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Application of Value Management to Selected Construction Projects in Nigeria

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Abstract
Due to the benefits of value management (VM) in capital projects in some developed and developing countries of the world, there has been call by built environment professionals in Nigeria for embracement of the practice by project stakeholders. VM has been introduced in the country but there are challenges with its implementation and application, this study therefore examine the influence of VM practice on 4 selected building projects. Case-study approach was employed in which group of professionals carried out hypothetical VM analysis of selected projects using 40-hour workshop plan. Prior to the examination of the projects, facilitators and members of the team were trained on the history, basis and application of VM to construction works and a typical project was examined in the course of the training. On a general note, the study revealed that VM has numerous benefits if fully implemented for construction projects thereby enhancing value for money for project clients, owners or sponsors. The two notable benefits are reduction of cost while maintaining function as well as identification and removal of unnecessary materials, process and workmen time. Beyond the introduction of VM into curriculum of higher institutions and presentation at various workshops and seminars, a major issue of implementation should be addressed by stakeholders in the construction industry.
Keywords: Construction projects; Cost; Nigeria; Project function; Value management.

1. INTRODUCTION

The construction industry is large, complex and dynamic in nature (Behm, 2008). All over the world new innovations are springing forth to meet up with the clients' growing demand, complexity of construction projects, advancement in technology and introduction of new innovations amongst others. An Employer commissioning a building project will expect to obtain a building that satisfies his needs as to form and quality, of which he will pay optimum price. It is the duty of the construction experts to try and create new methods that will meet these demands in terms of quality and function and at an affordable cost, hence the development of new methods like Value Management (VM). Demand for VM all over the world is on the increase as noted by Morrison (1984) and Nigeria will soon be a part of it (Oke and Ogunsemi, 2011).

VM according to The Office of Government Commerce (2007) is "a well established methodology for defining and maximising value for money". Oke and Ogunsemi (2009) observed that, though this definition might be incomplete, it suggests that the discipline of value management can be applied to any type of project regardless of size or time frame and at all stages. This is in contrast to the general belief that value management must and can only be applied at the design stage of construction project. This shows that value management is becoming dynamic and various forms of its application in the construction industry are springing up.

Odeyinka (2006) further defined VM as "a service, which maximises the functional value of a project by managing its development from concept to completion and commissioning through the audit (examination) of all decisions against a value system determined by the client". Hence VM can therefore be seen as "a systematic and multi-disciplinary process directed towards analysing the functions of projects from its inception to completion and commissioning for the purpose of achieving best value and return on investment at lowest possible overall life cycle cost" (Oke and Ogunsemi, 2013).

Oke and Ogunsemi (2011) opined that VM has not been fully embraced in Nigerian construction industry as only very few number of value management workshops have been organised so far according to investigation and the workshops were even concluded prematurely. This may be a good start for the practice in the country and probably, one will expect it to gain ground in the next couple of years.

2 LITERATURE REVIEW

2.1 *History of value management*

Value management was developed in the United States during the 1940s and was first applied to construction projects in the 1960s, mainly by public sector bodies. Kelly and Male, (2006) observed that Value management was initially called value analysis and later the name Value engineering was used to describe the traditional approach to the discipline.

As a result of shortage of products component which was an aftermath of the World War II, the need

for alternatives was necessary, and this led to the development of Value engineering as it was called at the time. Due to the war, however, these alternative components were often equally unavailable and this led to a search not for alternative components, but to a means of fulfilling the function of the component by an alternative method. It was later observed that this method produced low-cost products without reducing quality and, after the war, the system was maintained as a means of both removing unnecessary cost from products and improving design hence birthing value engineering process based on analysis of function (Palmer, Kelly and Male, 1996).
The use of value engineering in most developed countries of the world became widespread in the 1970s, that it was often mandatory for general services administration contracts in the United States, and considerable success in its use was recorded and it is believed that Nigeria will soon be part of the development (Oke and Ogunsemi, 2013).

2.2 *Timing and format of Value management*

Ellis, Wood and Keel (2003) observed that most professionals prefer to be involved in the VM process at an early stage, to examine the business case or fundamental business needs. Although this is the case, it is important to note that VM can run all through the stages of a construction project, and in most cases there is one, two or a maximum of three value management exercises on a project depending upon client requirements and project value. The department of Housing and Works (2005) observed that the benefits of VM techniques are greatest early in the development of a project, with improvement in value gained far outweighing the time and effort involved. This is particularly the case if applied during concept development and the initial design stages, with the ability to significantly influence final project outcomes diminishing rapidly, as the project progresses past the design development stage.

Ellis et al (2003) stated that the commonly agreed format for a VM exercise is a workshop environment with all project stakeholders in attendance. There is often some preparation beforehand on the part of facilitators with clients and even some functional analysis. Interestingly there appears to be a trend towards reducing the duration of the workshop. Where one day was previously common place, a half-day workshop is now more usual even reducing to two hours in some cases. The reason for this includes reducing cost for the client and limited amount of time busy professionals are able to dedicate to the process.

2.3 *Benefits of Value management*

Rangelova and Traykova (2014) observed that over the past few decades, the economy has changed rapidly and intensifying competition has placed a growing importance and demand on increased efficiency, effectiveness and value for money. VM addresses these three facets effectively and directly. The Institute of Value Management (2008) and The department of Housing and Works (2005) also observed that other than value management acting as a cost reduction tool (i.e. cost savings), the most visible benefits arising out of the application of value management include: better business decisions by providing decision makers a sound basis for their choice; improved products and services to external customers by clearly understanding, and giving due priority to their real needs; enhanced competitiveness by facilitating technical and organizational innovation; a common value culture, thus enhancing every member's understanding of the organization's goals; improved internal communication and common knowledge of the main success factors for the organization; simultaneously enhanced communication and efficiency by developing multidisciplinary and multitask teamwork; decisions which can be supported by the stakeholders; time savings through focus of effort; aid to the briefing and approvals process; enhancement of risk management measures; increased quality; improved sustainability; and promotion of innovative service delivery processes.

Oke and Ogunsemi, (2011) opined that these benefits are available to providers and consumers in all sectors of the society: The industrial sector including manufacturing, construction and processing; the services sector, both public and private; and the government, health, education and other public activities.

3 RESEARCH METHODOLOGY

In order to determine the benefits of value management and its effects on project, a case study research is appropriate (Yin, 2003). The research looked at VM process carried out by different value management team for four (4) different proposed projects in Ondo state, Nigeria. Prior to the examination of the projects, facilitators and members of the team were trained on the history, basis and application of VM to construction works and a typical project was examined in the course of the training. Each Team identified certain elements that may benefit from the value management process and critically analysed these elements, proposing several alternatives and at the end picking the best suitable alternative.

CASE STUDY ONE

Case study one is a proposed viewing centre to which can also serve as a coaching centre, a centre for religious meetings and a community meeting hall. The value management team comprised of six (6) construction professionals and at the end of the workshop came up with several modifications to the original design with a

view to achieve value for money without compromising function. The estimated cost of the structure was put at ₦2,013,385.00 and at various stages of the workshop, alternatives were drawn up and the best alternative in terms of function was chosen and recommendation made by the team.

At the substructure stage the team suggested the reduction of foundation depth and foundation footing, use of 150 mm thick block wall as oppose the 230mm block in the original design, removal of hardcore and damp proof membrane (DPM) and reduction of oversite concrete slab thickness.

Several suggestions were made for the superstructure. This includes; the use of wooden frame and plywood, 150mm thick block, steel plate, 150mm block half wall to be completed with plywood and the use of wooden frame and corrugated iron zinc as oppose the use of burnt brick suggested in the original design. The use of corrugated iron roofing sheet, long span aluminium or stone coated aluminium roofing sheet on either a mono pitch, gable with reduced height in kingpost or hip roof was suggested. Batten wooden door, flush door, wooden panel door, purpose made steel door or aluminium door were suggested for door openings, while aluminium sliding, aluminium casement, projected aluminium, purpose made steel window or louver window were suggested for window opening.

In the area of finishes, ceramic floor tiles, terrazzo floor finish, floor carpet, ordinary floor screed, PVC floor tiles and broken tiles were suggested. While cement and sand rendering, use of wall paper, crack tiles, cladding using alumaco were suggested for the wall finishes. Asbestos board, celotex ceiling board, PVC ceiling sheet and plywood ceiling board as ceiling finishes were suggested while POP wall screed, emulsion paint, texcote, gloss or tyroline was suggested for painting of the proposed structure. Conduit wiring, surface wiring fluorescent fittings, expose lighting and cover with ceiling rose, ceiling fans and switch socket outlets was also suggested for electrical works.

CASE STUDY TWO

Case study two is a proposed two (2) bedroom bungalow. The proposed building is for the personal use of the client and in the nearest future can be for rent. The value management team comprised of five (5) construction professionals and at the end the workshop came up with several modifications to the original design. The estimated cost of the structure was put at ₦8,193,890.25 and at various stages of the workshop, alternatives were drawn up and the best alternative in terms of function was chosen and recommendation made by the team.

At the substructure stage, the use of 225mm thick hollow block without weak concrete, stone foundation or 150mm thick hollow block filled solid with weak concrete was suggested as oppose the 225mm thick block filled solid given in the original design. The use of laterite only, reduction of foundation depth, 100mm thick oversite concrete with or without BRC wire mesh, were suggested for the foundation and floor slab.

Several suggestions were made for the superstructure. This includes; the uses of 150mm blocks as oppose the 225mm in the original design. Wooden door to all openings or well fabricated local steel door externally and wooden doors internally was suggested as oppose the imported doors in the initial design, while the use of Aluminium sliding windows with 5mm thick tinted glass, louvers with wooden or aluminium frame was suggested for the window opening. 12mm diameter bar, 6mm steel rod with 10mm square pipe or 10mm square pipes only was suggested for the burglar proof as oppose the aluminium projected window and 10mm steel rod with 25mm square pipe initially designed. 0.45mm gauge aluminium, zinc or thatch roof and the use of wooden fascia or aluminium fascia were suggested for the roof covering and fascia. The team also suggested the reduction of columns from 10 to either 6 or 3.

In the kitchen and toilet, the Team suggested the walls should be rendered and painted with gloss or tiled up to door level while other walls should be rendered or tiled. Also the removal of facing bricks in the window area was suggested and the use of POP, PVC, Asbestos or wooden ceiling finish was also suggested. Terrazzo, vitrified tiles or cement/sand screeding was suggested for the floor as oppose the marble tiles in the original design and the use of either texcote or emulsion paint on all rendered wall was suggested. Surface wiring or half conduits as oppose the full conduit wiring in the original design, use of combined soak away pit and septic tank or single soak away pit and septic tank were suggested.

CASE STUDY THREE

Case study three is a proposed single bedroom en-suit security gate house and the value management team comprised of five (5) construction professionals who at the end of the workshop came up with several modifications to the original design with a view to achieve value for money without compromising function. The estimated cost of the structure was put at ₦2, 869,752.61 and at various stages of the workshop, alternatives were drawn up and the best alternative in terms of function was chosen.

At the substructure stage, the Team suggested the removal, reduction in thickness or use of weak concrete in place of hardcore fillings, reduction of thickness or total removal of blinding, reduction in thickness or the use of weak concrete for floor slab and total removal of BRC wire mesh reinforcement.

On the super structure, the use of timber, brick or 150mm thick block was suggested as oppose the 225mm block initially designed. The team also suggested the reduction in size of lintel, use of timber for lintel or the use of single lintels as oppose the chain lintel in the initial design. The use of wooden panel or sliding

door was suggested, while wooden window, sliding window or louver blade window was suggested as oppose the imported doors and projected aluminium window in the original design.

The total removal or reduction of the height of wall tiles in wet area was suggested, while the use of cement/sand screeding in bedroom or removal of floor tiles in the bedroom was suggested. The Use of PVC Ceiling, Asbestos Ceiling Boards or oven Baked Ceiling was suggested for the ceiling finish as oppose the POP in the initial design.

The Team suggested the removal of shower tray, wall mirror and tissue hanger, and tissue basket in the toilet/bathroom. Removal of GP tank, wash hand basin from toilet, water sink from kitchen, air condition unit, ceiling fan and the use of standing fan was suggested by the Team.

CASE STUDY FOUR

Case study four is a proposed church building and the value management team comprised of five (6) construction professionals and at the end of the workshop came up with several modifications to the original design with a view to achieve value for money without compromising function. The estimated cost of the structure was put at ₦38,062,060.00 and at various stages of the workshop, alternatives were drawn up and the best alternative in terms of function was chosen and recommendation made by the team.

At the substructure stage the Team suggested the removal or reduction in the thickness of hardcore, use of 150mm block in foundation as oppose the 225mm in the original design, use of 150mm, 100mm or just blinding for foundation footing.

The Team suggested the use of 150mm block, plywood, or glass block in place of 225mm block wall and a low pitch roof with corrugated iron sheet on wooden carcass, hip roof with corrugated iron sheet on steel carcass, hip roof with transparent rubber covering on wood carcass or gable roof with corrugated iron sheet on wood carcass, as oppose the hip design with steel carcass initially designed. Security steel doors, wooden doors sliding doors with burglar proof bars were suggested for the doors while louver blade window or casement window type was suggested for the window as oppose the purposed made security doors and glass projected window initially designed.

The use of plastering and painting with emulsion, wall tiles or rendering without painting was suggested for the walls as against the use of texcote in the initial design while the use of cement and sand screed or tiles was suggested as oppose the terrazzo floor finish given in the initial design. Reduction of conveniences from 4 to either 3 or 2 was also proposed by the Team.

4 FINDINGS AND RECOMMENDATION OF VALUE MANAGEMENT TEAM

4.1 Introduction

Base on the experience of team members in building construction, project function and obtaining best value for money, the best alternatives drawn up was chosen and recommendations made thereof.

4.2 Findings from selected projects

CASE STUDY ONE

The Team recommended the reduction of foundation depth to 400mm, reduction of foundation footing thickness to 100mm, use of 150mm thick block wall in foundation, eliminate the use of hardcore, damp proof membrane and reduction of floor slab concrete to 75mm thick. This was proposed since there is no structural effect as the ground is stable and firm, the structure is a bungalow and the site is completely free from underground water. Hence, saving cost and construction time. The team suggested the introduction of 100mm diameter steel pipe column to bear the load from the roof and the use of burnt brick due to its light weight and savings in finishes. The uses of gable roof with reduced kingpost height and long span aluminium roofing sheet was proposed due to the aesthetic and durability nature of the long span aluminium roofing sheet. The team retained the use of purpose made steel door and window as proposed in the original design due to its durability and enhancement of security, while the use of ordinary floor screed, cement and sand rendering to walls and PVC ceiling sheet were recommended. The use of surface wiring and expose lighting and cover with ceiling rose was also recommended since it will reduce cost and it is easy to maintain.

Following a justified review of all elements and components associated with the construction of the proposed structure and maintaining its original function, the value management team valued the project from an initial design cost of ₦2, 013,385.00 to a reduced cost of ₦1, 452,100.00 with a variance of ₦561, 285.00

CASE STUDY TWO

The Team recommended the use of 150mm block filled solid in foundation, laterite only and 100mm thick oversite concrete as against the 225mm block, laterite with hardcore and 150mm thick with BRC wire mesh in oversite concrete due to low traffic in the proposed building. The use of 150mm block wall was recommended as oppose the 225mm block in the original design. Also the use of well fabricated local steel door externally and wooden frame doors internally, aluminium sliding windows with 5mm thick tinted glass and 10mm square pipes was recommended as oppose the imported metal door, aluminium projected window and 10mm steel rod with

25mm square pipe in the original design. The use of 0.45mm gauge roof covering with aluminium fascia on 2.1m high roof was recommended by the team. The use of aluminium fascia is as a result of the stable wind in Akure which the aluminium fascia can withstand, thereby saving cost and time of construction of the initial concrete fascia. 3 numbers of reinforced columns is to be introduced as against the initial 10 since no structural effect is visible.

The kitchen and toilet walls are to be tiled up to door level, while all other walls are to be rendered. The team also proposed the use of PVC in the sitting and dining rooms while asbestos ceiling finish is to be used in all other areas. The use of vitrified floor tiles as floor finish and gloss paint for the upper part of the kitchen and toilet walls and emulsion paint for the remaining part of the building were proposed. Half conduit for electrical wiring, use of one soak away pit and septic tank as oppose the initial 2 numbers.

At the end, there was a reduction in cost from the initial design cost of N8, 193,890.25 to ₦5, 121,167.63 with a variance of N3, 072,722.62.

CASE STUDY THREE

The Team recommended the removal of hardcore, blinding, BRC wire mesh and reduction of the floor slab to 100mm thick as oppose the 150mm thick in the initial design since the structure is not a load bearing one. Also the use of 150mm block wall and single lintel was recommended as oppose the 225mm thick block wall and chain lintel in the original design. Wooden panel door and an aluminium sliding window with burglar proof were proposed by the team. The kitchen and toilet walls are to be tiled to door level while the bedroom floor is to be screeded with cement and sand screed. The use of PVC ceiling finish was also proposed by the Team as oppose the acoustic ceiling tiles with aluminium ceiling grids and metal hanger in the original design.

Since there is an expectation of water supply from main building, the Team proposed the removal of the GP Tank and all provisional sums under water tank but increase provisional sum for the extension of water supply pipes from the main building to the proposed gate house. Also the since the design already has a well ventilated window opening, removal of the Air Condition unit leaving the ceiling fan as a means of air circulation was recommended.

Following a justified review of all elements and components associated with the construction of the proposed structure and maintaining its original function, the value management team valued the project from an initial design cost of ₦ 2,869,752.61 to a reduced cost of ₦ 1,975,865.36 with a variance of ₦ 893,887.25 giving a percentage decrease of 31.15%.

CASE STUDY FOUR

The Value management team recommended the use of 150mm thick hardcore, removal of damp proof membrane (DPM) and damp proof course (DPC) in the substructure since the site is free from underground water and has a stable soil type which can withstand the proposed load. The uses of corrugated long span roof covering on wooden carcass as oppose the baked slate and steel carcass in the initial design was proposed. Also sliding and casement windows and steel doors was recommended in place of the aluminium casement window and aluminium sliding glass door in the initial drawing, while the use of vitrified floor tiles, PVC ceiling finish and 3 numbers of conveniences was proposed there by reducing the cost of terrazzo, POP and an extra conveniences in the building.

At the end, there was a reduction in cost from the initial design cost of ₦38, 062,060.00 to ₦32, 240,150.00 with a variance of ₦5, 821,910.00.

4.3 Summary of findings

The research found out that apart from providing a more functional design, value management can also lead to great savings in cost of construction of any project. As seen in table 1 below, in case study one, when value management was carried out a savings of ₦561, 285.00 was made. This is about 28% savings from the initial ₦2, 013,385.00 stated for the original design as shown in table 1.0. Also a whopping 38% savings will be made in case study two if the value management team recommendation is followed. This will lead to a reduction in cost from the initial design cost of ₦8, 193,890.25 to ₦5, 121,167.63 with a savings of ₦3, 072,722.62. For case study three, the value management team valued the project from an initial design cost of ₦ 2,869,752.61 to a reduced cost of ₦ 1,975,865.36 with a variance of ₦ 893,887.25 which is about 31% savings for the client while about 15% savings was recorded in case study four with a reduction in cost from the initial design of ₦38, 062,060.00 to ₦32, 240,150.00 with a savings of ₦5, 821,910.00.

Table 1. The Cost and Percentage savings for each case study

	Original design cost (₦)	Alternative design cost (₦)	Variance (₦)	Percentage savings (%)
Case Study 1	2,013,385.00	1,452,100.00	561,285.00	28
Case Study 2	8,193,890.25	5,121,167.63	3,072,722.62	38
Case Study 3	2,869,752.61	1,975,865.36	893,887.25	31
Case Study 4	38,062,060.00	32,240,150.00	5,821,910.00	15

4.4 Discussion of findings

The research corroborates Norton et. al, (1995) and Locke et.al (1994) observation that Value Management creates a clearer focus on the project objectives as the main purpose of the proposed project was kept in view all through the workshop and no alteration was done to the initial objective of the project. The research also proves that VM works towards arriving at a more effective design, identification of alternative methods of construction and favourable adjustments to the construction timeline as several alternatives which might lead to a more effective design and considerable time reduction were drawn up during the course of the workshop.

From the research, it is observed that value management identifies and removes unnecessary costs associated with the projects, hence leading to maximum cost saving of between 15 – 38 % of the total contract sum on all 4 case studies. Over specification is addressed and an improved building programme can be developed leading to time being saved. This further corroborates Oke and Ogunsemi, (2011) findings that value management if fully incorporated will eliminate unnecessary design, reduce construction cost and enhance value for money.

All options, alternatives and innovative ideas are considered and maximum efficiency ratio is obtained. While discovery and discussion of project issues, constraints and risks involved in the projects and clearer project brief and decision making are achieved with the use of VM. If properly implemented it can identify possible problems early on in the project; It provides management with authoritative evaluations and supporting information of the project brief or design and their related capital and operation cost (Norton et. al, 1995 & Locke et.al 1994).

5 CONCLUSION AND FURTHER RESEARCH

From the evidence gathered, it is clear that value management can be applied to any type of project (small, medium or large) as oppose the common believe that value management can only be effective when used on huge budget projects.

As earlier stated, an Employer commissioning a building project will expect to obtain a building that satisfies his needs as to form, quality and function, of which he will pay a reasonable price. Thus, it is evident that the use of value management will go a long way in achieving this by identifying and eliminating areas of unnecessary designs which affects cost and has no functional benefits, reduce construction cost and time and enhance value for money, thereby giving an overall satisfaction to the client. The study further recommends VM as a truly beneficial practise that should form an integral part of a project and that it is worth investing some time and effort in by both the government and private investors.

The findings of the study provide possible directions for further studies in that the researcher was able to review value management activities carried out on proposed projects. Further work can be done using ongoing or completed projects.

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