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Value Engineering In Construction Industry

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Abstract—The Value Engineering is an intensive, interdisciplinary problem solving activity that focuses on improving the value of the functions that are required to accomplish the goal, or objective of any product, process, service, or organization. Value Engineering is an effective problem solving technique. Value engineering is essentially a process which uses function analysis, team- work and creativity to improve value. Value Engineering can be applied during any stage of a project's design development cycle. However, the greatest benefit and resource saving are typically achieved early in the development and conceptual design stages. VE may be applied more than once during the life of the project. In this paper we have discussed the concept of Value Engineering, its job plan and the effective implementation of it through a case study.
Keywords—Value Engineering, Job plan, Functions Analysis, Cost.

I. INTRODUCTION

Value Engineering is the systematic application of recognized techniques which identify the function of the product or service, establish a monitory value for that function and provide the necessary function reliability at the lowest overall cost. The purpose of the Value Engineering Systematic Approach is to provide each individual with a means of skillfully, deliberately and systematically analyzing and controlling the total cost of product. This total cost control is accomplished, in the main, by the systematic analysis and development of alternative means of achieving the functions that are desired and required. Value engineering results in the increased use of alternative less expensive material, cheaper design, weight reduction, new methods of manufacturing, indigenization, etc., to give the same or better performance, quality and efficiency at a lower overall cost. In order to produce a product or service to be competitive in the open market, the best value is determined by two considerations, namely, function and cost of product. Value of a product or service can be enhanced either by increasing the function or decreasing the cost or both while maintaining the performance quality and reliability.

II. LITERATURE REVIEW

1. Kelly (2011)- Value Management (VM) and the analysis techniques involved is applicable as an design management methodology, and is argued as being as relevant to civil engineering infrastructure projects, as it is to architecturally orientated building projects. VM is a systematic means to improve the value of products and services and might be argued as essential in any objective comparison of the available alternative fit-for-use materials and specification options in (civil) engineering design. VM can be defined as 'a service that maximises the functional value of a project by managing its development from concept to use through the audit of all decisions against a value system determined by the client'.

2. Wixson and Heydt (2000)- He comment on the importance of 'people', stating that it is the people involved in the team that have a direct bearing on the success of a value management study; therefore, top level managerial support is critical (Cheah 2005). Whilst acknowledging this to be the case, it might be suggested that the mining industry currently exploiting the huge resources available in the northern region of Western Australia (an area the size of Western Europe with a population of just 2.5 million) have traditionally regarded infrastructure support as a somewhat peripheral concern.

3. Neetu B. Yadav, Rakesh Kacha(2013)- The investment on the construction sector an infrastructure development of India, states the importance and vital role of construction industry. Again, apart from the huge amount associated, construction sector has verities of construction projects involving large number of stakeholders, materials, construction and management techniques, et al. which states a wider scope of application of the value engineering/management. Considering the characteristics of the Indian construction industry, it would be possible through VE studies to identify and overcomethe various loop holes with creative alternatives which will result into higher productivity, cost reduction, better performance, better quality, simpler design (Civil, structural, mechanical, etc.) and optimum project duration without affecting the function of any project or service.

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4. Amiruddin Ismail, Rahim Aminzadeh(2010)- To assess the effects of a VE study needs to consider not only the final economy but also the reciprocation relationship between Value Engineering with time, relationship between VE with quality and then study reciprocation between the expeditor and the construction participants. However VE, highway projects are reviewed and opportunities for better, less expensive means of completing the projects are analyzed. The intention is to improve project quality and productivity, foster innovation, optimize design elements and ensure overall economical costs. The goal of a VE study is to achieve implement excellence. Its objectives are to improve quality, minimize total ownership costs and decrease time.

III. HISTORICAL BACKGROUND

Value Engineering had its origin during World War II, at General Electric, when innovation was required because of material shortages. Some critical materials were difficult to obtain, and a great many of substitutions had to be made. Mr. Harry Erlicker, a vice president, made the observation that many times these changes resulted in lower costs and improved products. This encouraged him to seek an approach to intentionally improve a products value. He assigned Lawrence D. Miles, a staff engineer in 1947, the task of finding a more effective way to improve a product's value. In 1985, the Value Engineering process had gained worldwide acceptance. It spawned an international organization, Society of American Value Engineers International (SAVE Int.), dedicated to its practice, and the certification of competent practitioners. In 1997, SAVE approved a standard for Value Engineering Methodology.

IV. VALUE ENGINEERING METHODOLOGY

The value methodology is a systematic process that follows the Job Plan. The Job Plan consists of some phases. The recommended VE methodology (Job Plan) used by the VE team during the Workshop has five distinct phases. Briefly, these phases are:

A. Information Phase

The VE team gains as much information as possible about the project design, background, constraints, and projected costs. The team performs a function analysis and relative cost ranking of systems and sub-systems to identify potential high cost areas. The information phase also includes preparation of the cost and energy models from cost data assembled before the workshop began.

B. Function and Creative Phase

The VE team uses a creative group interaction process to identify alternative ideas for accomplishing the function of a system or sub-system. Functional analysis forces a broader and more comprehensive understanding of the project by Stimulating intense discussion and by compelling the team to view aspects they might not normally have considered VE team evaluates the ideas developed during the creative phase.

C. Evaluation/Analytical Phase

The ideas generated during the Speculative/Creative Phase are screened and evaluated by the team. The ideas showing the greatest potential for cost savings and project improvement are selected for further study. VE team evaluates the ideas developed during the creative phase. The VE team ranks the ideas. Ideas found to be irrelevant or not worthy of additional study are disregarded; those ideas that represent the greatest potential for cost savings and improvements are selected for development.

D. Development/Recommendation Phase

The VE team researches the selected ideas and prepares descriptions, sketches and life cycle cost estimates to support the recommendations as formal VE proposals. During the development phase of the VE study each designated idea is expanded into a workable solution. The development consists of the recommended design, capital and life cycle cost comparisons and a descriptive evaluation of the advantages and disadvantages of the proposed recommendations.

E. Report Phase

The VE consultant will work in concert with the A-E and the PBS representative to produce a preliminary written VE Report which is intended to represent the results of the VE workshop activities, and meet the VE Program objective. The post-study portion of a VE study includes the finalization of the VE Report in order to incorporate the VE proposals developed during the workshop. The Designer then responds by accepting and incorporating the proposals into the project design, rejecting the proposals, or recommending further study.

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V. DATA ANALYSIS

Case study of a cement concrete road construction site has taken to study value engineering application.

Name of Road	Coastal Road, Goregaon (Wes), Mumbai
Type of Road	Cement Concrete
Length of Road	1186 m
Width of Road	27.45m (4 Lane)
Total Cost(Phase 1)	114736126RS

In this Master format and uniformat was prepared. After preparation of masterformat and uniformat next step is to apply Pareto Law 20/80 which comes through ranking of the function according to their costs in descending order. Normally, around 20% of the functions constitute around 80% of the cost. These functions (20%) are the subject of value engineering. Weight for each criterion is assigned to reflect relative importance based on the project attributes that has been clearly verified and defined.

TABLE I FUNCTIONS OF UNIFORMAT RANKED IN DESCENDING ORDER

Sr.No.	Item Name	Cost (INR)	% of total cost	Accumulative cost	% Accumulative
1	M-40 (E.S)	39912000.00	34.79	39912000.00	34.79
2	GSB	23225400.00	20.24	63137400.00	55.03
3	WMM	21075552.00	18.37	84212952.00	73.40
4	DLC	5158389.00	4.50	89371341.00	77.89
5	DBM	4776625.00	4.16	94147966.00	82.06
6	M-15	4545600.00	3.96	98693566.00	86.02
7	STEEL	4419220.00	3.85	103112786.00	89.87
8	M20	4303100.00	3.75	107415886.00	93.62
9	KERB	2925600.00	2.55	110341486.00	96.17
10	BARRICADING	1930490.00	1.68	112271976.00	97.85
11	WALL N SLAB SHUTTERING	1715060.00	1.49	113987036.00	99.35
12	EXCAVATION	486890.00	0.42	114473926.00	99.77
13	WT	262200.00	0.23	114736126.00	100.00
14	SAND BLANKET	0.00	0.00	114736126.00	100.00
15	Soling	0.00	0.00	114736126.00	100.00
16	BC	0.00	0.00	114736126.00	100.00
17	THERMOPLAST	0.00	0.00	114736126.00	100.00
18	60 MM PAVER BLOCK	0.00	0.00	114736126.00	100.00
19	80 MM PAVER BLOCK	0.00	0.00	114736126.00	100.00
	Total	114736126			

It was noticed that the first 3 items (out of 13) forms 73.4% of the total cost. This means 23.07% of the functions form 73.4% of the cost which is very closed to Pareto Law. As a conclusion, the area of value engineering analysis and study will be controlled by the first three functions that are listed in following table.

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Sr.No.	Item Name	Cost (INR)
1	M-40 (E.S.)	39912000.00
2	GSB	23225400.00
3	WMM	21075552.00
Total		84212952.00

VI. CONCLUSIONS

Value Engineering can be applied during any stage of a project's design development cycle. However, the greatest benefit and resource saving are typically achieved early in the development and conceptual design stages. VE may be applied more than once during the life of the project. Early application of VE helps to get the project started in the direction, and repeated application helps to filter the project's direction based on new or changing information. It is important available and compare quality elements of the design with the owner's requirements. The application of Pareto Law 20/80 states that around 20 % of the functions constitute around 80% of the cost. These functions (20%) are the subject of value engineering. Likewise It was noticed that the first 3 items (out of 13) forms 73.4% of the total cost. This means 23.07% of the functions form 73.4% of the cost which is very closed to Pareto Law. As a conclusion, the area of value engineering analysis and study will be controlled by the first three functions.

VII. ACKNOWLEDGMENT

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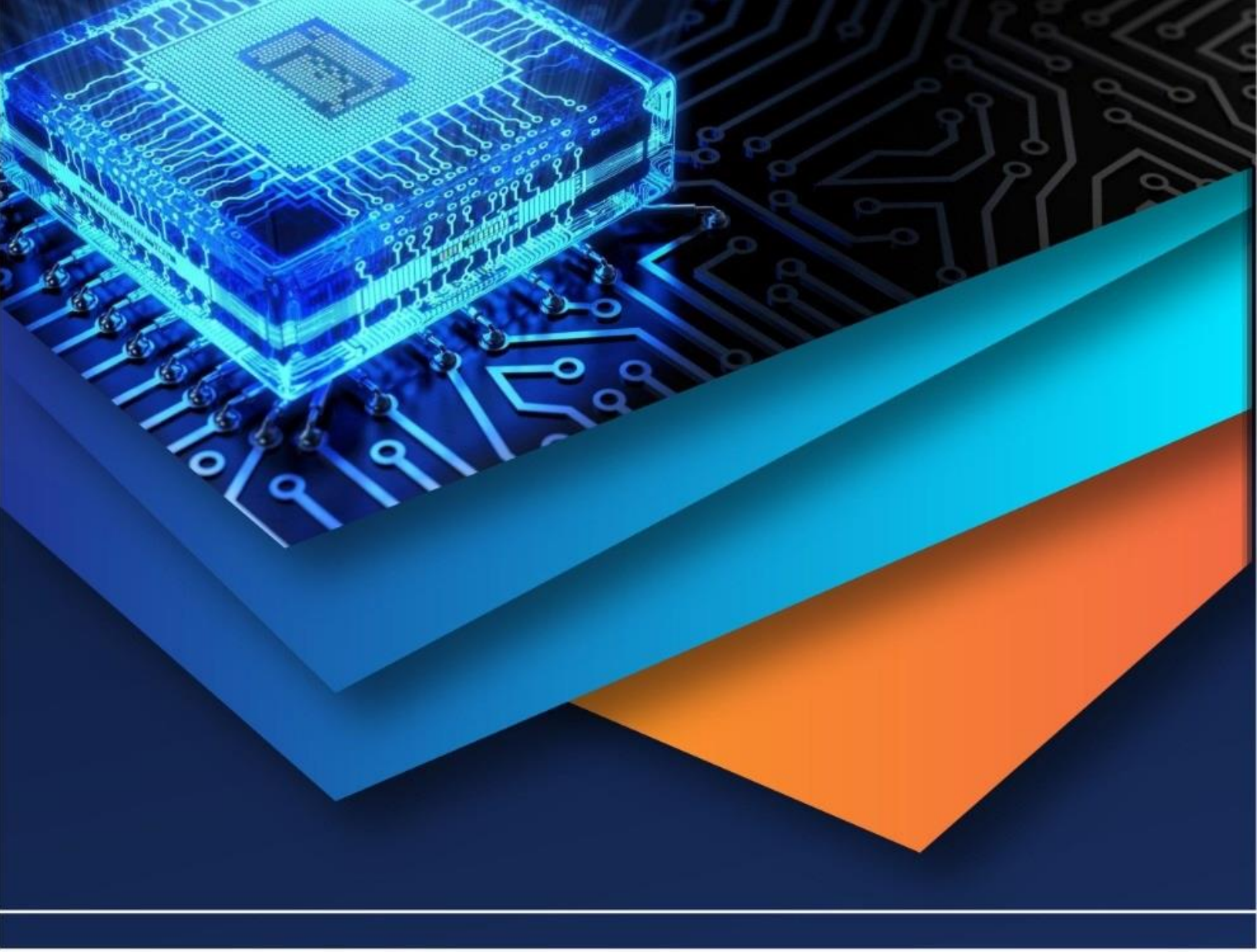
VIII. FUTURE SCOPE

A. It can be use to control human resources on the field.
B. It is useful to any activity which is having alternatives to reduce cost.
C. There is often a tendency on projects to try to gain more scope within the budget.

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