

Architectural Design Aspect of Value Engineering In Heritage Building: A Case Study of “Panchadeval Bridhashram”

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Abstract

Many scholars have suggested that application of value engineering during design phase can decrease the cost of construction through 5% to 10%. Though it has lots of importance, value engineering is hardly found in developing country like Nepal. Therefore, the overall objective of the study is to follow value engineering approach during the initial phase of retrofitting and reconstruction phase of Panchadeval Bridhashram project and optimize the estimated cost of the project. In achieving the stated research objective, both qualitative and quantitative research method has been adopted i.e., mixed method case study. Theoretical proposition for value engineering was proposed, and quantitatively above proposition was verified. The research data were collected through the literature review, site visits, interrogations, consultants related to the project. Data analyses were done both qualitatively and quantitatively. From the qualitative analysis it was found that, the extra added redundant structures and space could be well managed and planned by restoring the heritage, architectural, religious, spiritual, and contemporary use value. Therefore, value engineering not only optimizes cost, but also improves overall quality and function of the building.

Keywords

Value Engineering, Panchadeval Bridhashram, Retrofitting, Redundant, Reconstruction, Value, Cost Optimization

1. Introduction

In architecture value engineering shows radical change from the traditional method of design. The technique offers a plateau for better building environment [1]. It enables to criticize scientifically, justify functionality and performance of different building types, elements and system, in relation to quality versus cost. Value engineering is an organized effort for analyzing designed building features, for achieving essential functions at the lowest life cycle cost. The methodology does more than reduce costs. It benefits to improve time, performance, quality, and determine the type of work that should be performed [2]. No successful practical application of VE in building project. “Social studies of practicing architects, particularly the most successful ones, care least about economics of their designs compared to other goals like aesthetics”. Value engineering concept has not reached attention in Nepal from both government and professionals as well. No successful

practical application of VE in building project [3].

The Panchdeval Bridhashram at Pashupatinath is run by Government of Nepal under Ministry of Women, Children and Senior Citizen. It is registered as Social welfare Centre (Elderly’s Home) in 2052 B.S. It was operated as being the Panchadeval Pakshala in the regime of His Majesty Surendra Vir Vikram Shah. It gets its name from five temples inside the building courtyard. The building itself is the oldest member of the Ashram. It is more than a century old, That’s why it is a heritage building and should be conserved as the tangible asset of our country. The architecture has not been preserved so well till date. The outer wall has been renovated frequently in the recent past, the building itself is not convincingly well maintained. The accommodation at the old-age-home is old unfit for the elderly. The home lacks space; therefore, many elderly people are crammed into dingy rooms. The home has 160 elderly people. There are 65 male and 95 females currently living in the old age [4]. Originally there were about 230 members

residing. On site visit several redundant spaces, structures, temporary structures were found. The building is in the retrofitting phase and Value engineering analysis is done at this phase of building lifecycle. VE consideration by the architects during the design phase of the project can achieve following results [5]. Overall project cost can be reduced. Quality of the project can be improved. Unfunctional elements increasing the cost can be reduced.

The broad objective of the study is to perform methodological study of value engineering in context of building projects. The specific objectives of this research are as follows: -

- To study how VE methodology adds value to the building.
- To study how architectural design optimize the construction cost in building.

1.1 Scope of the Study

What study includes and what not?

- Various factors including macroeconomics and inflation are related to cost but only construction related building economics are taken into consideration.
- Today value based design approach exists but this study takes value engineering into consideration.

1.2 Limitation of study

What study includes and what not?

- Only 2-3 design variables are taken into consideration.
- Methodology is based on value engineering procedures and techniques.

2. Literature Review

VE is an organized/systematic approach that analyzes the functions of systems, equipment, facilities, services, and supplies to ensure they achieve their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety [6]. Typically the implementation of the VE process increases performance, reliability, quality, safety, durability, effectiveness, or other

desirable characteristics. Value relates to satisfying organization’s numerous conflicting needs with the resources that is required to address such needs; it increases with the soaring satisfaction level and lower consumption of resources, and mathematically, represented as the ratio of function over cost where performance may be used as an alternate to function.

$$Value = (function\ or\ performance) / Cost$$

The function characterizes what is expected to be done as a part of project. The value directly proportionate to increasing function, which increases value and is governed by decreasing maintenance cost [7].

The measurement of value is based on three basic elements: Functional Performance, Quality and Total Cost. Functional Performance is the elementary purpose for any sort of product, project, or administrative process, quality describes the measurement of value is based on three basic elements: Functional Performance, Quality and Total Cost. Functional Performance is the elementary purpose for any sort of product, project, or administrative process, quality describes the magnitude of expectations, requirements, and desires of heir; such requirement may be durability, aesthetic values, and others. The total cost includes the amount expended as effort, money, and time. Measurement gives a concrete relationship between these elements as shown in figure below.

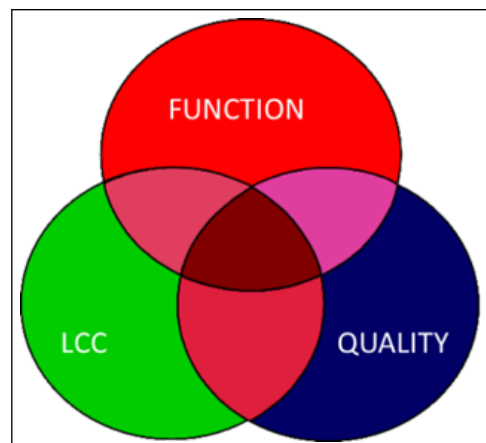


Figure 1: Value Indicator

Such relationship may be represented as

$$Value\ Indicator = Quality + Function / Life\ Cycle\ Cost$$

As per the above relationship, one may conclude that with increasing cost, value will be less unless function

enhances this may be contrary as inflated cost doesn't compensate the improvement over product as suggested by Nabeeh. The above relationship is applicable to material value only, however, may not be representative for value such as beauty, heritage values and others. Hence, applying studies of value engineering need meticulous identification of appropriate time on project, though in this study we will focus only on application on architectural projects.

2.1 Determining the appropriate time to apply studies of Value Engineering on architectural projects

Value engineering may be applied on architectural project at any stage of project cycle- from planning to execution through operation and maintenance: but best application is at the planning stage where there is flexibility to accept proposals from value engineering considering the owner major requirements and his objectives. This is because any alteration impacts minimal on time schedule of project, and hence the acceptance of proposals by the decision makers is better at this stage as compared to later stages. The design happens to be the most influential element on the cost which is limited to three percent of total cost of the whole project but influences quality of the project up to fifty percent in contrast to other elements; and thus, project design stage should be critically considered. The relationship between cost and time of studies of application of Value engineering is shown in Figure below[8] .

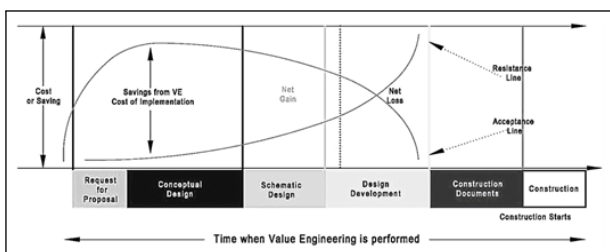


Figure 2: Relationship between cost and time of studies of application of Value engineering

2.2 HOW DOES VALUE ENGINEERING WORK?

A systematic approach consisting of five phases integrated with value engineering job plan at the top are used to analyze project in terms of its function; the five phases include Information, Speculation, Analysis, Development, and Implementation Phases.

To study value at any of project phases and implement the Value Engineering approach, a logical, sequential framework is applied. This framework is called the job plan and is derived from Miles' 1961 job plan.

The first phase of the job plan is the orientation, or selection phase, in which the client, or decision maker, identifies the main objectives, as well as possible areas of investigation, and the analysis team is appointed, and the strategy plan developed. Then other phases of value engineering begin.

Basic study of documents, background study, function, cost/worth of function identification are conducted in Information phase, followed by speculation phase where free use of imagination is used to speculate what else can be done. The analysis phase development and ranking of alternatives in terms of quality with realistic judgement and then phase of development comprises the development of details for the best alternative into written proposal. And in the last phase of implementation, we try to sell proposal amongst the client pool, eventually incorporating accepted proposal as a part of the project and follow-up procedure to ensure effectiveness of the solution. Figure below shows the diagrammatic representation of how value engineering works.

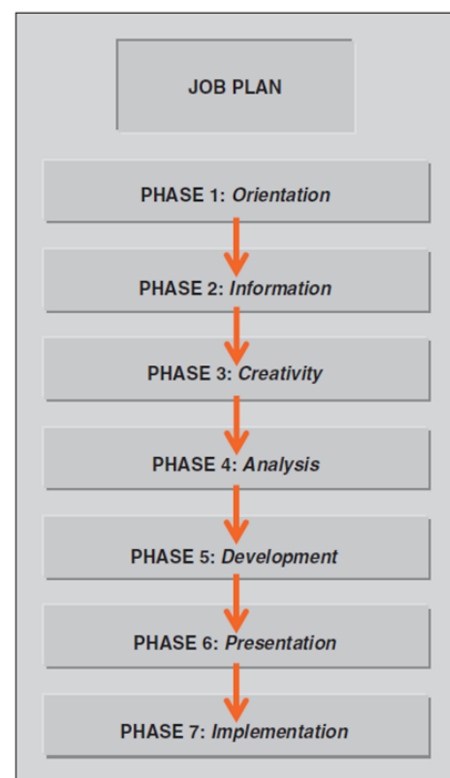


Figure 3: Phases of value engineering

Functionalism In 1900 s functionalism was highly appreciated for its functional space and avoided decorations and ornaments in the expression of buildings. This theory has been accepted since first century .Architect vitruvius from Rome stated in his theory three aspects utility, stability and beauty. Later on in 18th century architect Louis Sullivan stated ” form follows function”. Modern architect Mies van de Rohe and Le Carbusier designed simple buildings with functional efficiency. Major examples were Wainwright building, Barcelona Pavilion, Villa Savoye. These buildings were designed in a minimalist style i.e without any ornamentation or decoration.

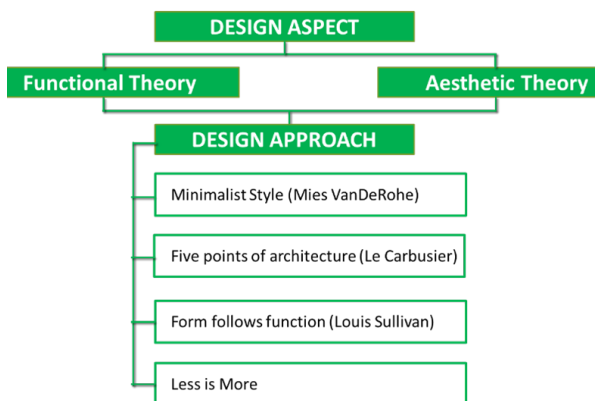


Figure 4: Functionalism aspect

Once data relating to the site has been collected it can be evaluated, considering some of the following parameters:

- Street patterns
- Street section
- Scale and the hierarchy/form/space
- Land use
- Typologies
- Neighbourhood relationships, formal street variation
- Perspective relationships, views
- Edge conditions, surfaces, and materials
- Natural and man made
- Movement and circulation within and around the site
- Vehicle vs. pedestrian
- Access
- Public space vs. private space
- Open space
- History
- Climate – sun angles and sun shadows
- Negative and positive spaces – we move through negative spaces and dwell in positive spaces

3. Research Methodology

A qualitative and quantitative strategy was adopted in this research as most data obtained relies on first hand observation, interrogation, brain storming, critical analysis and eventually cost estimate and projection. It generates non-numerical data in this integration of qualitative research is done for interventions studies. This part of the study primarily focus in qualitative approach of the value engineering and the quantitative aspect will be in next part of the study.

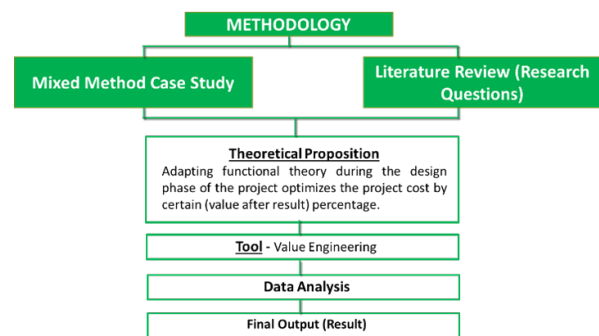


Figure 5: Methodology of study

The Fig No : 5 shows the methodological framework of the study in which the qualitative strategy is a part of Mixed Method Case Study, and the design parameters and variable are set widely from literature review. The meticulous study establishes theoretical proposition stating value engineering optimizes the cost of project in various phases of building lifecycle; utilises the tool value engineering, then the output data are analysed to ged final output for value engineering.

4. Result and Discussion

The current focus of this study lies in the qualitative strategy adopted for the study as a first part of the study, where qualitative research categories included studies based on observation, interviews, document and text from the existing records.

From the observational analysis it was found that the northern wing was completely damaged during the Gorkha Earthquake 2072. So, this part could not be retrofitted. Hereby, reconstruction of northern wing was proposed. For reconstruction only courtyard connected part was considered. Doing this we could restore the courtyard effect and provide ventilation to the building. In this way we can add value to the building in one hand and in another hand not considering the outer part cost can be reduced.

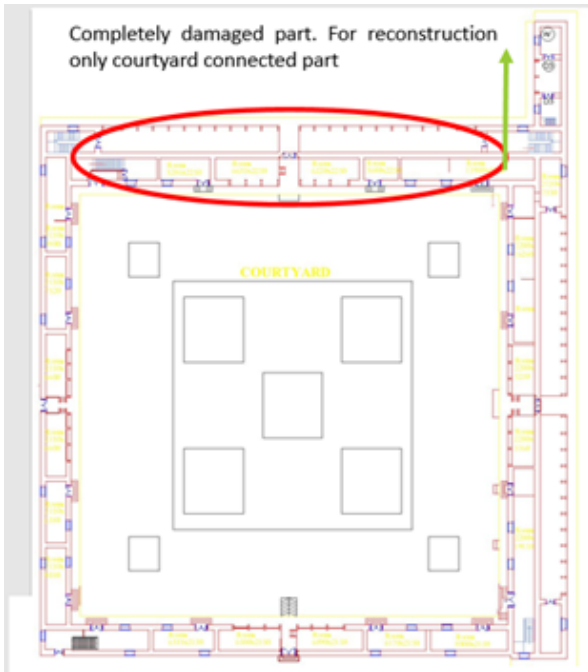


Figure 6: Plan of Panchadeval Briddhashram

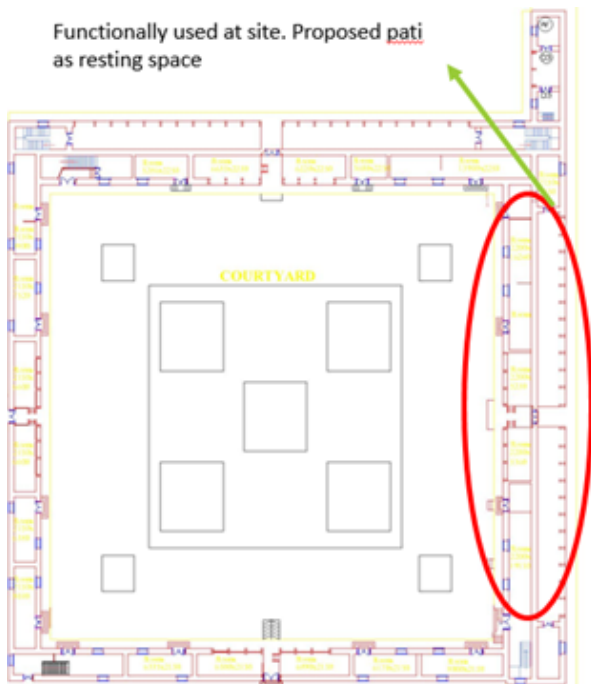


Figure 7: Plan of Panchadeval Briddhashram

Next observational analysis is that eastern part is historically important but that extra added part has been degrading the quality of the building. Its functional aspect has been deteriorated due to lack of lighting and ventilation. So, the ground floor is proposed for retrofitting and the first floor above is proposed to dismantle. Another analytical observation was that there is lack of space for old people to live in

but many spaces were used as store. Also attic space throughout the building was used as store. This space has habitable clearance but left unused. It can be used functionally, so this space was proposed as indoor play area, library etc. This attic space when provided with window on gable end could provide thermal comfort to the building. At the same time it would reduce the lighting and ventilation cost.

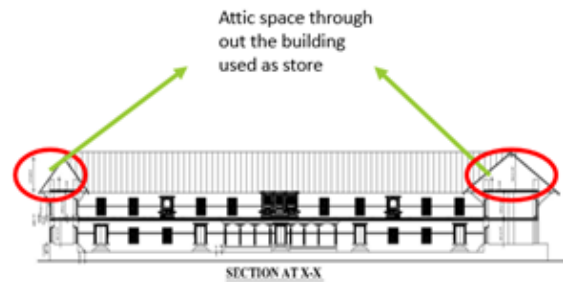


Figure 8: Elevation of Panchadeval Briddhashram

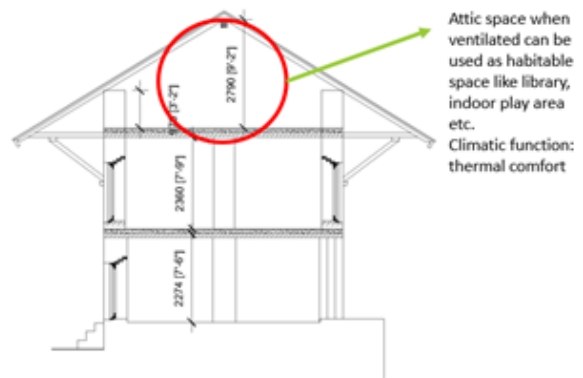


Figure 9: Section of Panchadeval Briddhashram

So upon detail analysis of the building condition and use of value engineering following results were obtained:

- Newari architecture courtyard planning was preserved
- Ventilation and lighting condition of the building was improved
- Functional spaces in the interior of the building were managed

With this overall lifecycle cost of the building can be reduced. Hence objective of value engineering is achieved.

5. Conclusion

The first part of study assessed the use of value engineering during the design phase of retrofitting and reconstruction of Panchadeval Bridhashram . Based on the results and discussions of the study following conclusions are drawn:

- The value engineering will add the function value to courtyard when the extra addition part to the northern courtyard shall not be constructed.
- The assessment concluded that as per conservation principles for buildings under this study, extra additional parts have to be conserved, however, value engineering principle draws out conclusion to demolish these parts to add functional value to the project.
- The qualitative aspect of value engineering in building showed that the upper attic space which are left unused can be turned into functional spaces like library, indoor game play area, stores; these add functional value to the building similar to traditional architecture, when such spaces were used as kitchens and stores.
- The blocked shades in various part of the courtyard can be turned into resting spaces for oldage people without decreasing the capacity and adding functional value which is a form of qualitative value.

6. Recommendation

- Using value engineering technique during planning phase of the project can reduce the

construction cost of the project.

- Architecture professionals should have the knowledge regarding value engineering as they play role in all phases of building life cycle.
- Government projects heritage buildings should adopt value engineering methodology, so that they can act as source of inspiration for other private projects.
- Value engineering should be adopted from policy level, so that its application can be increased in developing countries like Nepal.

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