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The Mediation Role of Value Management Over Project's Design and Planning, Value Enhanced Product Relationship

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Abstract

The objective of this study is to comprehend the underlying nature of the interactions between the variables of project design and planning, value management, and enhanced building or product value. To carry out this study, value management is viewed as a mediating variable (M.V.), enhanced building or product value is viewed as a dependent variable (D.V.), and project design and planning (I.V.). Following data analysis, it is deduced that: a) there is a significant correlation between I.V. and D.V.; b) there is a correlation between M.V. and D.V.; and c) there is a mediation effect of M.V. over the relationship of I.V. and D.V.

Keywords: Construction; Value management; Real estate; Projects design and planning; Enhanced building/ product value,

Introduction

Value management (VM) in construction projects has two benefits: lower costs and better functionality or quality. The process of managing value involves collaboration. The set of benefits for the rest of your life that a customer anticipates at a fair price from a project. The primary features must be accomplished at all levels in order to obtain the most bang for your buck, which will address planning and design issues. It may be used in the planning and design phases to get the highest return on investment. Value analysis, Value planning, and Value management are its three subgroups. More strategic studies conducted during the initial stages of conceptual design are explained using value planning. It alludes to the steps required at the beginning of a project to identify, specify, and get consensus on the Client's goals. The value planning process continues through the design of the scheme. Worth engineering is a rigorous, well-organized process that assesses function in order to provide and raise the worth of goods or products. The Value Engineering approach is a technology that helps the construction industry become more cost-effective, to put it briefly. From detailed design to actual building, value engineering covers it all. Value analysis is a crucial technique and a creative way to cut wasteful spending. Without sacrificing quality, dependability, performance, or aesthetics, it guarantees the necessary functionalities at the lowest possible cost. Value analysis focuses on the post-occupancy evaluation procedure. In the 1940s, value analysis was the precursor to VM in the American manufacturing sector. The work of Miles (1972), a buy engineer for the General Electric Company, served as the foundation for the process' concepts and guiding principles. His guiding principle was to do the essential tasks at the lowest possible cost (Kelly & Male, 1993; Dallas, 2006). Male et al.'s original methodology is still recognizable today, but its application has been expanded and the methodology has been translated to meet the needs of various industries. The original methodology looked at ways to provide a product's functions at a lower cost and then confirmed the economic and technical viability before changing production procedures. Value engineering was first used in the construction industry in the UK in the 1960s, but it experienced a renaissance starting in the mid-1990s (Ashworth & Hogg, 2000) due to the emphasis placed on the need for innovation and excellence in the UK construction industry, which was first promoted by Latham (1994) and then Egan (1998). The use of VM in the building process is now widely accepted, and its clientele come from all business sectors (Ellis et al., 2005). It shouldn't be the case that using virtual machines (VMs) equates to saving money. Although VM often does result in cost reduction, according to Norton and McElligott (1995), the goal is to increase value rather than lower cost. Therefore, the procedure primarily entails the removal of extra expenditures that were incorporated into designs without lowering the degree of practical excellence.

Objectives of the Study

The study objectives are

1. To study influence of projects design and planning (I.V.) over enhanced building/product value (D.V.).
2. To observe influence of value management (M.V.) over enhanced building/ product value (D.V.).
3. To study value management (M.V.) effect over the projects design and planning (I.V.) and enhanced building/product value (D.V.) relationship.

Literature review

Value management (VM) studies are frequently under pressure because of a lack of time and funding and VM studies to be successful, all stakeholders must put up a coordinated effort (Qiping Shen et al. 2018). Theimpact of value engineering/management ideas are used in building construction projectsduring the project's design and planning phase to achieve greater quality at reduced costs (Fig.1) and value engineering/management in building construction can result in a 5%–10% decrease in construction costs (Brijesh Ramani et al. 2017).

After examining the knowledge and application of VM in the Chinese construction industry, three key reasons why VM was not widely adopted in its working environment were discovered (Shen & Liu 2003). These factors included a lack of knowledge about how VM should be implemented, a lack of faith in the introduction of VM to different parties, and a lack of time to deploy VM. According to the results of earlier studies, various barriers to VM adoption in developing nations were discovered to be consistent and distinctive. This backs up the claims made (Aghimien et al. 2008) that similar project features and methods of execution in developing countries account for similarities in the hurdles to VM deployment in those countries.To make the current task easier, the variables that hinder the deployment of VM were gathered with the help of earlier research. The application and usage of VM in a proper manner will yield the cost advantages and it is higher than the inputs (B. Hwang et.al. 2015, Hedau A. (2020). VM has been widely adopted and is now a highly regarded approach, but its adoption in small projects has not yet been successful in the majority of impoverished regions and is still constrained by project size (A. Alshehri 2020). The broad adoption of VM in diverse construction projects may be severely constrained by a lack of VM understanding, relevant guidelines, and stakeholder support **(**Lai 2006**)**. This was supported by, who also said that the main challenges to VM workshops in Malaysia were a lack of knowledge and training, reluctance to change, and conflicting project goals among many partners (Jaapar et al. 2009). Intrinsic qualities, such as constrained budgets, fewer staff members participating, and other factors, small projects are more likely than bigger ones to have difficulties with systematic management. Because of the fierce competition, Small and Medium-sized Contractors (SMCs) often set their bid prices so cheap that they risk having inadequate leftover funds for VM operations (G.R. Smith, C.M. Bohn 1999). The VM assists construction companies, especially Small and Medium Enterprises (SMEs) that often contract for small projects, to address the issue of the poor profitability of small projects and to increase self-competitiveness to stay ahead of the competition (X. Lin et. al., 2022). The small projects are more likely to be shorter in duration and less complicated, with a significant problem of the ratio between management inputs and project expenses (Griffith & Headley 1998). The repetition, routine, maintenance, refurbishment, remodelling, and upgrading are among the frequent sorts of work they perform, and these projects might cost less than or equal $1 million USD **(**P.S. Dunston, A.G. Reed2000). Many developing nations still lack understanding of VM and its numerous applications **(**M. Thneibatet.al. 2021). Lack of internal knowledge and awareness regarding VM and its application, SMCs, which typically contract for modest projects, did not give VM the attention it deserved **(**S.B. Abd-Karimet.al.2017**;** Kineberet.al.,2021**;** S.Y. Kimet.al.2016). VM has developed into a proactive, problem-solving or solution seeking process that can be used to improve the functional value(s) of a project by managing the development of a project from the design concept to operational use (and eventual decommissioning) through structured, team-oriented, and open-dialogue exercises (Hayles et al., 2010). These exercises make recommendations for alternatives (or affirm current solutions), and they assess future choices in light of the client's value expectations. It is a methodical, team-based approach to issue resolution that may be used throughout the phases of building idea, design, construction, and maintenance. To maximise value for the client, VM addresses the crucial question of function in relation to cost (Hayles and Simister, 2000, Ahmad, S. R., Prasad, K. D. V., Bhakuni, S., Hedau, A., Narayan, P. S., & Parameswari, P. (2023). VM is a method for creative problem solving that contains a variety of qualitatively distinct components and adopts a broader perspective on problem solving than many other strategies (Barton and Knott, 1994).VM is widely employed and, generally speaking, highly successful in the Northern Ireland construction sector. The research, however, revealed a universal opinion that the VM process is typically not applied at the most suitable stage of a project, which implies that if it were, it may be more efficient than it is at the moment. It appears that the VM process is not being carried out using

formal approaches. Instead, a lot of informal and loose techniques are employed (Srinath Perera et.al. 2011). The knowledge and guidance obstacles, environmental hurdles, resource barriers, methodological barriers, and cultural barriers are the main challenges to VM in small construction projects. Major obstacles were identified as being mostly linked to the knowledge, direction, and environment of VM dissemination in small construction projects. The main obstacles are "inadequate VM training and facilitation skills", "absence of proper guidelines", "lack of corresponding legislation/incentive for VM", "lack of past experience in VM", and "lack of VM experts". Additionally, certain possible countermeasures that are thought to be effective in reducing the obstacles were investigated (Xiaobin Lin & Ain Naadia Mazlan &Syuhaida Ismail 2022).

Research Gap

To the best of the author's knowledge, no research of this sort has ever been conducted in Hyderabad, India; thus, this work will satisfy the criteria of interdependency of the specified factors and their significance in the building sector.

Methodology

A literature review was the first step in the study's flow, followed by the collection of variables, the creation of the questionnaire instrument, the administration of the final survey, the elimination of redundant data, the statistical package for the social sciences (S.P.S.S.) data analysis, the summary of results, and the conclusion remarks (Fig.2).

Measures of the population and sample size

The population of the study included civil engineers from Hyderabad's southern region, and the sample was drawn from Hyderabad-based construction firms. The sample has been collected using a random sampling process. 150 is the considered the sample size.

Variables

Project planning and design are viewed as independent variables (I.V.), value management as a mediating variable (M.V.), and increased product or building value as a dependent variable (D.V.).

Data Source

To understand opinion/ideas value management of various authors various published articles are referred and the same shall be considered as secondary data. Due to the unique nature of the study and the lack of data availability, the data that was expected to be directly obtained from respondents will be considered as primary data.

Preparation of a questionnaire

A questionnaire constructed considering three variables/factors namely projects design and planning, value management and value enhanced product/building. To gather replies, a closed-ended survey is created and a 1-to-5 Likert scale is used (i.e., strongly disagree to strongly agree).

Pilot Study

After the questionnaire was given to civil engineers, 150 responses were gathered. The data were tested for correlation using the S.P.S.S. software programme, and the results of the two-tailed significance test and the flag significant correlation test were produced using the Karl Pearson's coefficient of correlation. At a 5% level of significance, the Pearson critical coefficient is 0.312. The correlation test indicates a link between better project design and planning, value management, and greater product/building value, hence the non-correlated sub-factors of the questionnaire have been eliminated

Mediation model

The term "mediation" refers to the transfer of an I.V.'s influence on a D.V. through one or more variables. We'll refer to this model as having a single mediator variable. If the I.V. has both a direct and an indirect influence on the D.V., the mediation is referred to as partial mediation, and if the I.V. effect was only detected indirectly, it is referred to as complete mediation. The proposed mediation model is shown as a route model in Figure 3. It is to determine whether there is a direct connection between I.V. and D.V. as well as to investigate the impact of M.V. on that connection.

Final study

In Hyderabad, southern India, middle-sized contracting firms, promoters, and builders have been the objective of the finalised questionnaire instrument, which has been distributed to civil engineers with an invitation to participate. The working civil engineering community provided one hundred fifty-four (154) replies over the course of four months, and one hundred fifty (150) of those were deemed suitable for study. As a result, the responses are taken into consideration for data analysis.

Data analysis

The S.P.S.S programme was used to do a linear regression analysis to examine the relationships between the variables as well as the effects of one variable on the relationships between the other two variables. The improved product/building value variable has been classified as a dependent variable (D.V.), the project's design and planning variable as an independent variable (I.V.), and value management as a mediating variable (M.V.). Figure 3 illustrates the suggested Mediation model.

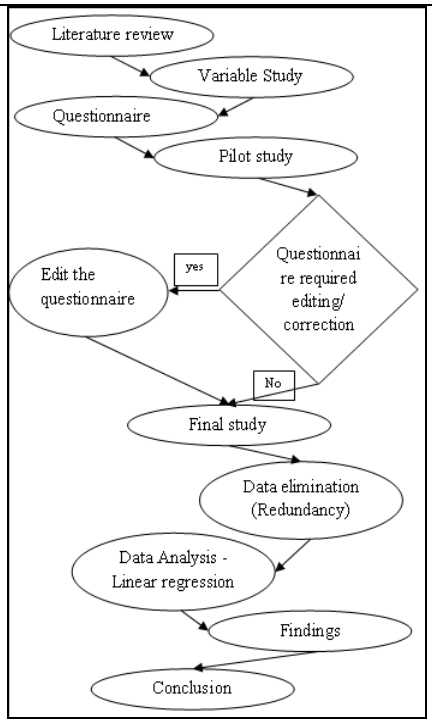

Fig.2: Methodology (Author's source)

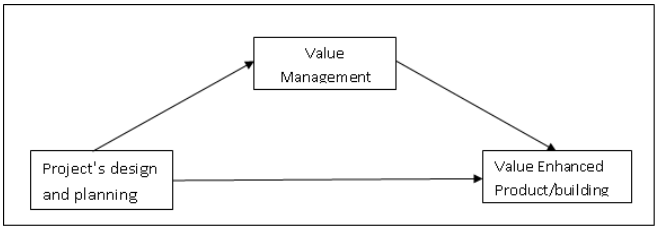

Fig.1: Study factors linkage (Source: Author)

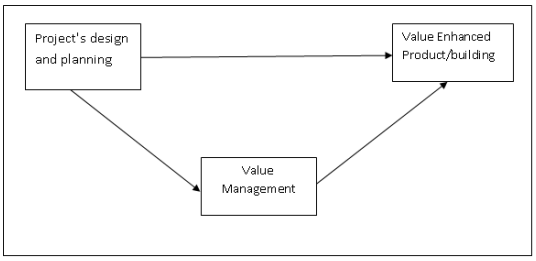

Fig.3: Proposed Path diagram (Source: Author)

Findings and Conclusion

The summary of findings and conclusion will be carried out based on analysis outcome.

Limitation

The study's scope was restricted to private builders, contractors, and developers working in Hyderabad, India's construction sector. These organisations are responsible for creating the city's residential infrastructure.

Hypotheses

For the proposed investigation, the following hypotheses have been developed:

Hypotheses-1

H_0: There is no-significant relation between project’s design and planning (i.e. I.V.) and enhanced product/building value (i.e.D.V.).

H_1: There is a significant relation between project's design and planning (i.e. I.V.) and enhanced product/building value(i.e.D.V.).

Hypotheses - 2
H_0: There is no-significant relation between project's design and planning (i.e. I.V.), value management (i.e. M.V.).
H_1: There is a significant relation between project's design and planning (i.e. I.V.), value management (i.e. M.V.).

Hypotheses - 3
H_0: There is no-significant relation betweenvalue management (i.e. M.V.) with enhanced product/building value (i.e.D.V.).
H_1: There is a significant relation between value management(i.e. M.V.) with enhanced product/building value (i.e.D.V.).

Hypotheses - 4
H_0: There is no-mediation effect of value management (i.e. M.V.) over project's design and planning (I.V.) and enhanced product/building value (i.e. D.V.) relation.
H_1: There is full mediation effect of value management (i.e. M.V.) over project's design and planning (I.V.) and enhanced product/building value (i.e. D.V.) relation.

Data analysis:

Statistical Package for the Social Sciences (SPSS) was used to compile the data, which is as follows:

Demographic descriptive statistics: Analyses of demographic responses have been conducted and demonstrated as gender (Fig.4), marital status (Fig.5), age (Fig.6), educational qualification (Fig.7), work experience(Fig.8), salary(Fig.9), residence(Fig.10), family association (Fig.11)

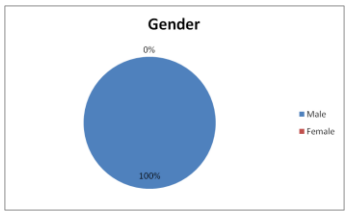

Fig.4 Gender

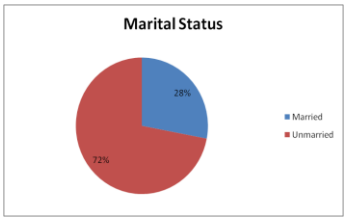

Fig.5 Marital Status

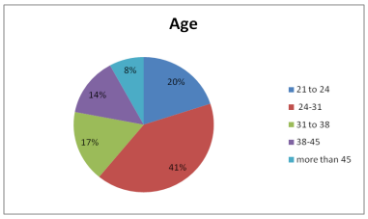

Fig.6 Age

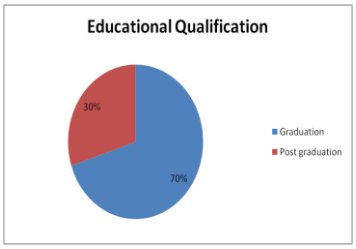

Fig.7 Educational Qualification

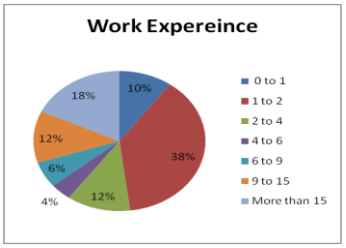

Fig.8 Work Experience

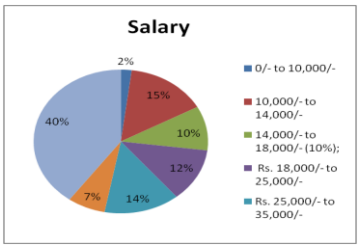

Fig.9 Salary

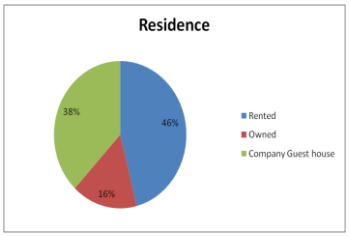

Fig.10 Residence

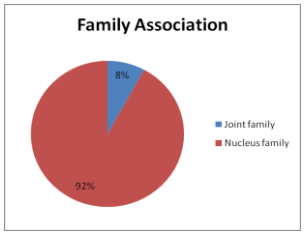

Fig.11 Family Association

Analysis of data

The replies have been condensed and put into SPSS. The data has then been examined using the linear regression technique.

I.V. and D.V data analysed by linear regression engaging the SPSS and the analysis is

A significant regression equation was found (F (1,148) =2278.492, $p<0.00$) with an R^2 of 0.939.
Project's design and planning = - 0.202 + 0.862 * enhanced product/building value

I.V. and M.V data analysed by linear regression engaging the SPSS and the analysis is

A significant regression equation was found (F (1,148) =275.152, $p<0.00$) with an R^2 of 0.650.
Value management= 0.801 + 0.686 * enhanced product/building value +0.592

M.V and D.V data analyzed by linear regression engaging the SPSS and the analysis is

A significant regression equation was found (F (1,148) = 118.67, $p<0.00$) with an R^2 of 0.445.
Enhanced product/building value = - 0.754 + 0.986 * value management+0.745

I. V, M.V and D.V data analyzed by linear regression engaging the SPSS and the analysis is

A significant regression equation was found (F (2,147) = 1182.083, $p<0.00$) with an R^2 of 0.941.
Enhanced product/building value = -0.272+ 0.802* Project's design and planning+0.088* value management + 0.242

There is no-mediation effect of value management (i.e. M.V.) over project's design and planning(I.V.) and enhanced product/building value (i.e. D.V.) relation.

Results and Interpretation

According to the objective(s), the results and conclusion are condensed.

Objective 1: To study the influence of I.V. over D.V.

From hypotheses testing, $p<0.05$, we are unable to accept the null hypotheses, hence null hypothesis is rejected and the alternative hypothesis has been accepted. It is concluded that there is a statistically significant influence of Project design and planning (i.e. I.V.) over the Enhance product/building value (i.e. D.V.). From the testing outcome it is very clear to mention that Project design and planning variable is one of the supervising characters.

From the linear regression, the total effect (C) between Project design and planning and Enhance product/building value is worked out as 0.862.

Objective 2: To observe the influence of M.V. over the D.V.

Because the null hypothesis cannot be accepted based on hypothesis testing, the alternative hypothesis has been accepted and the null hypothesis is rejected ($p<0.05$). It is determined that value management (i.e., M.V.) has a statistically significant impact on the enhancement of product/building value (i.e., D.V.). The testing results make it quite evident that one of the supervisory characters is the value management variable.

Objective 3: To observe M.V. effect over the I.V and D.V. relationship.

From hypotheses testing, $p<0.05$, we are unable to accept the null hypotheses, hence null hypothesis is rejected and the alternative hypothesis has been accepted. It is concluded that there is a statistically significant influence of value management (i.e. M.V.) over the Project design and planning (I.V.) and Enhance product/building value (i.e. D.V.) relationship. From the testing outcome it is very clear to mention that value management is influencing the Project design and planning and Enhance product/building value relationship.

The unstandardized coefficients of Project design and planning and value management are (β) 0.686 and the standard error is 0.041, according to the study of linear regression. The standard error is 0.35 and the unstandardized coefficients of value management and Enhance product/building value (i.e. a) are (β) 0.088. The unstandardized coefficients of value management and improving product/building value (i.e., the direct effect) are (β) 0.802 and the standard error is 0.03 respectively.

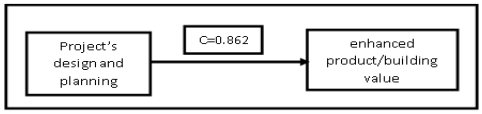

Fig.12 Direct Effect between I.V. and D.V

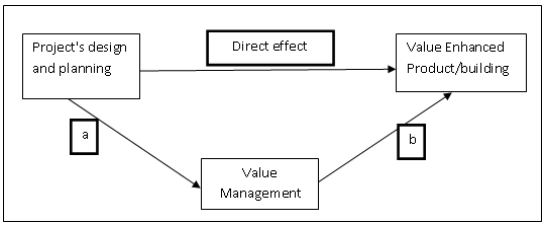

Fig.13 Total Effect between I.V. and D.V

C (Total effect) = Direct effect + Indirect effect

$= C^1 + a * b = 0.802 + (0.686) * (0.088) = 0.862$

From the above relationship it is concluded that there is a partial mediation among the Project design and planning (I.V.), Enhance product/building value (i.e. D.V.) and value management (i.e. M.V.). Sobel testing concludes that there is a significant mediation effect (p= 0.01290538) among mentioned variables.

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