

Overcoming the Impact of COVID-19 Using Integrated Project Delivery Model

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RICS

Research Article

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Abstract

Value engineering is a systematic approach, widely used to optimize the design or process or product in the designing stage. It used to achieve the client's obligation by increasing the functionality and attain the targeted cost in the cost planning. Value engineering effectiveness and benefits decrease along with the progress of the project since the change in the scope of the work and design will account for more cost all along the lifecycle of the project. Integrating the value engineering with other project management activities will promote cost minimization, client satisfaction, and ensure early completion of the project in time. Previous research studies suggested that value engineering can integrate with other project delivery activities, but research studies unable to frame a model that collaborates the project management activities with the job plan of value engineering approach. Analysing various project management activities and their synergy between each other have studied. The project management activities and processes like a) risk analysis b) lifecycle cost analysis c) lean construction d) facility management e) Building information modelling f) Contract administration, collaborated, and project delivery model planned along with the Royal Institute of British Architects (RIBA) plan of work. The key outcome of the research is a value-driven project delivery model, which will succeed in dealing with the economic impact, constraints and conflicts arise due to the COVID-19 outbreak in the Indian construction sector. Benefits associated with the structured framework is construction project delivery that ensures early contractor involvement, mutual risk sharing, and reviving the project with a cost overrun and delay back on track, discussed in the research

Introduction

Nearly 96 projects of road transport and highways, which original cost is more than 150 crore causes extend of cost overrun around 39.30 % in the year 2019-2020. (Ministry of statistics and programme Implementation , 2020) .The cost overrun and schedule variance is mainly due to ineffective cost planning, Improper implementation, less productivity while comparing to agriculture, manufacturing, and less collaboration between the shareholders. In addition to this, COVID -19 outbreak has further increase delay and disrupt the completion of the project. Cost reducing approach like value engineering optimizes the design aspects of the product, process, or services in the design stage, but its benefits decrease has the project progress. Scope of changing the design decrease in the execution and closeout stage. Cost reconciliation should be done along the entire lifecycle of the project. To increase the value of the project from appraisal to closing out stage, this paper highlights the Value integrated project delivery model framework, which framed along with the RIBA Plan of work to provide a systematic understanding of the project delivery model and emphasizing value in the critical path of work. Elaboration of the synergistic relationship between value engineering with other project management processes like lean construction, risk management, life cycle cost analysis, facility management, bidding process, and vendor management and how the integration of all, would assist to overcome the economic impact, change in strategies and conflicts raised due to COVID-19 in the Indian construction sector is the key outcome of the research.

II. AIM AND OBJECTIVE

The main objective of the research work is to frame a value integrated project delivery model to use in the Indian Construction Sector.

Objectives

1. To understand the systematic approach of value engineering
2. To study the relationship and integrate the value engineering with other project management tools like Lean construction, risk assessment, vendor management, and facility management
3. To identify and Assess the Impact of COVID-19 Outbreak in the Indian Construction Industry
4. To frame the value integrated methodologies along with other project management processes to overcome the challenges of value engineering itself and impact of COVID-19

III. LITERATURE REVIEW

Value, defined as the ratio of benefits from the course of action to cost incurred .value may be reduced , when cheaper alternative with less lifespan chosen (RICS, 2017). Lawrence D Miles, the pioneer of value engineering was working at General electric. During world war II, there was a shortage of strategic materials required for the war. Miles framed the functional analysis concept with the idea of value and management and held the notion that every product has its specific purpose. This methodology became much popular and then a learning society formed in 1959 called the society of American Value Engineers. The VE methodology got much attention after the department of defines implemented (US) it in 1961 by staffing the full-time value engineer and introduced the clauses in the construction contract. and the various study conducted by the Department of defence to find more opportunities for applying value engineering. SAVE started grew within the US and then in 1996, SAVE international formed. Since the conception of Value engineering has been used in the various project which has a complicated design, or which entail costly material. (SAVE , 2007). value engineering has an interdisciplinary examination of each factor that provides value enhancement and cost-effectiveness. Value Engineering can apply to the Conceptual, pre-design stage, and detailed design and procurement and construction stage. The cost would reduce by new technology, but the functionality has not improved. Value Methodology has a job plan .It says to analyses the product well to develop a greater number of alternatives. It has three stages: pre, value engineering, Post-study. the uniform has developed and cost distribution by Pareto law 20/80 applied. The value engineering analysis has been controlled by functions. (Nitin L.Rane, 2016)

"The risk assessment is done for the alternative or the innovative ideas introduced by the value engineering or value management process. This is done in addition to general risk management for the entire project .Since the link between value and risk is not establish ,only technical risk are taken into account

.Life cycle cost analysis use to assess the alternative technical design ,to choose the best option considering all the aspects of cost incurred along the entire cycle of the product ,process , or service .Lifecycle cycle costing can be used for choosing the best alternative design for value engineering in evaluation process .Optimal alternative can be attained by assessing the economic impact of innovative idea ,along the entire life cycle of the project .Building Information Modelling and Value Engineering concern with preventing the waste by preventing overprovision of information and functionality ,which increases the cost of the project .BIM also allow visual stimulation and lifecycle cost view from completion to operation and maintenance .BIM enables rapid evaluation of the alternative of value engineering innovative ideas .

The lean construction is a technique to remove the non-value added process from the construction activity to increase the value of the product, service , or process .The lean construction can be applied to optimize the smaller to larger process from design to management of the process ,which is beyond the scope of the value engineering .” (RICS, 2017).Lean integrated Value Engineering for the construction industry ,an approach called LiVE ,which explains the synergy of both the method. The Lean construction and value engineering emphasis more on the value than other value addition tools and technique .The concept of LiVE approach is “systematic approach to identify the client value ,identify the value flow with disruptions ,client pull functional requirement to reduce the cost and waste and adds value to the client’s money “the study has seven phases “value establishment phase” ,“value analysis of functional requirement phase” , “value creativity phase” , “value evaluation phase” , “value development phase” , “value verification phase” . (E.M.A.C. Ekanayake, 2017)

Construction industry started to move from cost-based approach to value based approach. Value engineering does not address the planning, tracking, managing the requirement .The value based approach to managing the construction project ,the client plays major role in initiating it .Value management is evolving it's from to include concepts from quality to other disciplines “To induce the value into management of construction projects ,a broader approach at the regional level is required ” (Forgues, 2005).The following are the nine stage for replacing the traditional Plant Design System by value based management framework .1)Developing the specification .The client requirement’s addressed and specification is updated according the requirement of client .2)Requirements are assessed to clarity, meaningful and measurable .3)Functional and non-functional requirement are selected 4)Feasibility study for the intend of client’s requirement is checked 5)requirement associate to scope is approved 6)Requirement are traceable to the design 6)Designs are implemented 7)Requirement are inspected through commissioning 8)Quality assurance team will assess the deliverable. (Forgues, 2005)

Methodology

METHODOLOGY APPROACH

The Inductive research approach is chosen to perform the research because not ample theories or research is developed in the value addition along the lifecycle of the construction project. The research is carried out through the following steps in Figure 1.

DATA COLLECTION

The mixed data collection method is selected, because through the Qualitative analysis, a deep understanding of the basics of value and the characteristics of each project management activities are studied. The reason for cost overrun and the impact study during the COVID-19 is carried out, to address the issues in the construction industry. The research areas which has not to be explored and the research gaps are founded. An initial framework is derived, which overcomes the challenges in the construction industry.

Quantitative data collection is carried out to produce the conceptual real-time knowledge, which supports the ideas generated. The industrialist inputs are collected through the questionnaire and quantitative data analysis is done to check the reliability of the primary data collected.

QUALITATIVE DATA COLLECTION

CONTENT ANALYSIS

To get a better insight into the basic characteristics of the project management activities and their synergetic relationship between value engineering and other project management activities, literature, and reports are collected. Various journals have tried to link the lean construction and value engineering process to attain value addition along the design stage and construction stage. The research has not proceeded further to establish the framework of value addition along the entire lifecycle. The research gaps are identified.

RESEARCH QUESTION

The research is emphasizing the value addition in the entire lifecycle of the project is not been explored much. The integration of value engineering with other project management areas and benefits attained is still under research. This research paper primarily answers the following questions

1. Why do we need to integrate the value engineering and other project management activities?
2. What are the benefits of doing that?
3. How COVID-19 impacts can be resolved by considering the Value-driven project delivery model?

QUANTITATIVE DATA COLLECTION

SURVEY

To support the idea of a value-driven project delivery model, the survey consists of 4 open questions and 6 questions that were measured to the scale of 5 points Likert scale. The aim is to get responses from 50, quantity surveyor, project manager, and facility manager, and the Questionnaire has been circulated among various mediums. Some of the questions are

1. How COVID-19 outbreak has impacted the project you are Working on?
2. Has any project revived measures framed?
3. Have you implemented any of the following in your project?
4. If not, what was the reason

Likert 5 scale Question

1. Adding more value and optimizing the process, product, and services are very crucial
2. integration of value engineering with other project management activities is beneficial
3. Executing a value enhancement of construction progress along the entire lifecycle is possible
4. Value-driven project delivery model will provide balance along with the scope, schedule, cost
5. value-driven facility management leads to innovation and adds value despite the budget constraint
6. Value integrated delivery model will revive the project back to track

DATA ANALYSIS

Table 1. Cumulative Percentage of respondents

	Strongly disagree	Disagree	Agree or disagree	Agree	Strongly Disagree
Question 1	6%	8%	8%	16%	62%
Question 2	2%	4%	2%	20%	72%
Question 3	8%	4%	8%	28%	52%
Question 4	4%	4%	6%	38%	48%
Question 5	2%	4%	8%	26%	60%
Question 6	4%	4%	14%	26%	52%

Source : Author

The Cumulative percentage of total count for each question is listed in the table .The mean of the Likert data lies between the agree to strongly agree

HYPOTHESIS TESTING

Non-parametric Test: Chi-square test was conducted through SPSS software. Since the Likert data are ordinal, a nonparametric test is done. SPSS is statistical analysis software used to analysis independent data of Likert scale. To

Table 2. Hypothesis test summary

	Null Hypothesis	Test	Sig. ^{a,b}	Decision
1	The categories of VAR00001 occur with equal probabilities.	Chi-Square Test	.896	Retain the null hypothesis.
2	The categories of VAR00002 occur with equal probabilities.	Chi-Square Test	.896	Retain the null hypothesis.
3	The categories of VAR00003 occur with equal probabilities.	Chi-Square Test	.896	Retain the null hypothesis.
4	The categories of VAR00004 occur with equal probabilities.	Chi-Square Test	.896	Retain the null hypothesis.
5	The categories of VAR00005 occur with equal probabilities.	Chi-Square Test	1.000	Retain the null hypothesis.
6	The categories of VAR00006 occur with equal probabilities.	Chi-Square Test	.896	Retain the null hypothesis.
a. The significance level is .050.				
b. Asymptotic significance is displayed.				

Source: Author

Table 3. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.987	.992	6

source: Author

Table 4. Reliability statistics if item got deleted

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Question 1	49.8000	3200.700	.958	.984
Question 2	49.8000	2839.200	.979	.987
Question 3	50.0000	3416.000	.989	.983
Question 4	49.8000	3383.200	.916	.988
Question 5	49.8000	3127.200	.999	.980
Question 6	49.8000	3383.200	.984	.983

source: Author

The Likert data are analysed for Reliability analysis using SPSS .The Cronbach alpha value shows the reliability value of the data collected .The reliability test is done for each question .The α value is more than 0.9 in all the cases .So the data collected has excellent internal consistency and very much reliable .

The Interpretation is the Industrial professional agrees with integration of value engineering with various project management activities will result in reviving the bloated construction project into track and basically agree with the core idea of the value integrated project delivery model. Since the null hypothesis is selected and data are consistent for all the individual conditions, research proceeded to develop the framework model, value integrated project delivery model.

V. IMPACT STUDY OF COVID-19

1. FACILITY MANAGEMENT

There is immense growth in the facility management sector and space allocation of office rooms needs to be reconsidered. Satellite offices to overtake the co-working model. Building health will increasingly gain importance in the long term.

Knight Frank reported Facility management market size is around USD 14.98 million. The total area of the requirement under organized FM is 3000 million sq. Ft. Portfolio shares concerning office around 65 percent, 10 percent retail, and residential around 25 percent. The cost of the FM would raise approximately 6-9 percent on account of wellness, customer care, automation, skilled manpower, hygiene.

JLL India, which manages 420 million square ft area, said that maintenance cost would raise.

2. IMPACT IN REAL ESTATE

The Net absorption and Gross leasing activities have seen declination by 2/3, which is a 40 % decrease compared to Q1 2019, and sales of residential units have dropped to 30-40 in the top 7 cities.

The demand of up to 15 % more space in houses for making it feasible for work from home. The gated community will be preferred, even in tier 3 and Tier 4 cities. Housing loan rate of interest came down to 7.40 %, which will boost the buying capacity, and depicting Rupee against dollar allows NRIs to invest in the residential sector.

3. SUPPLY CHAIN MANAGEMENT

The availability of material and machinery and way of procuring it from different countries will be difficult and due to the shortage of cement and sand, the price has been increased. There is De-globalization of supply chain management. The project dependents on special equipment, fixtures, robotics, and exporting construction material to a foreign country are more likely to get disruptions by supply chain management.

4. LABOR PRODUCTIVITY

Migrant workers comprise at least 80% of the total workforce population in the construction sector. 30% of the available workforce is still away from the site due to the fear of the Coronavirus. It will take around 3 -4 months for migrant workers to come back to sites and their productivity will be affected not in excess by 30% (RLB , 2020). Reverse migration creates a labor shortage and increases labor costs. Four state governments have passed an order to increase the labor working hours from 8 hours working day to 12-hour working day, but it will shift the burden towards the labors.

5. CONTRACTUAL OBLIGATION

The traditional project delivery model does not share the risk mutually along with the client and subcontractor. So integrated project delivery model with mutual risk-sharing should be followed. Clients / Employers should take care about instructing the closure of sites or for other actions to be taken by contractors to combat COVID-19. This could leave the contractor in a better position under the contract terms than where the contractor elects to close the site or to take relevant action. Force majeure closure in the contract if not well defined it may end in conflicts.

6. ECONOMIC IMPACT

1. The labour costs for the skilled worker are expected to rise by 20 to 25 % and for the semiskilled and unskilled worker are expected to rise by 10 %
2. The additional Interest cost for capital working loan during the delay in the construction period
3. Cost of the project will be increased by providing the personal safety equipment, labour health insurance and making the construction site resilient to the infection spreading and Revised health and safety procedures
4. Nonlinear project cost may raise by 2 to 5 percentage of the total cost
5. The recovery of liquidated damages would be not possible for certain sectors like solar projects, where the force majeure clause is not included in the power purchase agreement.

7. VIRTUAL WORKFORCE

Problems like sharing information, lack of clarity, no proper guidance, tracking the performance will affect the productivity and reliable workflow. The transparency of the construction sector is still a question mark even before the COVID-19 outbreak.

8. DIGITALIZATION

1. Instead of replacing the labor by robots, most of the construction robots are there to aid and enhance the worker's performance. The predictable activities like bricklaying, rebar bending, and welding, robots can be used. Artificial intelligence can be used to monitor site progress in real-time. Virtual reality can help users to visualize spaces from any location.
2. Use of Modular construction, prefabricated construction, Internet of things, wearable and site sensors, Future proof, 3-D printing has made construction sites safer, increased productivity, improved collaboration, and to mitigate risk like COVID-19 in the future

9. SCOPE

Change in the strategy, Schedule of the project will be changed comply to the government guidelines, and costing needs to be done again. Plan for revival for the project should be made based on the outbreak impact in the project region.

Resolve immediate challenges. Re-entry creates a detailed plan to enter business quickly. Reform according to the roles and regulation of government. Respond to the nearest cash management and other issues. Reimagine, the new way of working with new technology. (KPMG, May 2020)

10. BIDDING PROCESS

Contractor participation in the bidding process will be less. The modification of the tender should not alter the overall nature of the contract.

11. ECONOMIC RECESSION

1. The construction sector is already facing financial stress, RERA regulation, tight working capital but along with this COVID-19 outbreak impacts like a disruption in work, and movement of labor, recovery would be very challenging
2. Goldman Sachs put out the GDP growth forecast for India at 1.6%, down from 3.3%
3. Liquidity risk may cause the client and contractor to stop the work due to the overall fragile economic scenario
4. It is too not early to estimate the full financial impact of the coronavirus crisis. Moreover, the upcoming monsoon will additionally severely obstruct work from June 2020, it will take 7-8 months to completely resume the work

IV. SYNERGY BETWEEN VALUE ENGINEERING AND OTHER PROJECT MANAGEMENT ACTIVITIES

Table 5. Synergy between value engineering and lean construction

	Value Engineering	Lean construction
Cost Reduction	Adding value	Adding value through reducing the waste, delay and increasing the reliability, cost reduction is achieved
Process	Understanding the client requirement and suggesting the alternative to satisfy the functionality requirement	It involves the Last planner to decide their work and responsibility which needs to be completed rather than push them to do
Approach	Analytic approach	Strategic approach
Waste Elimination	It thrives for Immediate waste reduction	It is a continuous process
Stages	It has a systematic process -6 steps	Plenty of Tools are there for lean construction
Effectiveness	It produces result during the pre-construction stage	It can be effective in all the stages
Team	VE team is responsible for suggesting the alternatives	Involves the last planner is planning process
Risk	Major Performance criteria are decided by most cost consuming items and based on risks	Constraints log are maintained to find the stakeholder who is responsible
Techniques	Pareto 80/20, FAST diagram, LCCA, Quality Deployment chart are used	PPC, Variance Chart, LPS, Value stream mapping are used
Assessment	The post-mortem report is used to analyse the effectiveness of value Engineering	Lean rapid rating model is used to find the effectiveness of the project
Effectiveness	It produces Greater result mostly in the Designing Stage	It can be applied to all the stages from procurement and tendering like lean project delivery method to an effective way of doing payment bills
Safety	Safety and environmental impacts are assessed for the alternatives	Safety and health hazards are managed and monitored
Client Inclusion	Client satisfaction is incredibly low	Client satisfaction can be improved by 5S

Source : Author

BUILDING INFORMATION MODELLING

BIM enables us to visualize the component with its lifecycle cost so it will be easy to find the cost consuming building component and to find alternatives for that. All the information regarding the building components is clearly shown by BIM levels, which enables us to choose an appropriate alternative in terms of cost, timeframe for completion, sustainability, risk, and performance.

Embracing the potential and uses of BIM would save time so the LeVC could understand and analyze the building and client requirements more than spending the time in estimating the lifecycle cost and gathering the information together.

LIFECYCLE COST ANALYSIS

Value engineering and lifecycle cost analysis should be done simultaneously to a product. Both of them are different concepts of cost management. Life cycle analysis would help to identify the operating and maintenance cost, terminal value, and occupancy cost incurred along the life span of the product and inflation rate at the element level, component level for options appraisal are considered. The life cycle cost analysis is done along the evaluation phase of the value engineering to help to find the best alternative, which serves the same performance requirement. In the evaluation phase, the best alternative can be chosen if the alternative design is chosen based on the lifecycle cost rather than the unit cost of the product, which enhances the net saving. The initial cost of the product may be low but the maintenance and operation cost will be high. Knowing the physical cost of the product is very essential.

The lifecycle cost can be calculated in two ways. One using the historical cost data of similar projects. The second one is the usage of sensitivity analysis which elements are more sensitive to change. Cost Sensitivity shows the degree or extent of change of the Life Cycle Cost of a project with a change in the parameters such as cost, quality, scope, and schedule. Cost Sensitivity Analysis is the trial analysis to address the variability of parameters along the life cycle. The Life cycle cost estimate at different stages of construction is calculated, which can be used for cost benchmarking.

FACILITY MANAGEMENT

Considering the current pandemic situation, Space management and Health and safety service of Facility management gained so much importance. Every commercial building needed to be respaced for their office space and separate rooms is needed to be provided for employers. The Blue-collar worker's needs are onward surge for regular maintenance of the building and workload among them should be reduced. But the Facility management services have also restricted with the limited budget, innovation, and technology are exceptionally low due to the budget constraint. The value-driven faculty management would provide the intended of cost-saving and functionality for the facility management services. Both value engineering and facility management focus on improving the functionality of the building. Key benefits of value driven facility management are

1. Encouraging innovative ideas in facility management by value approach

2. Choosing technologies like the Internet of things which reduce the workload on the blue-collar employee
3. Understanding the client requirement and accomplish it, will be easier by value-driven faculty management
4. Value and function of each service are known, so the quality and budget of a different company can be analyzed, and the best one can be chosen
5. KPI are decided to monitor the work progress, value, and effect

Result

Table 6.VALUE DRIVEN PROJECT DELIVERY MODEL

RIBA Plan Of work	Strategic design	Preparation and Brief	Concept Design	Developed Design	Technical Design	Construction	Handover and closeout	In use
Project Management Activities								
Value Engineering	Client Led VE workshop -Pre-study	Client- Expertise led Workshop – Information study	Design Expertise led workshop - Function analysis	Value Engineering– Creative and evaluation stage	VE study – Development phase, Presentation stage	Implementation Stage -KPI, earned value management, Cost-Value Reconciliation to monitor the progress	Audit stage	Reporting the VE Database
L Lean Construction				1. Analysis of the alternative idea's process, value-added and non- value-added duration using historical data 2. Master Planning- Involving Designer and Architects	Phase Planning - Designer and contractor	1. Look ahead, weekly ahead planning - Subcontractor, Last planner. 2. Implementing a Lean tool and technique according to the project to minimize the waste, lean supply chain management.		
Value-driven Facility Management	Identification of client Requirement	The risk associated with client requirement	Client- Expertise led Workshop – Information study	Life cycle costing for maintenance and operation using BIM	Deciding the Sourcing of service	Value Engineering– Creative and evaluation stage	VE study – Development phase, Presentation stage	Implementation and audit stage
BIM	Deciding the levels of BIM required for the project		BIM simulation preparation.	BIM team coordinating meeting with the design team to prepare value engineering data model and master planning _	BIM meet coordinating meeting with the client to visualize the Phase planning stimulation, value engineering stimulation for alternative	Fabrication plan for offsite production		Manage the ROI, retrofit planning and life cycle management
Risk Assessment	Project Risk associated with conservation, health, and safety, inclusive design, planning, future use is addressed by pre risk mitigation process		Interim risk assessment and risk allocation	Interim risk assessment for the alternative ideas of value engineering	Risk treatment planning - Review risk data from a similar project like probability, impact, conditionality	Risk Monitoring	Post mitigated risk assessment	
Life cycle cost analysis			Lifecycle cost analysis -BIM simulation	Whole Lifecycle cost analysis for the alternative ideas of design using BIM	Life cycle cost benchmarking for elements of the building			

Value-Integrated project delivery, Early contractor involvement, Engineering procurement construction (EPC), CM (Varies according to procurement type)	Order of cost estimate and procurement strategies are decided	Formal cost plan is prepared and Value integrated Tender are invited	<ol style="list-style-type: none"> 1. Value integrated Bids are received, and award of contract 2. Prepare project roles for relevant parties (these roles should be as detailed as possible – from planning to handover) 3. A respective team is formed. 4. Establish risk assessments and discuss how integrated delivery can reduce drastically such risks 	Conduct meetings to discuss parties' input and assess impacts to associated input of other parties	<ol style="list-style-type: none"> 1. Extra time should be provided for various iterations to design. This is the only stage where revisions are entertained so issues should be completely sorted (by ALL parties) 2. Change control procedures can be established and implemented at this stage though it is not overly recommended (except specified by the client) 	Building contract administration	Conclude the contract and share the risk and rewards	
Information Exchange	Provide EIRs, relevant information and strategic brief to relevant parties to assess	diligence report and a revised initial project brief	the final project brief, BIM, collaborative information sharing software	Planning application, Updated cost plan	Project specification, Updated cost plan	Manufacturing And construction information, Final procurement	Evaluation and feedback for project performance	Updated Building Information

Table Template Source : RIBA Plan of work (RIBA, 2020)

Table Data Source : Author

Discussion

EARLY CONTRACTOR INVOLVEMENT

The project delivery model like Integrated project delivery, Design and build, construction management enables the early contractor involvement. The contractors are introduced into the planning stage and their inputs are added from pre-design to handout stage. The client, who has no prior knowledge related to the construction sector can go for this type of nontraditional procurement route. The contractor is involved in cost planning, design, scheduling, and deciding the construction methodology.

In the last planner system, contractors and subcontractors will team up and collaborate with the Design team and BIM planning team, to set milestones, look ahead schedule, and weekly schedule to be completed by the last planners.

The contractor is involved in the value engineering process, so the adverse impact of value engineering alternatives on other construction activity can be identified and more value engineering creative ideas can be generated and the degree of execution in the site can be known early.

The facility manager has enough time to generate innovative ideas and to decide the use of technology to increase the performance of the building since the facility manager is involved from the early design stage.

The roles and responsibilities of the client, contractor, and, subcontractor should be defined with clarity, so conflicts and dissatisfaction can be avoided.

RISK AND REWARD SHARING

The contracts like Target sum contract, guarantee maximum price, and integrated project where the loss/gain attained after the project will be mutually shared by the client and the contractor. The pain and loss percentage should be decided according to the contribution of the individual parties. It encourages the team to collaborate, particularly during a project's challenging or difficult stretches. Better decisions are made since a wider range of expertise is involved.

The target costing and kaizen costing along the entire lifecycle of the project can be achieved by the value integrated project delivery method. Then the profit attained can be shared as per the contractual obligations. The contractor is more responsible and the performance of them is increased.

Any risk like COVID-19 outbreak can be effectively mitigated in the future, since the risks are shared mutually, and costs associated with the risk can be shared mutually by all the key stakeholders.

PROJECT COST

The direct cost associated with the project will decrease by lean thinking in the execution of the design with lean construction tools and techniques. The waste minimization in the job site, using technology, innovations, target, and kaizen costing, less design error and information sharing using BIM, increased productivity, value-driven facility management will increase the property value and reduce the cost along the life cycle of the project.

The benefits of value integrated bidding process are the internal value engineering evaluation team evaluates the bids rather than appointing the external value engineering team. For complex projects, the idea generation will be much easier and faster for the value engineering team.

The lifecycle cost benchmarking using BIM, target costing and kaizen costing, Key performance index will indicate the economic progress of the project at different stages of the project and tracked through the entire project. The waste generation in construction is about 57%, which contributes to cost overrun. The optimism usage of resources like labor, material, plant and machinery, information, transportation using lean tools can decrease the direct cost.

Conflict may occur while setting the target cost. The owner's interest often wants a lower price, where else the contractor seeks for higher target price to have a financial incentive. This conflict may be resolved by choosing the appropriate team member and open book estimating.

SCHEDULE

The potential benefits of this project delivery method are construction time reduction due to its extensive planning, and it links the detailed construction planning with the schedule, a phase during design.

The schedule is planned by the team involving the appropriate last planners at each stage. In look ahead plan, where the last planner identifies the constraints in the upcoming task to be performed, at least three weeks before. It helps the contractor to prepare for the task. Constraints are associated with the work to be done are identified and resolved within a specified period.

Value Stream mapping represents the flow of material and information along the process required to deliver the product, service. It is also known as "material and information flow mapping". It takes a lot of effects to do the value stream map for the process. A map should be drawn to actual work that takes place on the site rather than how we think it to be work. The happening in the site and the flow should be captured well. End to end process mapping will help to identify the waste and issues in the site. Cycle time for each step is to note down and the value-added duration and non-value-added duration are mentioned in the value stream map. Delay, transportation, hand to other subcontractors, waiting time are non-value-added time in this context. The reason for non-value-added time is analyzed and the waste minimization process is applied. Pre-mapping would be helpful for the data collection process before the site visit.

CLIENT SATISFACTION

Value engineering's main principle is to achieve the client's performance requirement and adding more functionality to the project. The value engineering process is started in the earlier stage of the project, so the client has enough time to decide the project scope and requirement, so the contractor can perceive the requirement. A value engineering study should not affect the duration scheduled for the project. The target, kaizen costing also increases the profitability and the functionality of the project.

The tools like 5s which ensure a well-organized job site and perfection is achieved in the quality of the project by continuous improvement process. Both the value addition techniques will satisfy the client requirement through effective design and well optimized execution process along the entire lifecycle of the project, which will increase client satisfaction.

BUILDING INFORMATION MODELING AND OTHER SOFTWARE USAGES

BIM, a digital, three-dimensional model linked to the database of project information is one of the powerful tools supporting this project delivery model. BIM combines the design, scheduling, costing, fabrication information of interconnected models in a complex project, space planning, energy performance of the building, or component. It enhances the collaboration of the project from design to maintenance.

The visualization of the building model gives the client and contractor a clear understanding of how the project is developed, used, accessed, and how information is shared between participants. In the value engineering process, BIM integrated value engineering model shows all the information combinedly, so decision making is much easier for the client

CONSIDERATIONS TO REVIVING THE INDIAN CONSTRUCTION SECTOR

- Construction Technology – off-site construction and modular construction production are much encouraged to enable controlled workspace for labour. Lean six -sigma, which can increase the production of construction component and Production time, the Production cost can be reduced effectively by reducing the waste and variance in production
- Productivity – The productivity of labor will decrease due to working with personal protective equipment and lengthening the working hour for 12 hours. The last planner system enables the labor to decide the target to be completed by themselves and the visualization of project progress using tools like PPC, a variance will increase their productivity. Daily huddle meetings will align the performance of the last planner daily rather than weekly. During this lockdown period, the labor can be trained about Lean tools, technique, and health, safety norms in the workplace to be followed through virtually
- Material, Plant & Machinery – Cement and sand price got escalated by 5 % due to supply chain disruption and less availability. The efficacious material and construction methodology are chosen by value engineering and usage is optimized by lean construction tools and technology. Lean logistics can produce better space utilization and increase warehouse efficiency.
- Engineering – Target value design can be used. The target cost is set up and value engineering, lean construction is used to achieve the target in the design and construction.
- Contracts – Lots of dispute and conflicts has raised between client and contractor regarding the loss-sharing incurred due to COVID-19 and claims have been raised .risk and reward sharing type procurement route should be mandated. Value-driven project delivery model, procurement routes like target sum, guarantee maximum price ensure risk, and rewards are shared among the key stakeholder and focus on project successful delivery
- Operation and maintenance – Need for facility management services has increased, to maintenance, and to create a safer workplace for workers. The workload on the blue-collar will be very high. Value-driven facility management will encourage innovation and economic justification is attained.
- Digitalization-Use of BIM, IoT, collaboration software, and robots can aid the labor and staff and enhance the quality of the work.
- Project scope and scheduling, costing – The project scope and strategies, de-scoping is reviewed. The schedule and cost plan is modified according to the modified engineering, procurement, delay, inflation, weather impacts .collaborative planning will help to understand difficulties faced by both client and contractor, and plan according to which benefits both the parties.
- The bidding process-Indian government should mandate the value engineering process for the construction process. To encourage the value engineering process, Value integrated bidding process for public projects can be introduced. Since most of the infrastructure projects are to be privatized, the value integrated bidding process will be a great initiative in the Indian construction sector.

Conclusion

In India, Industries like manufacturing and Information service started using the value-added approach or client-based approach, the construction sector is still repeating the traditional practices. Client satisfaction and service quality are extremely low in the Indian construction and real estate sector. Major bottleneck hampers cause client dissatisfaction is quality of planning and cost is low, the pre-tendering approval process is low, weak engineering, design, performance, and risk management skills, low prevalence of lean construction, less availability of the skilled contractor and worker, which leads to cost overrun and delay. (McKinsey & company, 2009): The definition of value “to realize all and only what is required by the client stakeholders to fulfill their needs”. (PMI , 2015)

This research focusing on moving the Indian construction sector from a cost-based approach to a value-based approach. The research has addressed the importance of adding worth to the project along the lifecycle of the project. Various processes and tools can enhance the value of the project. To establish a relationship between them, value engineering, which has a systematic approach, and various countries started to mandate its implementation. To characteristics the synergetic relationship of value engineering with other project management activities, the value integrated project delivery model framed. The systematic process of using the management tools and techniques to add and track the value is elaborated through the RIBA plan of work.

In this recession period, constructional professionals should plan for reviving the construction sector by innovation and technology. The value-driven project model enables the project stakeholder to bounce back with revisited strategies by increase the value of the project. Only around 1-2 percentage of construction projects in India have implemented the value engineering process. The government of India should mandate the value engineering process and private companies should be aware of the benefits attained by a value-based approach and to make understand the purpose of the study to the client. The client should increase their roles in the project management activity, so they can manage, track their requirement.

Declarations

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X. CONFLICT OF INTEREST

The author states that there is no conflict of interest

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Figures

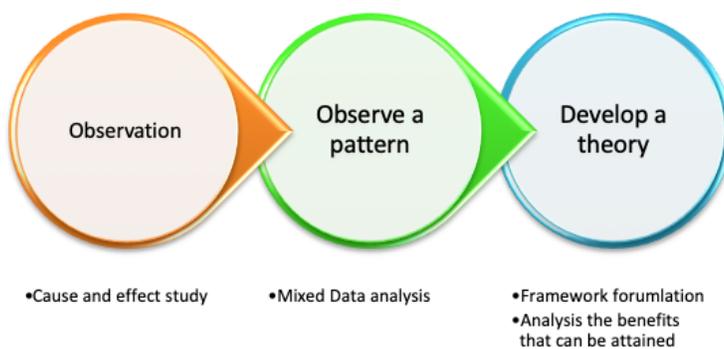


Figure 1

Research Methodology



Figure 2

process of data analysis

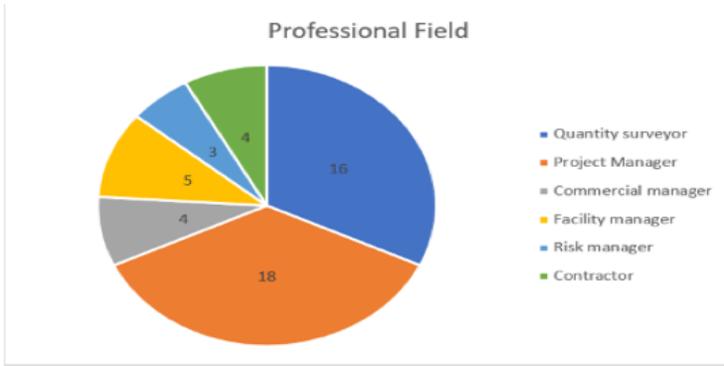


Figure 3

Professional classification of respondents