

Effective Implantation of Value Engineering In Road Construction Project

Shahid Shafi Lone¹, Dr. Sandeep Singla²

M. Tech Scholar, Deptt. of Civil Engineering¹, Professor Deptt. of Civil Engineering²

RIMT University Mandi Gobingarh Punjab^{1,2}

Abstract

The construction projects are time-consuming and costly, can be with offer and use of new techniques in the management of the project was to reduce these two factors, value engineering is one of the new techniques reduce the cost of a project that can be with value engineering studies and the use of all items of a project to achieve the optimal result. In The value engineering with use of person's creativity can be lead to ways to reduce the cost of the project; lake of application of value engineering in project creates many problems that are no secret on nobody of the project managers. The current construction practices require a great effort to balance the factors such as money, time and quality. Comparing with other industries it seemed that construction industry remains the toughest one to deal with. It is proven that certain modern techniques can be easily adapted to the project to balance the factors above said. Value engineering is an efficient tool among them for fostering the construction quality with an aim of low cost and high services. The value engineering is a methodology used to analysis the function of the goods and services and to obtain the required functions of the good and service of the user at the lowest total cost without reducing the necessary quality of performance. It 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.

Keywords: Value Engineering, Construction Project, Road Construction, Cost vs. Time, Quantity vs. Time

1. Introduction In recent years in construction projects such as dam construction, road construction, oil and gas oil, gas, complex construction, military projects and Talk of time span and operating expenses comes that in this regard opportunities and new fields created working for value engineering. Promote value engineering and risk is in during the both. In many cases, persons who are engaged in value engineering workshops. With attention to the depending on the type of project and the development of their ideas and with attention to the approach of persons who serve in the project, approach is cost reduction, therefore ideas expressed and given finally been approved and introduced as the output for the project whose implementation of the ideas associated with high risk, usually the best ideas of value engineering are the most risky ideas. In building construction, building quality has contributed impact in value of building, so employers and manufacturers are trying to raise the value of building from proper design methods and strict implementation of optimal, therefor employers with selected consultations and designers achieve to new designs and accessed to this status indebted to holding the value engineering sessions.

Value engineering is scientific that considers a project or plan based on the analysis and full consultation and collective advantages and disadvantages, considering the project found the ideal exploitation. In most countries of the world; European countries particular, value engineering has been application design and project implementation as a symbol of saving time and costs. Value engineering (Ibusuki, 2007; Cooper, 2017) is the systematic application of recognized techniques which identify the function of a product or service, establish a value for that function, and provide the necessary function reliably at the lowest life-cycle cost. In the highway context, products and services include not only the structural elements of highways, but

also the processes, equipment, and supplies used in their development, from concept through operation and maintenance. In all instances, the required function should be achieved at the lowest life-cycle cost consistent with requirements for performance, maintainability, safety, and aesthetics.

Complete the project in the specified time horizon and allocated cost. Deliver value to the customers by providing excellent customer support. Roads are an integral part of the transport (Van *et al.*, 2016) system. A country's mad network (Yu *et al.*, 2016) should be efficient in order to maximize economic and social benefits. They play a significant role in achieving national development and contributing to the overall performance and social functioning of the community. It is acknowledged that roads enhance mobility. Taking people out of isolation and therefore poverty. In this study has been tried that value engineering for review discussed on the type of appropriate design and implementation.

1.1 Road Construction

Road construction in India is about rs.150 billion. The contracting industry consist of large scale contractors (Rs.500 million and above) about 20 large contractors accounting 40% of construction (Eastman, 2018) activities. medium scale contractors (Rs.100-500 million) is involved about 20% of construction activities and small scale contractors (Rs.5-100 million) is involved in remaining 40%. Application of Value Engineering in Construction VE (value engineering) was developed at General Electric Corp. during World War II and is widely used in industry and government, particularly in areas such as defense, transportation, construction and healthcare. VE is an effective technique for reducing costs, increasing productivity and improving quality. It can be applied to

hardware and software; development, production and manufacturing; specifications, standards, contract requirements and other acquisition program documentation; and facilities design and construction. VE is defined as "an analysis of the functions of a program, project, system, and product, item of equipment, building, facility, service or supply of an executive agency, performed by qualified agency or contractor personnel, directed at improving performance, reliability, quality, safety and life cycle costs". It may be successfully introduced at any point in the life-cycle of products, systems, or procedures. VE (value engineering) was developed at General Electric Corp. during World War II and is widely used in industry and government, particularly in areas such as defense transportation, construction and healthcare. VE is an effective technique for reducing costs, increasing productivity and improving quality. It can be applied to hardware and software; development, production and manufacturing; specifications, standards, contract requirements and other acquisition program documentation; and facilities design and construction. VE is defined as "an analysis of the functions of a program, project, system, and product, item of equipment, building, facility, service or supply of an executive agency, performed by qualified agency or contractor personnel, directed at improving performance, reliability, quality, safety and life cycle costs". It may be successfully introduced at any point in the life-cycle of products, systems, or procedures. Value engineering (VE) (Ibusuki, 2007; Cooper, 2017) was developed at General Electric Corp. during World War II and is widely used in industry and government, particularly in areas such as defence, transportation, construction (Eastman, 2018) and healthcare. VE is an effective technique for reducing costs, increasing productivity and improving quality. It can be applied to hardware and software; development, production and manufacturing; specifications, standards, contract requirements and other acquisition program documentation; and facilities design and construction. VE is defined as "an analysis of the functions of a program, project, system, and product, item of equipment, building, facility, service or supply of an executive agency, performed by qualified agency or contractor personnel, directed at improving performance, reliability, quality, safety and life cycle costs". It may be successfully introduced at any point in the life-cycle of products, systems, or procedures.

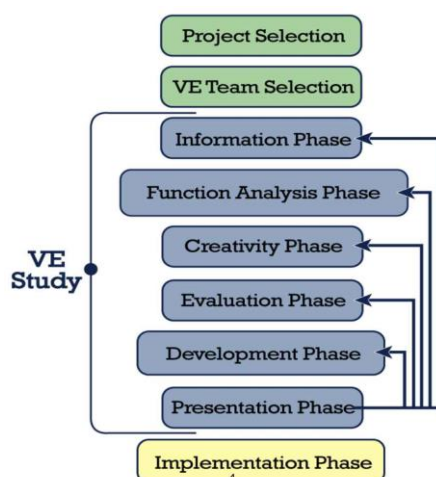


Fig 1: Value Engineering in Construction

VE is a technique directed toward analysing the functions of an item or process to determine "best value", or the best relationship between worth and cost. In other words, "best value" is represented by an item or process that consistently performs the required basic function and has the lowest life-cycle cost. In this context, the application of VE in facilities construction can yield a better value when construction is approached in a 'limner that incorporates environmentally-sound and energy-efficient practices and materials. Because "costs" are measurable, "cost reduction" is often thought of as the sole criterion for a VE application and indeed it is primarily addressed in this document. However, the real objective of VE is "value improvement" and that may not result in an immediate cost reduction.

2. Research Background

Lavina, & Mittal, S. (2018) this study attempts to determine the factors accountable for probability of financial distress in the context of real estate and construction industry of India. Financial ratios covering liquidity, solvency, activity and profitability have been used as predictors. In addition, this study applies linear probability, probability and logic models to carefully examine the superior predictors of financial distress. Bilozor-Renigier, M., et al. (2014) the development of the real estate market is conditioned by a variety of endogenous and exogenous factors. The selected factors determine the local characteristics of the real estate market, while other factors classify it as one of the main branches of the national economy. Rapid economic growth and the search for new investment opportunities have made the real estate market a competitive arena, with a variety of participants implementing various investment strategies Zirape, B. L., & Warudkar, A. A. (2016) this study identified risk factors associated with a construction joint venture (JV). Risk factors fall into three broad categories: (1) internal; (2) specific projects; and (3) external. The survey was conducted through a questionnaire and through the Relative Importance Index (RII) to identify the most critical risk factors. It examines the most effective mitigation measures that construction professionals take when dealing with these risks for construction projects. Detailed questionnaires, literature surveys and case studies, this research methodology will employ risk management in joint ventures (JVs) construction projects for real estate. Kundu, D., & Boral, E. (2018) This paper attempts to break the relationship between the extension of the subway track and the growth of residential real estate. The study identified a positive correlation between subway passenger flow trends and real estate growth in the three districts. As a public transportation mode, the Kolkata Metro can not only increase accessibility, but also change the urban landscape through the emergence of real estate. Dalpaos, C., Canesi, R. (2014) Aim of the paper is to provide a novel valuation model to address risk and uncertainty in property investment decisions. When the future is uncertain and the investment is long-lasting and lacks liquidity, the decision to invest at a certain point in time and to properly assess the risk is a key issue. During the global financial crisis, investors need to know how to measure risk and determine the relationship between the risk they bear and the risk premium. Sajad, M., & Sadiq, M. (2016) Software engineering is concerned with the development and advancement of huge and multiple

software intensive systems. It provides theories, methods, and tools for the specification, architecture, design, testing, and maintenance of software systems. Today, the development of software systems is huge, complex and critical, and only through the use of automated methods can these systems be developed and developed in an economical and timely manner. The use of automated software tools is critical to the successful planning and management of projects. Ahmed, S. M., et al. (2017) in the domestic sector, increased energy consumption of home appliances has become a growing issue. Therefore, reducing and scheduling energy use is the key to any Home Energy Management System (HEMS). To better match demand and supply, many utility companies provide residential demand response plans that change the electricity consumption patterns of residential users by reducing or diverting their energy use during peak hours. In this study, the HEMS real-time optimal scheduling controller was proposed to manage energy consumption using the new binary backtracking search algorithm (BBSA). Guo, J., Xu, S., & Bi, Z. (2014) Real estate appraisal information systems have been studied by many researchers in the past including those systems that have integrated geographic information systems, artificial neural networks, etc. This paper proposes a new integrated approach to real estate assessment that can be used in real estate assessment systems to improve efficiency and accuracy.

3. Methodology for Data Analysis

Data analysis is a process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, informing conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, while being used in different business, science, and social science domains. In today's business, data analysis is playing a role in making decisions more scientific and helping the business achieve effective operation.

3.1 Regression

Linear regression is a basic and commonly used type of predictive analysis. The overall idea of regression is to examine two things: (1) does a set of predictor variables do a good job in predicting an outcome (dependent) variable. (2) Which variables in particular are significant predictors of the outcome variable, and in what way do they—indicated by the magnitude and sign of the beta estimates—impact the outcome variable? These regression estimates are used to explain the relationship between one dependent variable and one or more independent variables. The simplest form of the regression equation with one dependent and one independent variable is defined by the formula $y = c + b \cdot x$, where y = estimated dependent variable score, c = constant, b = regression coefficient, and x = score on the independent variable

3.2 Chi-square (R2)

The Chi Square statistic is commonly used for testing relationships between categorical variables. The null hypothesis of the Chi-Square test is that no relationship exists on the categorical variables in the population; they are independent. The calculation of the Chi-Square statistic is quite straight-forward and intuitive:

Where, f_o = the observed frequency (the observed counts in the cells) and f_e = the expected frequency if NO relationship existed between the variables. As depicted in the formula, the Chi-Square statistic is based on the difference between what is actually observed in the data and what would be expected if there was truly no relationship between the variables.

4. Results and Discussion

As this thesis investigate the 5 different project running in Delhi to Mathura as highway projects. The questionnaire collect the data in very limited time for the cost, time and quality. This value engineering is the optimization of all, beside this thesis explore the individual factor dependency (DepF) upon the other two factors.

Table 1: Summary Time Output

Summary Output	
Regression Statistics	
Multiple R	0.941345353
R Square	0.886131074
Adjusted R Square	0.877696339
Standard Error	0.738162513
Observations	30

Table 2: P-value of Time Output

	Coefficients	P-value
Intercept	1.718625006	4.39E-05
Quantity	10.65870567	2.57E-09
Cost	-0.173836526	0.029699

DepF(T)

$$\text{Time} = (10.65870567) * \text{Quantity} + (-0.173836526) \text{ Cost}$$

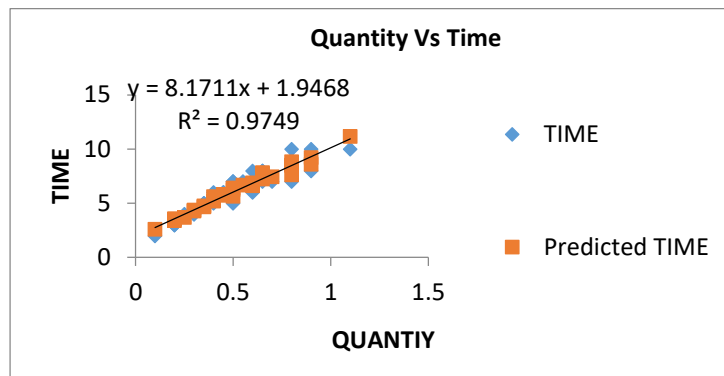


Fig 2: Line fit plot for Quantity

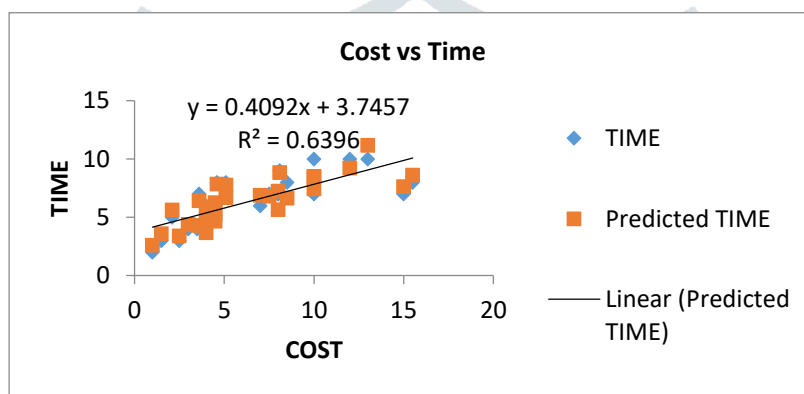


Fig 3: Line fit plot for Cost

Table 3: Summary Statistics of Quantity Output

Summary Output	
Regression Statistics	
Multiple R	0.97103
R Square	0.942899
Adjusted R Square	0.938669
Standard Error	0.05946
Observations	30

Table 4: P-Value for Quantity Output

	Coefficients	P-value
Intercept	-0.06887	0.071159
Cost	0.0264	1.58E-06
Time	0.06916	2.57E-09

DepF(Q)

$$\text{Quantity} = (0.0264) * \text{Cost} + (0.06916) \text{ Time}$$

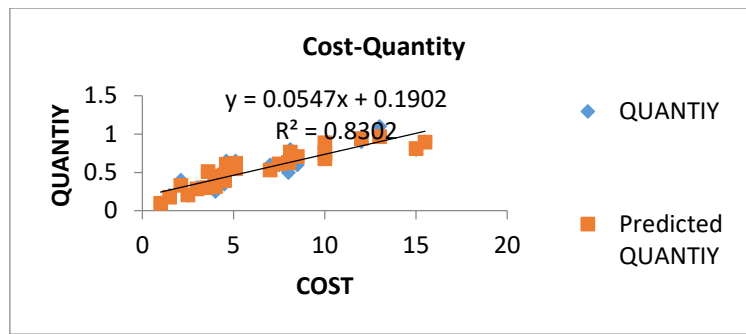


Fig 4: Line fit plot for Cost

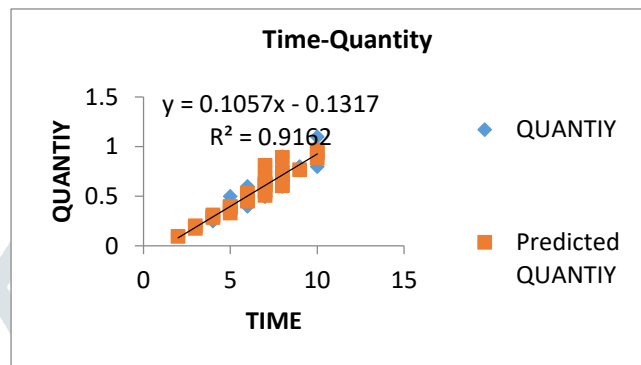


Fig 5: Line fit plot for Time

Table 5: Summary of Cost Output

Summary Output	
<i>Regression Statistics</i>	
Multiple R	0.904561
R Square	0.81823
Adjusted R Square	0.804766
Standard Error	1.715915
Observations	30

Table 6: P-Plot for Cost Output

	Coefficients	P-value
Intercept	0.516329	0.648682
Quantity	21.98568	1.58E-06
Time	-0.93935	0.029699

DepF(C)

$$\text{Cost} = (21.98568) * \text{Quantity} + (-0.93935) \text{ Time}$$

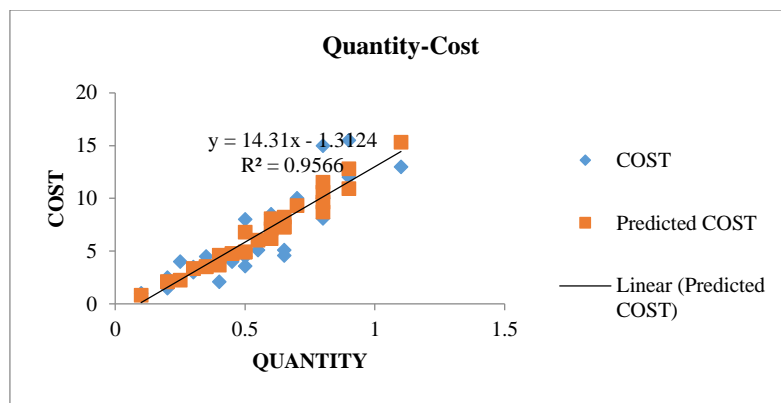


Fig 6: Line fit plot for Cost Output

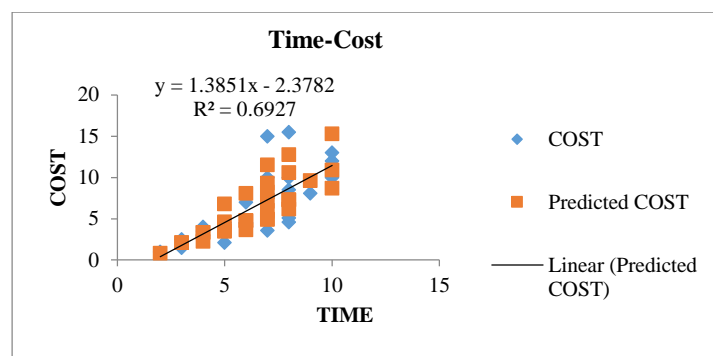


Fig 7: Line fit plot for Cost Output

5. Conclusion and future work

The model in this study can evaluate the projects performance of VE study. By reduced cost, reduce time and increase quality which in this model for per KM using of technique VE that achieved. Therefore, this model tested for another project and can be used for other projects also in this research. Linearity between VE with cost, time and quality as separately calculated and shown. To evaluate the effects of a VE study needs to consider not only the final economy but also the reciprocation relationship between VB with time, relationship between VB with quality and then study reciprocation between the expeditor and the project participants. However, VE, others road construction projects are reviewed and opportunities for better, less expensive means of completing the projects are analysed. The intention is to improve project quality and productivity, foster innovation, optimize design elements and ensure overall economic costs. The goal of a VB study is to achieve performs excellence. Its objectives are to improve quality, minimize total ownership costs and decrease construction time.

References

1. Ibusuki, U., & Kaminski, P. C. (2007). Product development process with focus on value engineering and target-costing: A case study in an automotive company. *International Journal of Production Economics*, 105(2), 459-474.
2. Cooper, R. (2017). *Target costing and value engineering*. Routledge.
3. Van Geenhuizen, M., & Rietveld, P. (2016). New trends in policy making for transport and regional network

integration. In *Policy Analysis of Transport Networks* (pp. 17-32). Routledge.

4. Yu, N., de Roo, G., De Jong, M., & Storm, S. (2016). Does the expansion of a motorway network lead to economic agglomeration? Evidence from China. *Transport Policy*, 45, 218-227.
5. Lavina, & Mittal, S. (2018). The Determinant of Financial Distress in Indian Real Estate and Construction Industry. *Gurukul Business Review (GBR)*, 6-11.
6. Bilozor-Renigier, M., Et Al. (2014). Rating Methodology for Real Estate Markets – Poland Case Study. *International Journal of Strategic Property Management*, 198–212.
7. Zirape, B. L., & Warudkar, A. A. (2016). Risk Management in Construction Joint Venture Projects in Real Estate. *International Journal of Engineering Science and Computing*, 4541-4544.
8. Kundu, D., & Boral, E. (2018). Trend of Residential Real Estate Development after Metro Railway Extension: A Case Study of Some Selected Wards of South Kolkata. *International Journal of Recent Scientific Research*, 25683-25688.
9. Dalpaos, C., Canesi, R. (2014). Risks Assessment in Real Estate Investments in Times of Global Crisis. *Wseas Transactions on Business and Economics*, 369-380.
10. Sajad, M., & Sadiq, M. (2016). Software Project Management: Tools assessment, Comparison and suggestions for future development. *International Journal of Computer Science and Network Security*, 31-43.
11. Ahmed, S. M., et al. (2017). Real time optimal schedule controller for home energy management system using

new binary backtracking search algorithm. *Energy and Buildings* 138, 215–227.

12. Bailey, J.M., & Muth, F. R. (2015). A Regression Method for Real Estate Price Index Construction. *Journal of the American Statistical Association*, 934-942.

