.	2	No	5000	10,000.00
	Subtotal C/F				78,034.00
3.00	LIGHT FITTINGS				
3.01	600mm single batten fluorescent luminaire c/w 2 x 20w lamp.	1	No	6235	6,235.00
3.02	1200mm single batten fluorescent luminaire c/w 1 x 40 lamp.	11	No	4500	49,500.00
3.05	Single Wall-mounted Luminaire	4	No	4900	19,600.00
3.06	Duplex Wall-mounted Luminaire	4	No	7500	30,000.00
3.07	Ceiling-mounted Luminaire c/w 25w energy bulb	3	No	3000	9,000.00
	Subtotal C/F				132,335.00
4.00	MEDIUM VOLTAGE EQUIPMENT				
4.01	10-Way, 3-phase Distribution Board c/w 100A TP integral isolator and MCBs.	1	No	52000	52,000.00
4.02	100A current operated ELCB	1	No	41000	41,000.00

4.03	1ooA TP switch fuse c/w fuses for bulk pore supply	1	No	41000	41,000.00
4.04	Cooker Control Unit	1	no	11200	11,200.00
	Subtotal C/F				145,200.00

SUMMARY

Conduiting and Wiring	**1,643,666.00**
Lighting and Power Point Accessories	78,034.00
Light Fittings	132,335.00
Medium Voltage Equipment	145,200.00
Total	1,999,235.00

Table 2: Priced Bill of Quantities for House B

ITEM	DESCRIPTION	QTY	UNIT	SUPPLY, INSTALL AND CONNECT	
				RATE (N)	**AMOUNT (N)**
1.00	CONDUITING AND WIRING USING 20MM PVC CONDUITS				
1.01	Lighting Points using 1.5mm² cablesand earth.	24	No.	5, 454	130,896.00
1.02	Lighting Switches using 1.5mm² cablesand earth	11	No.	5,454	59,994.00
1.03	Ceiling Fan points using 1.5mm² cables and earth	2	No.	5,454	10,908.00
1.04	13A socket outlet points using 2.5mm² cable and earth	8	No.	11,571	92,568.00
1.05	15A socket outlet points using 2.5mm² cable and earth	7	No.	16,000	112,000.00
1.06	100mm UPVC pipe in foundation for in-coming supply power cables	50	No.	25066	1,253,300.00
	Subtotal C/F				1,659,666.00
2.00	LIGHTING AND POWER POINTS ACCESSORIES				

2.01	1-gang, 1-way light switch.	8	No.	3410	27,280.00
2.02	1-gang, 2-way light switch	3	No.	5510	16,530.00
2.03	13A single switch Socket outlet.	8	No.	1378	11,024.00
2.04	15A single switch socket outlet	7	No.	2200	15,400.00
2.05	Ceiling Fan c/w multi-stage regulator.	2	No.	5000	10,000.00
	Subtotal C/F				80,234.00
3.00	LIGHT FITTINGS				
3.01	600mm single batten fluorescent luminaire c/w 2 x 20w lamp.	1	No	6235	6,235.00
3.02	1200mm double batten fluorescent luminaire c/w 1 x 40 lamp.	8	No	4500	36,000.00
3.03	1200mm double batten fluorescent luminaire c/w2x40 lamp	1	No.	9000	9,000.00
3.04	Ceiling-mounted Luminaire c/w 18w energy bulb	3	No	3000	9,000.00
3.05	Ceiling-mounted Luminaire c/w 25w energy bulb	4	No	3000	12,000.00
3.06	Single Wall-mounted Luminaire	4	No	4900	19,600.00
3.07	Duplex Wall-mounted Luminaire	4	No		
	Subtotal C/F				91,835.00
4.00	MEDIUM VOLTAGE EQUIPMENT				
4.01	10-Way, 3-phase Distribution Board c/w 100A TP integral isolator and MCBs.	1	No	52000	52000.00
4.02	100A current operated ELCB	1	No	41000	41000.00

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4.03	100A TP switch fuse c/w fuses for bulk pore supply	1	No	41000	41,000.00
4.04	Cooker Control Unit	1	No	11200	11,200.00
	Subtotal C/F				145,200.00

SUMMARY

Conduiting and Wiring	**1,659,666.00**
Lighting and Power Point Accessories	80,234.00
Light Fittings	91,835.00
Medium Voltage Equipment	145,200.00
TOTAL	1,976,935.00

From the summaries of the cost implications in the two designs, the cost of conduiting and wiring in house A is N1,643,666.00, while for house B it cost N1,659,666.00. This gives a savings of N16.000.00. from house A. Lighting and power point accessories is N78,034.00 for House A, and N80, 234.00 for House B. This again gives a savings of N2,200.00 from house A. However, when the cost of light fittings was computed, house was found to be more expensive with the cost of light fittings to be N132,335.00, while that of house B was N91,835.00. House B gave a savings of N40, 500.00 on light fittings alone. The cost of the medium voltage equipment was the same for the two designs. Thus the total cost of for power points and light fittings in house A isN1,999,235.00, while the total cost for power points and light fittings in house B is N1,976,935.00. This gives a total cost savings of N22,300.00 as a result of reduced cost in light fittings due to reduced circulation space.

CONCLUSION

This paper demonstrated that a seemingly minor reduction in circulation space (2.24m^2) in the design of a house, resulted in the savings of twenty thousand three hundred naira on the cost of light fittings alone. This may appear marginal but it is sure to result in substantial cost savings in energy consumption over the lifetime of the building. Building clients, designers and constructors therefore need to adopt a rudimentary cost benefit approach in

considering the advantages of different design variables to obtain a suitable balance between cost, aesthetics and functional aspects.

RECOMMENDATIONS

Construction professionals and especially cost managers need to enhance the awareness of clients and some designers on additional costs can be incurred in buildings due to seemingly minor alterations in some design variables such as circulation space.

These include additional costs on:

i. Materials, components and fittings in project execution
ii. Work duration or programme.
iii. Energy consumption in the operation of the building.
iv. Maintenance and repairs.

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