Educational Administration: Theory and Practice
2024, 30(6), 5392-5409
ISSN: 2148-2403
https://kuey.net/

Research Article

Design and Implementation of a Construction Value Optimisation Framework in Tata Steel Limited

Surya Prakash Prabhaker[1*], Dr. Sandeep Kumar[2]

[1*,2]Tata Steel Limited Associate Professor Sarla Birla University

Citation: Surya Prakash Prabhaker, et.al (2024). Design and Implementation of a Construction Value Optimisation Framework in Tata Steel Limited, *Educational Administration: Theory and Practice*, 30(6) 5392-5409
Doi: 10.53555/kuey.v30i6.10880

ARTICLE INFO

ABSTRACT

This study looks into whether or not a Structured Value Optimisation Framework exists at Tata Steel Limited and whether or not it works to improve value delivery on construction projects. We used a quantitative method to gather data from 150 people in order to assess important factors including stakeholder value, minimising resources, innovating processes, and creating long-term value. The findings of one-sample t-tests show that all variables are statistically significant ($p < 0.001$), which confirms that there is a strong framework that helps projects reach their best possible outcomes. Also, paired sample tests were used to look at how governance procedures and stakeholder mechanisms fit together and depend on each other. Structured governance and alignment were strongly related, however there was a big gap between responsibility chains and stakeholder participation. These results show what Tata Steel's framework does well and where it could be improved in terms of governance. The report gives infrastructure companies useful information on how to set up value-based project delivery processes.

Keywords: Value Optimization Framework, Governance Structure, Stakeholder Engagement, Construction Projects, Tata Steel Limited.

1. INTRODUCTION

As the industrial landscape changes quickly, businesses are putting more and more emphasis on organised frameworks and governance processes to make sure that projects are delivered on time and with the most value possible (Kunene, 2024). For long-term success, it is especially important to use a value-driven strategy in the building and infrastructure industries, where projects are complicated and require a lot of resources. Tata Steel Limited, one of India's biggest industrial companies, has taken a number of strategic steps to improve the value delivery of its construction projects through organised frameworks and process innovation (Choudhury et al., 2023).

The idea behind optimised value delivery in construction is to make sure that projects are finished on time, under budget, and to the highest standards while giving stakeholders the most value possible. An integrated framework with five main parts makes this possible: Value Engineering, Lean Construction, Digital Transformation, Sustainable and Green Construction, and Risk Management & Quality Assurance (Ismaeil, 2024). Value Engineering is all about improving functionality at the lowest possible cost by cutting down on waste and encouraging the use of different materials and methods without sacrificing quality. Lean construction uses ideas from lean manufacturing to cut down on operations that don't add value. It does this by adopting tactics like Just-in-Time delivery and demand scheduling to make the workflow more efficient and cut down on delays.

Digital transformation in construction, using tools like Building Information Modelling (BIM), the Internet of Things (IoT), Artificial Intelligence (AI), and automation, makes planning, coordination, real-time monitoring, and making decisions based on what will happen in the future better. These technologies make things safer, reduce mistakes made by people, and make it easier for people to work together (Ibrahim, 2024). At the same time, green and sustainable building encourages the use of materials that consume less energy, renewable energy sources, and Life Cycle Assessment (LCA) to lower costs and environmental effect over time. Quality assurance and risk management make ensuring that risks are found and dealt with early on while still following engineering and safety rules. When used together, these parts make up a whole system for maximising value.

Governance is very important for getting the most value out of building projects. An organised governance system makes sure that everyone is working towards the same goals, is responsible for their actions, and is using resources wisely (Cui et al., 2024). It makes roles and duties clear, helps people make better decisions, and lowers risks by quickly finding and fixing problems. Governance frameworks also help make sure that all resources are used wisely, so there is no waste and all resources help create value (Bainomugisha et al., 2024). Also, using KPIs and real-time analytics to keep an eye on a project lets it get better all the time, and organised coordination makes it easier for teams, contractors, and authorities to talk to each other (da Silva & Cardoso, 2024).

Tata Steel Limited has strong governance principles built into its culture. The Tata Code of Conduct, active board committees, and enterprise risk management (ERM) systems all stress the importance of honesty, ethics, and long-term success for the organisation (Chen et al., 2023). Tata Steel shows its dedication to digital innovation and protecting the environment by using circular economy methods and following the greatest global governance standards (Brinkman, 2024).

This study looks into whether Tata Steel Limited has a Structured Value Optimisation Framework and a governance approach that works effectively with it. It wants to find out how these mechanisms help with stakeholder satisfaction, resource efficiency, process innovation, and long-term value creation. The study also looks at how governance structure alignment, stakeholder engagement, and responsibility chains are all connected in project execution frameworks.

1.1. Objectives of the study

- To examine the existence and effectiveness of a structured Value Optimization Framework in delivering optimized value in construction projects at Tata Steel Limited.
- To assess the role of a structured governance process in driving and sustaining value across all phases of construction projects at Tata Steel Limited.

1.2. Hypothesis of the study

H1: There exists a structured Value Optimization Framework at Tata Steel Limited that significantly contributes to the optimized delivery of value in construction projects.

H2: Tata Steel Limited follows a structured governance process that effectively drives and sustains value throughout the entire lifecycle of its construction projects.

2. LITERATURE REVIEW

The research on value management, governance frameworks, stakeholder engagement, resource optimisation, process innovation, and long-term value generation is critically examined in this chapter. It focusses on how these components affect project performance and organisational competitiveness in major industrial organisations. The assessment also highlights global and Indian models, frameworks, and best practices.

Nejhadheydari et al. (2024) looked at the idea of value engineering and its history. Part of the process includes figuring out the history, idea, and action plan of value engineering and evaluating them. This includes looking at and researching major research and studies that have been done in this field. This study uses both library research and content analysis. The results of this study led to a summary and conclusions about value engineering and why it is important for industry and big projects. This study shows that value engineering is a useful and powerful way to look at all major industrial and civil projects with the goals of saving money, improving quality, making customers happier, and enhancing investment value.

Bhattacharjee and Singhania (2023) looked at the research and development journey of Tata Steel and broke it down into its amazing and gritty aspects. Tata Steel has been the best example of technological progress in the country since the beginning of time. In a country where there hasn't been much money for investments in industrial research, Tata Steel has been a notable exception. There were basically three steps in the chain of events that led to Tata Steel starting its R&D section. Tata Steel was very involved in making rail steel grades, steels for armour purposes and steels for building bridges from the time it was founded till the end of World War II. From then until the late 1990s, the Jamshedpur Research & Development unit was a trustworthy partner for the corporation, helping it make more products at different stages of production and coming out with new products specifically for the Indian market. Tata Steel Research & Development was developed to help the company reach its strategic goals around the turn of the millennium. These goals included creating value for stakeholders and staying ahead of the competition in the market. This was done because things were changing quickly inside and outside the company.

Barman et al. (2024) talked on how important it was to find the main enablers, how they affected important process parameters, and the valuable lessons that were learnt along the way of change. The study looks closely at how different factors in the process affect the productivity of the furnace. The most important things are the top gas pressure, the burden distribution, the best slag regime, the raceway adiabatic flame temperature, the PCI injection rate, and the casting processes. It also looks at the experiment that was done to add colemanite powder to the furnace in order to make it more permeable. Using a controlled method of colemanite injection, we were able to raise the amount of wind while keeping the same differential pressure throughout the furnace. An injectable channel that was devised inside the corporation made this method even

better. This publication also goes into great detail about the results and observations that were made when colemanite and PCI were injected at the same time.

Prabhaker and Kumar (2024) looked at a complete framework for getting the most value out of building projects, focussing on the work of Tata Steel Limited in particular. The construction sector still has to deal with the same problems over and over again, even if it is able to deliver projects on time, under budget, and with high quality while also maximising shareholder value. This study's goal was to fill that gap by creating a unified framework that combines lean principles, risk management, and value engineering. The study used a mixed-method methodology, which means it looked at a lot of different sources of information and did a detailed case study of Tata Steel Limited's construction projects. The suggested framework is built via an iterative process. This strategy uses ideas from both theoretical studies and real-world examples of how Tata Steel has used them in its own operations. The most important results show that using lean construction concepts, together with improved risk assessment tools and value engineering methodologies, greatly improves the results of the project. The structure works especially well when it comes to cutting down on waste, making the best use of resources, and making stakeholders happier. Using this framework on projects shows that the projects take an average of 15% less time, cost 12% less, and the quality parameter that is measured goes up by 20%. This study added to what we already know about construction management by showing a systematic way to optimise value that was founded on theory and tested in practice. The framework gives important information that can be used on other large-scale industrial construction projects because it was used at Tata Steel Limited. These ideas could change the way businesses work in order to give customers more value.

Aithal (2024) looked into how important ethical business practices are for developing business excellence. The goal of this research is to show how ethical principles may help an organisation be successful, gain the trust of its stakeholders, and stay in business by looking at Tata Group's commitment to ethical ideals. The study sheds light on the changing relationship between competitive advantage and ethical business models. It provides useful information for people who work in the sector, regulators, schools, and businesses that want to be ethical leaders. The research used an exploratory method. Keyword-based search engines like Google, Google Scholar, and AI-powered GPTs help us find the basic information we need. The data is then looked at with research-based analysis techniques in order to try to accurately understand the results. We utilise the SWOC analysis tool to look at how the Tata Group of Companies does business in an ethical way. An external analysis of the Tata Group, a worldwide corporation with holdings in steel, cars, IT, and consumer goods, will look at its ABCD listing. The research gives a full picture of the company's goods and services. The Tata Group can figure out its strengths and weaknesses, as well as how to improve its market position and customer happiness, by carefully and systematically looking at these four areas.

Kassen (2025) used the knowledge of experienced programmers who built a variety of blockchain-based data management solutions for the e-government sector, as well as studies of specific e-participation cases in several public areas where the promise has already been kept, to add to the ways in which this technology could push political aspects of reforms to the public sector. This paper's goal was to do just that: list, assess, and compare the possible pros and cons of using blockchain for public policy. Several independent developers from around the world tear up the blockchain as/custom: 1. They want to promote blockchain as a possible platform that might revolutionise digital governance, speed up democratic processes, and help the government reach certain public goals. To make this argument clearer, we could make it easier for regular people to get involved in online politics, encourage more political discussion and cooperation among citizens, give public views more weight, or even use collaborative decision-making in e-government.

3. RESEARCH METHODOLOGY

The methodology describes the research approach, sample procedures, data collection technologies, and statistical tools for data analysis. The methods ensure trustworthy and valid outcomes. Value optimisation, stakeholder involvement, governance structure alignment, and long-term value production are examined in an organised manner. The study methodology examines how organised frameworks effect project success and value delivery at Tata Steel Limited using the correct statistical methods.

3.1. Research Design

The study uses a quantitative research design to find out if a Structured Value Optimisation Framework and governance mechanisms exist at Tata Steel Limited and how well they perform. This method is good for checking hypotheses statistically and assessing perceptions in a specific group.

3.2. Population and Sampling

The people we want to study are Tata Steel Limited personnel who work on construction projects. Using purposive sampling, a sample size of 150 respondents is chosen. This makes sure that the people who take part have relevant experience and knowledge of the organization's project management and governance procedures.

3.3. Tools used for Data collection

Based on the ideas of value optimisation and governance, a structured questionnaire is constructed. The questionnaire has statements that are scored on a five-point Likert scale, with 1 being "Strongly Disagree" and 5 being "Strongly Agree." It can be done online or on paper, depending on the availability and ease of the respondent.

The questionnaire asks on the following important areas:

- **Value Optimisation Framework** (which includes creating long-term value, minimising resources, innovating processes, and maximising customer and stakeholder value)
- **Governance Mechanisms** (includes a systematic governance process, aligning the governance structure, setting up a chain of responsibility and authority, and getting stakeholders involved)

3.4. Tools and methods for statistical analysis

The study uses SPSS software to look at the data we collected:

- **One-sample t-tests** are used to find out if the mean values for value optimisation variables are significantly higher than the neutral test value (3.0).
- **Paired samples t-tests** are used to look for differences between two sets of governance variables
- To see how strong the connection is between different parts of the governance process, **correlation analysis** is done.

All statistical tests employ a 5% level of significance ($p < 0.05$) to figure out if something is significant.

3.5. Ethical Consideration

Before filling out the questionnaire, all participants give their informed consent. The study keeps data private and anonymous, and people can only take part if they want to.

4. DATA ANALYSIS AND INTREPRETATION

This section details the data collected to determine if Tata Steel Limited had the Value Optimisation Framework and organised governance mechanisms. Testing hypotheses and learning from responses is the major purpose. The Descriptive statistics, one-sample t-tests, paired sample t-tests, and correlation analysis are used to analyse quantitative data from 150 construction workers' structured questionnaires. These statistical tools determine how much individuals agree on customer and stakeholder value, resource minimisation, process innovation, governance structure, and stakeholder involvement.

Table 1: Descriptive Statistics of Key Study Variables (N = 150)

Variable	Mean	Standard Deviation	Standard Error Mean	Minimum	Maximum
Value Optimization Framework	3.65	0.55	0.045	2.20	4.80
Customer and Stakeholder Value	3.80	0.60	0.049	2.00	5.00
Resource Minimization	3.50	0.58	0.047	2.10	4.70
Innovation of Process	3.90	0.52	0.043	2.50	4.90
Long-term Value Creation	3.75	0.57	0.046	2.30	4.85
Structured Governance Process	3.85	0.50	0.041	2.60	4.80
Governance Structure Alignment	3.90	0.52	0.042	2.40	5.00
Chain of Responsibility and Authority	3.70	0.55	0.045	2.10	4.90
Stakeholder Engagement	3.95	0.48	0.039	2.80	5.00

Figure 1: Graphical Presentation of Descriptive Statistics

The descriptive statistics show that Tata Steel employees largely approve of value optimisation and governance in Table 1 and Figure 1. Stakeholder Engagement (3.95) and Innovation of Process (3.90) had the highest mean scores, indicating great agreement on their relevance to project success. Resource Minimisation has the lowest mean (3.50), suggesting improvement. The standard deviations show reasonable response consistency, and the statistics suggest that the organization's construction projects have strong value and governance features.

Hypothesis 1: Existence of a Structured Value Optimization Framework

The Hypothesis offer statistical analysis regarding the Structured Value Optimization Framework for optimized value delivery in Tata Steel Limited's construction projects. The alternative hypothesis (H1) posits that such a framework is indeed presented in the Table 2 or Figure 2.

Table 2: One-Sample Statistics of Value Optimization Framework Variables at Tata Steel

One-Sample Statistics				
	N	**Mean**	**Std. Deviation**	**S.E Mean**
Value optimization framework	150	3.65	0.55	0.045
Customer and Stakeholder Value	150	3.80	0.60	0.049
Resource Minimization	150	3.50	0.58	0.047
Innovation of process	150	3.90	0.52	0.043
Long-term value creation	150	3.75	0.57	0.046

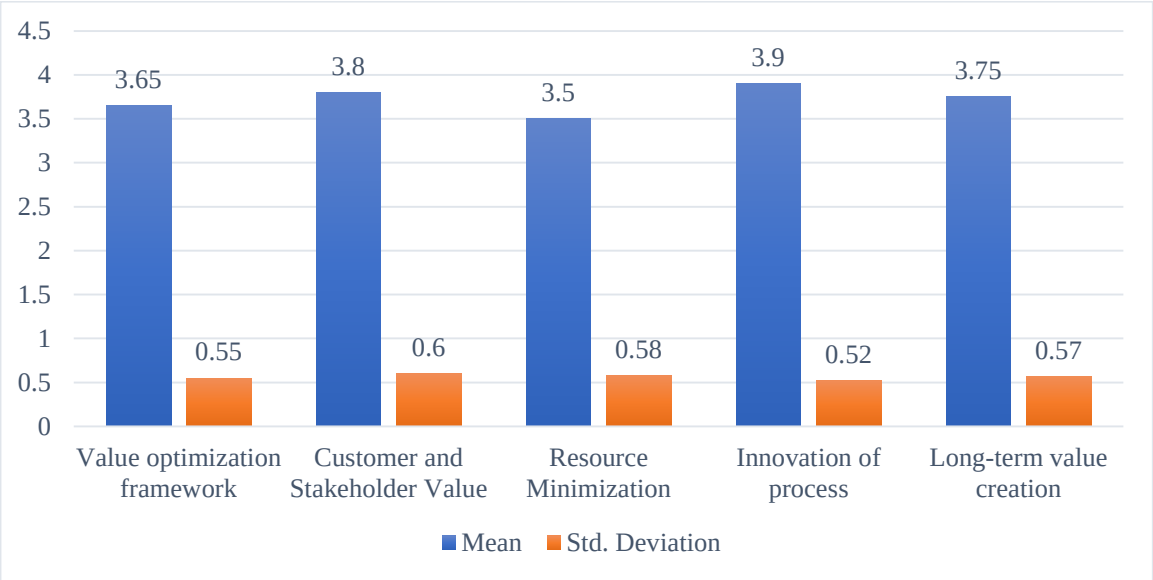


Figure 2: Graphical presentation of One-Sample Statistics of Value Optimization Framework Variables

The average scores for all five variables are higher than the test value of 3.0, which means that the respondents had a positive view of the framework's parts. The highest mean score is for "Innovation of Process" (3.90), followed by "Customer and Stakeholder Value" (3.80) and "Long-term Value Creation" (3.75). The overall *Value Optimisation Framework* has a mean score of 3.65, which means that employees mostly believe that such a framework exists and works. The standard deviations are rather low (between 0.52 and 0.60), which means that the answers are consistent.

Table 3: One-Sample Test Results for Value Optimization Framework Variables at Tata Steel

One-Sample Test						
	Test Value = 3					
	T	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
Value optimization framework	14.44	149	0.000	0.65	0.56	0.74
Customer and Stakeholder Value	16.33	149	0.000	0.80	0.71	0.89
Resource Minimization	10.64	149	0.000	0.50	0.41	0.59
Innovation of process	20.93	149	0.000	0.90	0.81	0.99
Long-term value creation	16.30	149	0.000	0.75	0.65	0.85

Table 3 shows the results of one-sample t-tests that were done to see if the mean responses were significantly different from the neutral test value of 3. All of the variables reveal highly significant findings ($p < 0.001$, which means that most of the people who answered agreed that Tata Steel actively practices the value optimisation aspects. The t-values are very high (for example, 20.93 for "Innovation of Process" and 16.33 for "Customer and Stakeholder Value"), which shows that there is a strong deviation from neutrality. The confidence intervals for each variable do not cross zero, which adds to the evidence that the results are statistically significant.
These results support Hypothesis H1, which says that the Value Optimisation Framework is structured and present in the organisation.

Hypothesis 2: Role of Structured Governance in Sustaining Project Value
The Paired Samples Statistics Table 4 and Figure 3 show three pairs of governance-related variables examined for Tata Steel's construction projects.

Table 4: Paired Samples Statistics

Paired Samples Statistics					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Structured governance process	3.85	150	0.50	0.041
	Governance structure alignment	3.90	150	0.52	0.042
Pair 2	Chain of responsibility and authority	3.70	150	0.55	0.045
	Stakeholder engagement	3.95	150	0.48	0.039

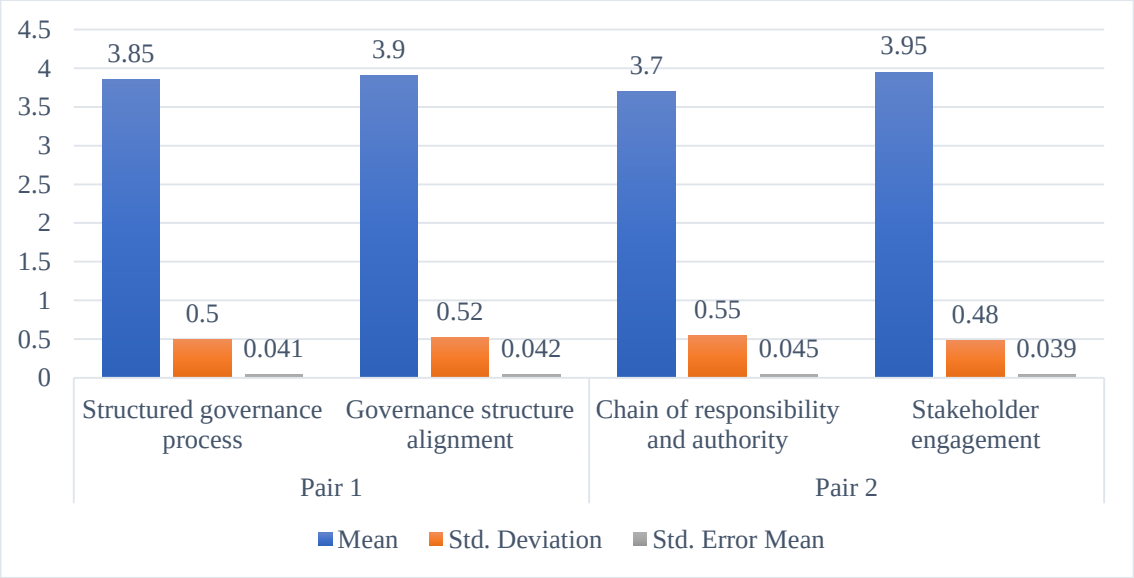


Figure 3: Graphical Presentation of Paired Samples Statistics

Two important pairs of governance-related variables are shown in Table 3 along with their descriptive statistics. For Pair 1, both Structured Governance Process and Governance Structure Alignment have high mean values (3.85 and 3.90, respectively), which means that most people agree that the process and structure are aligned. Pair 2 shows a clear difference, with Stakeholder Engagement (3.95) getting a higher score than Chain of Responsibility and Authority (3.70). These variations show that while governance processes are generally seen as good, stakeholder involvement may be a little more important than formal authority structures in getting good governance results.

Table 5: Paired Samples Correlations

Paired Samples Correlations				
		N	**Correlation**	**Sig.**
Pair 1	Structured governance process & Governance structure alignment	150	0.72	.000
Pair 2	Chain of responsibility and authority & Stakeholder engagement	150	0.65	.000

Table 5 shows how the paired variables are related to each other. There is a strong positive association between Structured Governance Process and Governance Structure Alignment ($r = 0.72$, $p < 0.001$), which means that the two governance mechanisms work well together. Chain of Responsibility and Authority and Stakeholder

Engagement are also strongly linked (r = 0.65, p < 0.001), which means that being clear about who is responsible is closely linked to how well stakeholders are involved. These results suggest that the parts of governance in Tata Steel's construction projects are connected and work well together.

Table 6: Paired Sample T-test

		Paired Differences			t value	df	Sig.
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	Structured governance process & Governance structure alignment	0.05	0.30	0.025	2.00	149	0.212
Pair 2	Chain of responsibility and authority & Stakeholder engagement	0.20	0.40	0.033	6.06	149	0.004

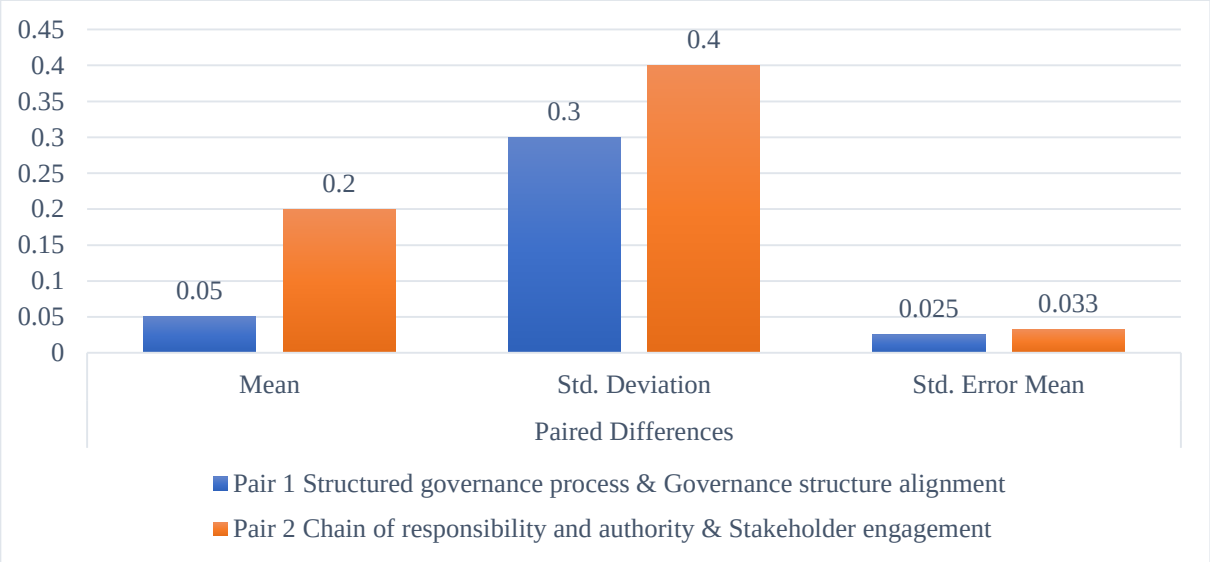


Figure 4: Graphical Presentation of Paired Sample T-test

Table 6 and figure 4 show the results of the paired t-tests that compared pairs of governance variables. Pair 1 (Structured Governance Process vs. Governance Structure Alignment) does not indicate a statistically significant difference (p = 0.212), which means that respondents see these two characteristics in a comparable way and they are well linked. But Pair 2 (Chain of Responsibility and Authority vs. Stakeholder Engagement) shows a statistically significant difference (p = 0.004), with stakeholder engagement getting a far higher score. This means that there can be a gap where informal stakeholder power is stronger than the formalised responsibility structure.

These results somewhat support Hypothesis H2, since governance seems to be organised but not completely fair when it comes to internal authority and external participation.

5. CONCLUSION AND FUTURE SCOPE

This study finds that Tata Steel Limited has set up a clear Value Optimisation Framework that helps its construction projects produce more value. One-sample t-tests show that important factors including stakeholder value, resource efficiency, process innovation, and long-term value creation are not only existing but also being used by project teams. Also, looking at governance processes shows that the parts of governance are very well aligned and depend on each other, especially when it comes to including stakeholders and giving them responsibilities. The paired sample tests, on the other hand, also show where things may be better, especially the little gap between official responsibility chains and stakeholder involvement. This means that the governance structure is mostly in line, but further balancing of internal authority mechanisms and external engagement tactics could make project outcomes better. The results support the idea that formal frameworks and governance mechanisms can help big companies like Tata Steel deliver project value effectively. The study gives industry leaders who want to make structured value practices a part of their companies in the building and infrastructure sectors useful real-world information.

Research Contribution

- Developed a comprehensive Value Optimization Framework tailored for Tata Steel's construction projects, integrating lean principles, value engineering, and risk management for enhanced project outcomes.

- Designed and validated a Structured Governance Mechanism to systematically align project execution with strategic objectives, improving stakeholder engagement, decision-making, and value delivery across project life cycles.
- Empirically tested and confirmed the effectiveness of the Value Optimization Framework and Governance Process through hypothesis testing, providing practical models and actionable insights for large-scale industrial project management.

Value Optimisation Model (VOM) for Construction Projects

A. Redefining Value from the perspective of practical application: Literature review clearly depicts that it is difficult to measure the value the way it has been defined. Hence, to bring development in the application of value concept it is imperative to define the value in a measurable term so that value of any project, product or system can be measured and hence, improvement can be brought.

Based on practical application, the value definition has been articulated in such a way that it can be measured and suitable actions can be initiated to bring improvement. The three key factors such as Function (denoted as F1, F2 ...), Required Safety Factor (Kr) and Excess Safety Factor (Ke) have been considered for giving practical dimension to value. These have been explained with three situation given below and at the same time, this also triggers for suitable actions to optimise value and bring better alignment with customer and other stakeholders needs.

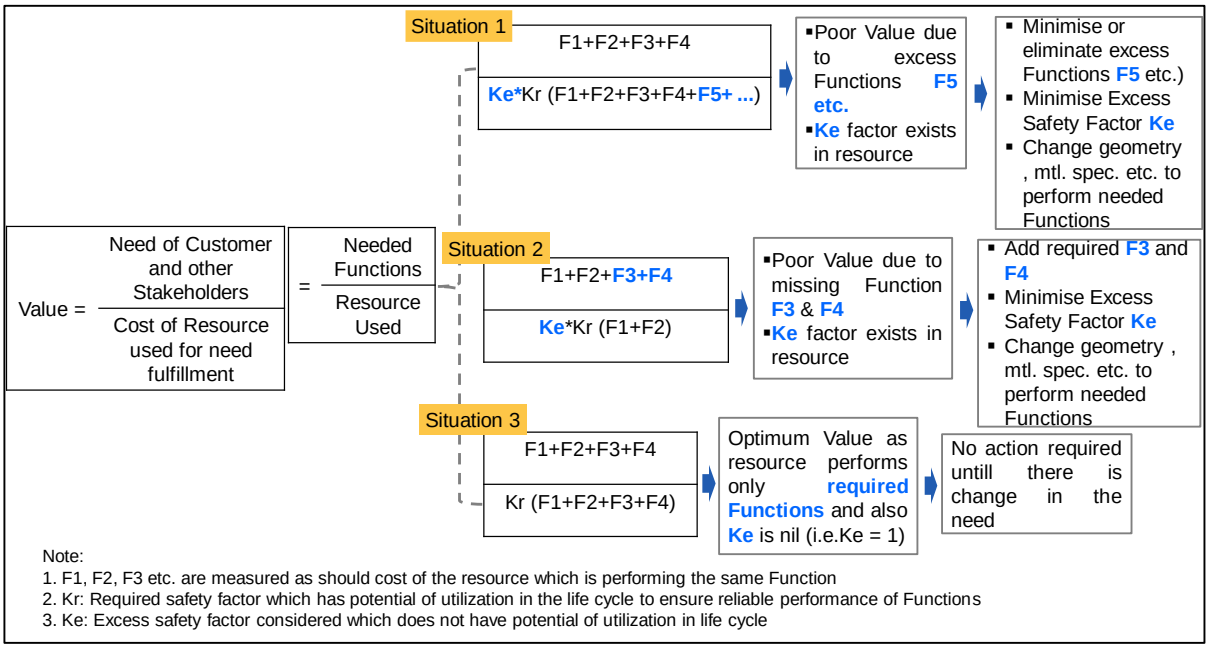


Figure 7.1: Practical Definition of Value
(Source: Author)

B. Suggested Strategy for Project Value optimisation: It has been observed that the project is very sensitive to its completion time line and sometime it becomes difficult to conduct detailed analysis of each and every component of the project. Such detailed analysis consumes significant amount of time and resource. Hence, based on research study and practical experience, it is suggested to follow the following strategies:

B.1 Value Lever based optimisation across the value chain: In case delivery time line is very critical, in that case it is suggested to classify the whole facility into the following two segments

i. Critical Facilities / Components
ii. Non Critical Facilities / Components

The following levers are being suggested to practice especially in case of facilities which are critical to time line.

a. Capacity optimisation across the value chain
b. Specification optimisation of equipment along with supporting facilities such as Piping (Diameter, Thickness, Material grade etc.)
c. Criticality assessment of Functions to generate new idea.
d. Geometry Optimisation such as length, width, height etc.
e. Route optimisation
f. Import to localisation.
g. Structure Vs Civil comparison
h. Features de-contenting such as add on features related to performance, safety etc.
i. Optimisation / elimination of future expansion
j. Selection of light weight cranes to reduce load on structure thereby reduction in structure and civil content.

k. Alternate / Global sourcing
l. Make Vs Buy
m. Load Vs Weight optimisation for structural and civil part
n. Utilisation of existing resources / facilities such as auxiliary facilities, structure, motors, material handling system etc.

For Non Critical Items, detailed value analysis to be conducted which is being explained in next section.

B.2 Detailed examination of value and its optimisation:

Tata Steel follows a Stage Gate Process of Front End Loading (FEL) for managing the entire construction projects right from conceptualisation to scope finalisation, engineering and execution.

Hence, there are four Stage Gates

FEL 1 – Project conceptualisation
FEL 2 – Scope Finalisation
FEL 3 – Front End Engineering Design (FEED) and Project approval
FEL 4 – Detail Engineering & Project Execution

Based on learning through application of value concept in past projects at Tata Steel, It is suggested to apply Customer oriented FAST (Function Analysis and System Technique) from FEL 1 to FEL 3 to finalise the Functional needs to be fulfilled by the projects and with optimum size of facilities. This exercise improves the project performance alignment with stakeholders and hence, value.

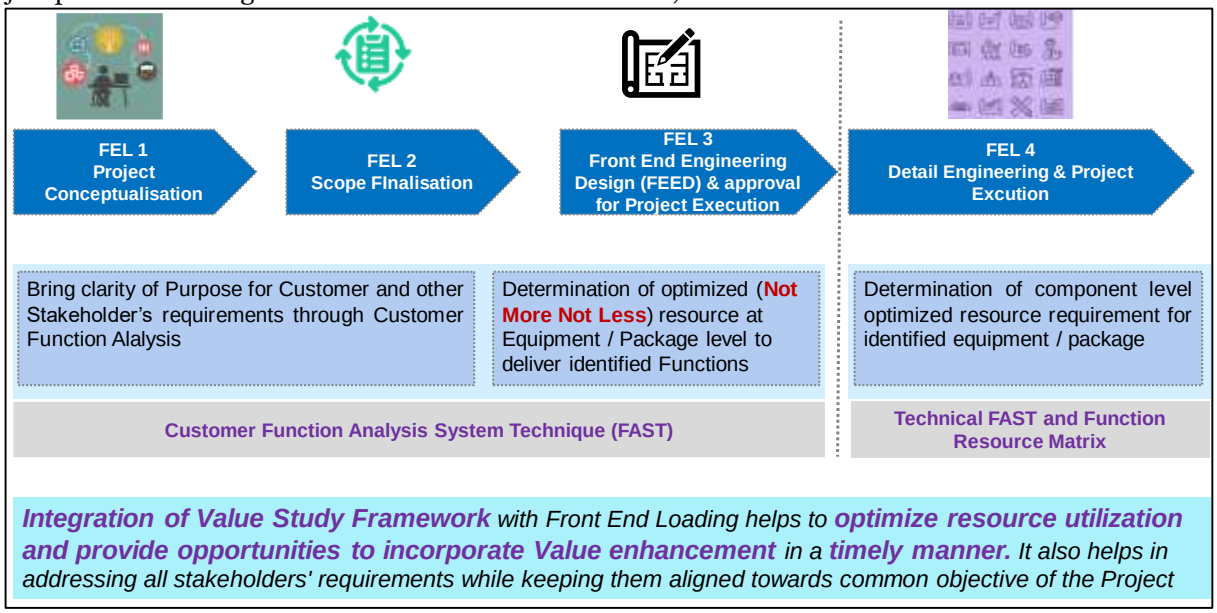
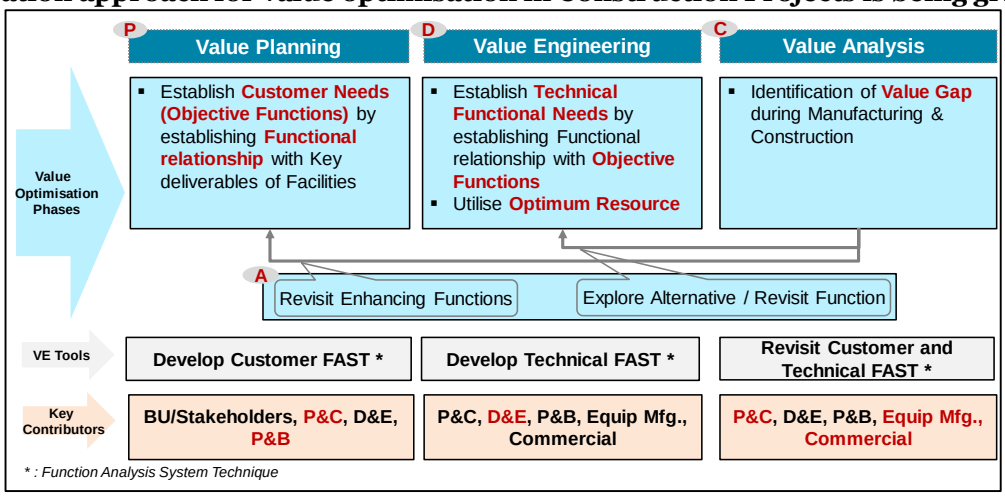


Figure 7.2: Stage Gate Process of Construction Project Management
(Source: Author)

It is also being suggested that Technical FAST and Function Resource to be utilised for further in further optimisation of technical Functions and the resource used for this purpose.

The application approach for value optimisation in Construction Projects is being given below:



BU: Business Unit, P&C: Project & Construction, D&E: Design & Engineering, P&B: Planning & Budgeting, Equip Mfg.: Equipment Manufacturing

Figure 7.3: Value Optimisation in Construction Projects

(Source: Author)

The following steps are being suggested while applying this concept during planning, engineering analysis phase of project value.

Value Planning	Value Engineering	Value Analysis
▪ Define Key Deliverables of the Project ▪ Transform BU / Stakeholder requirements (**Key Deliverables)** into **Objective Functions** ▪ Categorise Objective Functions under **Basic and Enhancing Functions** ▪ Establish **Functional relationship with Key Deliverables** of the Project ▪ Requirement having Functional relationship with Key Deliverables is to considered as **Needed Objective Functions**	▪ Identify **Technial Functions** for Each of the **Objective Function** ▪ Form **Critical Path** by establishing "HOW" and "WHY" and "WHEN"relationship to deliver Objective Functions ▪ Place balance of Functions at **"All Time" or "Some Time"** position and check whether these are helping Critical Path Function to happen ▪ If Functions have the above relations then these Functions to be considered as **Needed Technical Functions** ▪ Balance of the **Functions are not needed** and hence, to be deleted	▪ Revisist the Technical Functions to ensure that these are **performing** as per the requirement of its **Higher Order Function** ▪ In case Function is **overperforming or under performing** optimise resource referring reffering Planning and Engineering part of Value

Figure 7.4: Steps followed during Value Planning, Engineering and Analysis
(Source: Author)

C. Practical Example of Customer Function Finalisation and its alignment with Project / Facilities Functions:

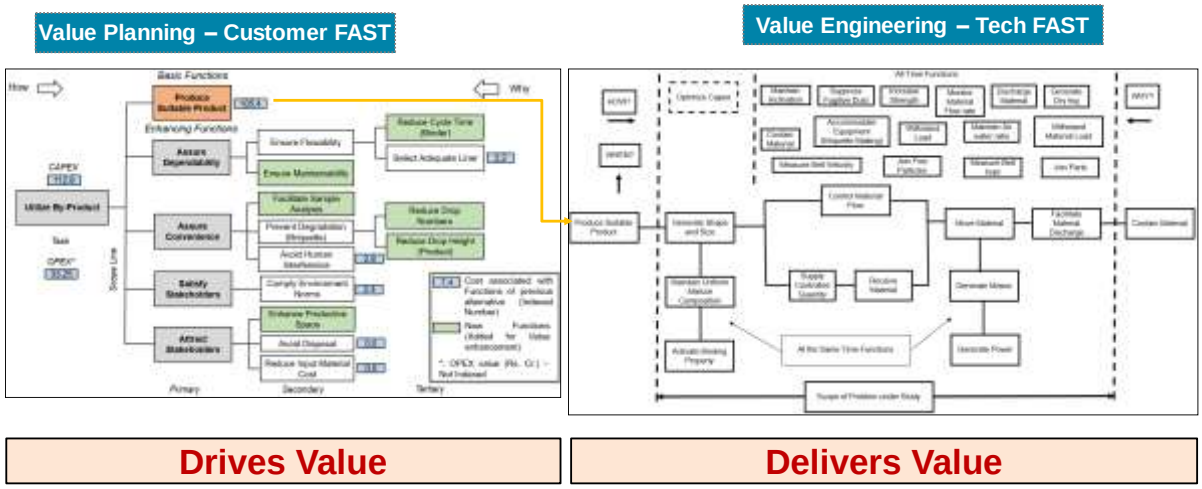


Figure 7.5: Relationship between Customer FAST and Technical FAST
(Source: Author)

Steps to be performed during value optimisation process:
Step1: Breaking up the project to package level such as Package 1, Package 2 etc.
Step 2: Package to be broken to next component level Item 1, Item 2 etc.
Step 3: Identify the Technical Function for each of the item considering their geometry and specification.
Step 4: Validate the Technical Functions with the purpose of the project to finalise required Functions
Step 5: Identify the value gap for the Function, which is needed for fulfilment of the purpose
Step 6: Identify Functions having high value gap and explore the different ways and means (Ideas) for doing the same Function. Also, explore the alternate ideas for those, which are having even good value to further improve the figure of value.
Step 6: Evaluate Ideas considering Technical feasibility, performance and benefits over the life cycle and obtain sign off with all the concerned stakeholders.
Step 7: Implement the finalised change and realise the benefits.
The above process steps have been depicted below for better visualisation.

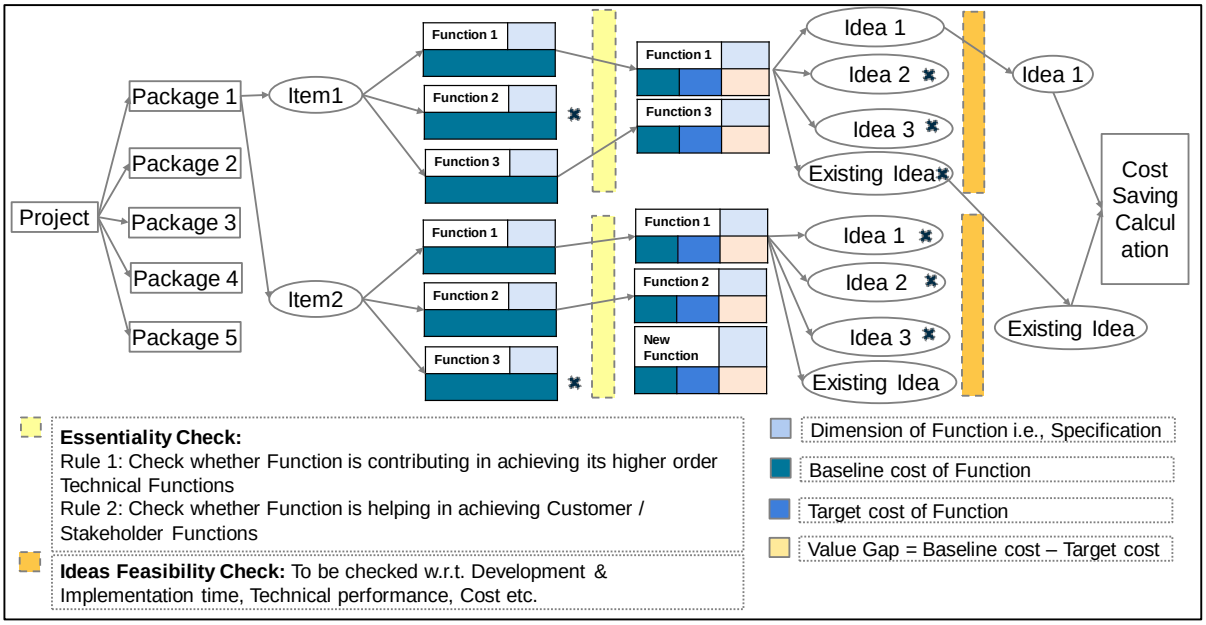


Figure 7.6: Steps to be performed during Value Study
(Source: Author)

Researcher's Value Optimisation Model (VOM): Refer Annexure I
(Source: Author)

Practical Dimension of Model Fit Test for Value Optimization Model (VOM)

Any new development at Tata Steel follows the Framework of Design Thinking Principle, which consists of major two set of actions depicted in the figure below.

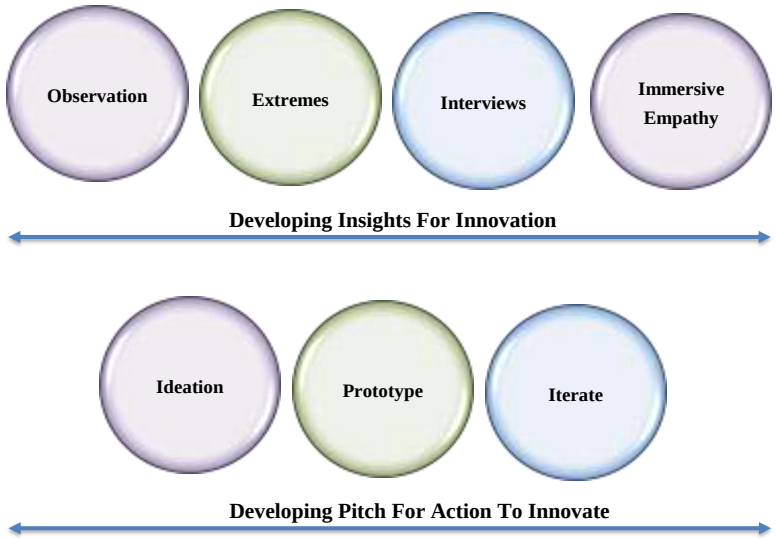


Figure 7.7: Design Thinking Framework
(Source: Tata Steel New Product Development Document)

A. Developing Insights for Innovation: This step involves engagement of all the stakeholders such as Project Manager, Engineering Manager, Procurement Manager, Cost Controller, Leadership Team etc.
In this case, Insights for this Value Optimization Model (VOM) was developed through literature review, interviews with above stakeholders in formal and informal way, observations by the Program Manager (Research Scholar in this case) and learnings from the Past Projects' success and Failures both inside and outside Tata Steel executing construction projects.

B. Developing Pitch for Action to Improve:

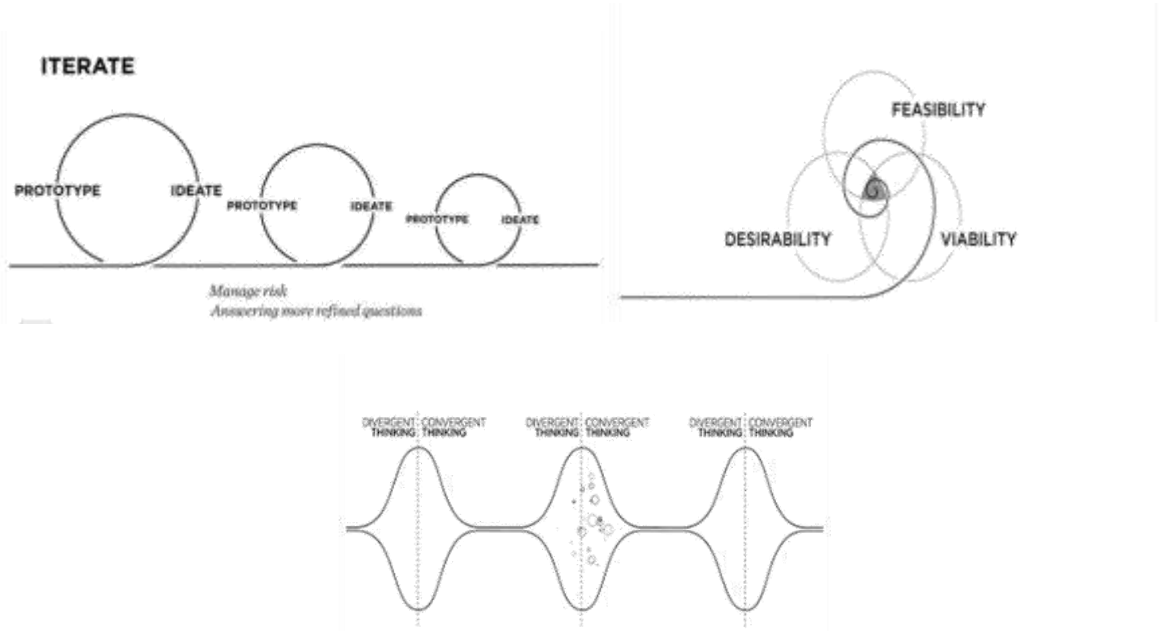


Figure 7.8: Iterative Process for Prototype Validation
(Source: Tata Steel New Product Development Document)

This step involves iterative process of minimum 3 to 4 cycle to ensure that the Model, which has been development, is completely aligned with stakeholders and will be able to fulfil the need of organization. In this particular case, four times Iterative cycle of "Prototyping to Ideation" have been completed and syndication sign off obtained. Post this sign off, this model was put for application on more than 50 no. of projects in year 2024 and 2025 and has given significant benefits in terms of capex avoidance by ~10 to 15% along with many other value additions in the projects. Learning from practical application were also incorporated and final version of the same is appended in the Thesis as outcome research.
Ptoto type testing conducted for the VOM is summarised in the Flow Chart given below.

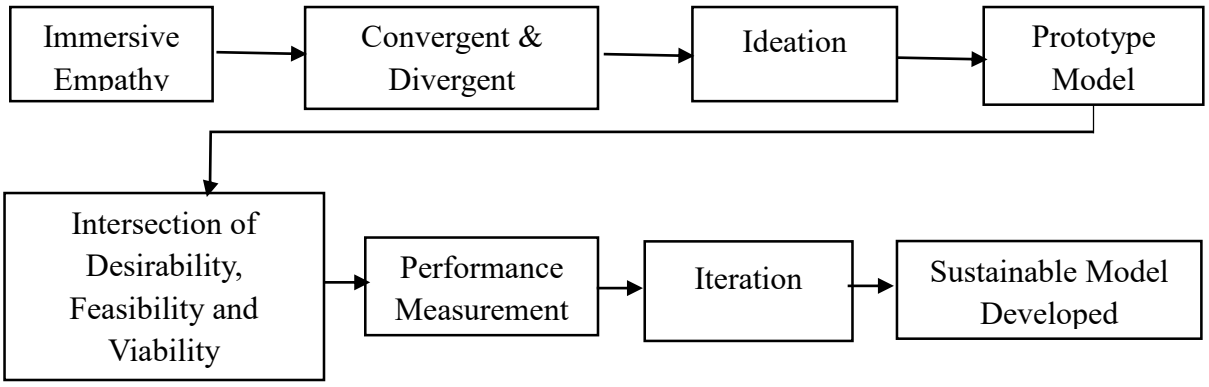


Figure 7.9: Summary of Model Fit Test Steps at Tata Steel
(Source: Author)

C. Case Study Evidence:
The Case Study "**Muthiah Kasi Award for "*Value study on Improvement in Logistic system of Cold Rolled (CR) Downstream Processing Facility at Tata Steel Kalinganagar"*** has used this Framework and won National Award during 40th INVEST International Value Engineering Conference held in year 2024. This award is given post rigorous evaluation by Practicing Value Practitioners (Certified Value Specialists).
This award is given for exemplary application of Customer Oriented Function Analysis System Technique (FAST) Diagram, demonstrating how Functions and particularly FAST diagram has helped to solve problems and/or led to creative solutions/innovation.
Application on the other projects have also won multiple National level awards in other category of International VE Conference. This clearly shows the acceptance by Tata Steel, Subjects Mater Experts from other organizations and Global Level Value Practitioners.

The study gives a lot of useful information, but it only looks at one company and one industry. In the future, research may grow by:

- **Comparative Studies:** Looking at how comparable frameworks are used in other industries or organisations (such public infrastructure or real estate) to see if they can be used in other industries and what the best practices are.
- **Longitudinal Analysis:** Following changes over time to see how governance and value optimisation processes change as a project grows, market needs change, or new technologies are adopted.
- **Qualitative Insights:** Using interviews and case studies to get a better sense of how employees think and how managers make choices.
- **Impact Assessment:** Finding out how much money, better quality, and happier customers the value optimisation projects actually brought about.

REFERENCES

1. Aithal, P. S. (2024). Achieving business excellence through ethical business model: A success story of Tata Group, India. *Poornaprajna International Journal of Management, Education & Social Science (PIJMESS), 1*(2), 165–198.
2. Bainomugisha, E., Warigo, P. A., Daka, F. B., Nshimye, A., Birungi, M., & Okure, D. (2024). AI-driven environmental sensor networks and digital platforms for urban air pollution monitoring and modelling. *Societal Impacts, 3*, 100044. https://doi.org/10.1016/j.socimp.2024.100044
3. Barman, S. C., Bag, B., Rai, S., Bansal, A., Kansabanik, N., & Chollangi, A. K. (2024). A journey: Achieving 11KT of daily hot metal production milestone at blast furnace 1, Tata Steel Kalinganagar. *Ironmaking & Steelmaking, 51*(3), 214–223. https://doi.org/10.1080/03019233.2023.2258769
4. Bhattacharjee, D., & Singhania, A. (2023). Research and development in Tata Steel—The past, the present and the future. In *Indian Metallurgy: The Platinum Years* (pp. 3–25). Springer Nature Singapore.
5. Brinkman, J. J. (2024). *Enhancing target cost process under NEC4 in large infrastructure projects: A guideline bringing theory into practice* (Master's thesis, University of Twente).
6. Chen, X., Tang, X., & Xu, X. (2023). Digital technology-driven smart society governance mechanism and practice exploration. *Frontiers of Engineering Management, 10*(2), 319–338. https://doi.org/10.1007/s42524-023-0265-z
7. Choudhury, A. R., Singh, N., Veeraraghavan, A., Gupta, A., Palani, S. G., Mehdizadeh, M., ... & Al-Taey, D. K. (2023). Ascertaining and optimizing the water footprint and sludge management practice in steel industries. *Water, 15*(12), 2177. https://doi.org/10.3390/w15122177
8. Cui, W., Chen, Y., & Xu, B. (2024). Application research of intelligent system based on BIM and sensors monitoring technology in construction management. *Physics and Chemistry of the Earth, Parts A/B/C, 134*, 103546. https://doi.org/10.1016/j.pce.2024.103546
9. da Silva, A., & Cardoso, A. J. M. (2024). Value creation in technology-driven ecosystems: Role of coopetition in industrial networks. *Journal of Theoretical and Applied Electronic Commerce Research, 19*(3), 2343–2359. https://doi.org/10.3390/jtaer19030125
10. Ibrahim, Y. (2024). *Impact of quantity surveyors as value managers on delivery of construction projects in Abuja* (Unpublished dissertation).
11. Ismaeil, E. M. (2024). Sustainability-based value engineering management as an integrated approach to construction projects. *Buildings, 14*(4), 903. https://doi.org/10.3390/buildings14040903
12. Kassen, M. (2025). Blockchain and digital governance: Decentralization of decision making policy. *Review of Policy Research, 42*(1), 95–121. https://doi.org/10.1111/ropr.12499
13. Kunene, R. (2024). *Adjusting project delivery approaches towards faster delivery circles* (Master's thesis, University of Johannesburg, South Africa).
14. Nejhadheydari, Z., Raeiszadeh, M., Taheri Haghighi, H. R., & Ghayyoomi, M. (2024). A review of value engineering and the need to use it in industry and huge projects. *Modern Research in Performance Evaluation*, *3*(1), 30–42.
15. Prabhaker, S. P., & Kumar, S. (2024). Development of framework for optimised value delivery in construction projects with reference to Tata Steel Limited. *The Researchers' International Research Journal*, *10*(1), 23–43.

ANNEXURE I: RESEARCHER'S VALUE OPTIMISATION MODEL (VOM)

Project Title:
VE Project Id:

1.0 ORIENTATION PHASE

1.1 CROSS FUNCTIONAL TEAM FORMATION

Sl.	Name	P. No.	Department	Leader/Member

1.2 DEFINE OBJECTIVE, KPI, BASELINE & TARGET OBJECTIVE:

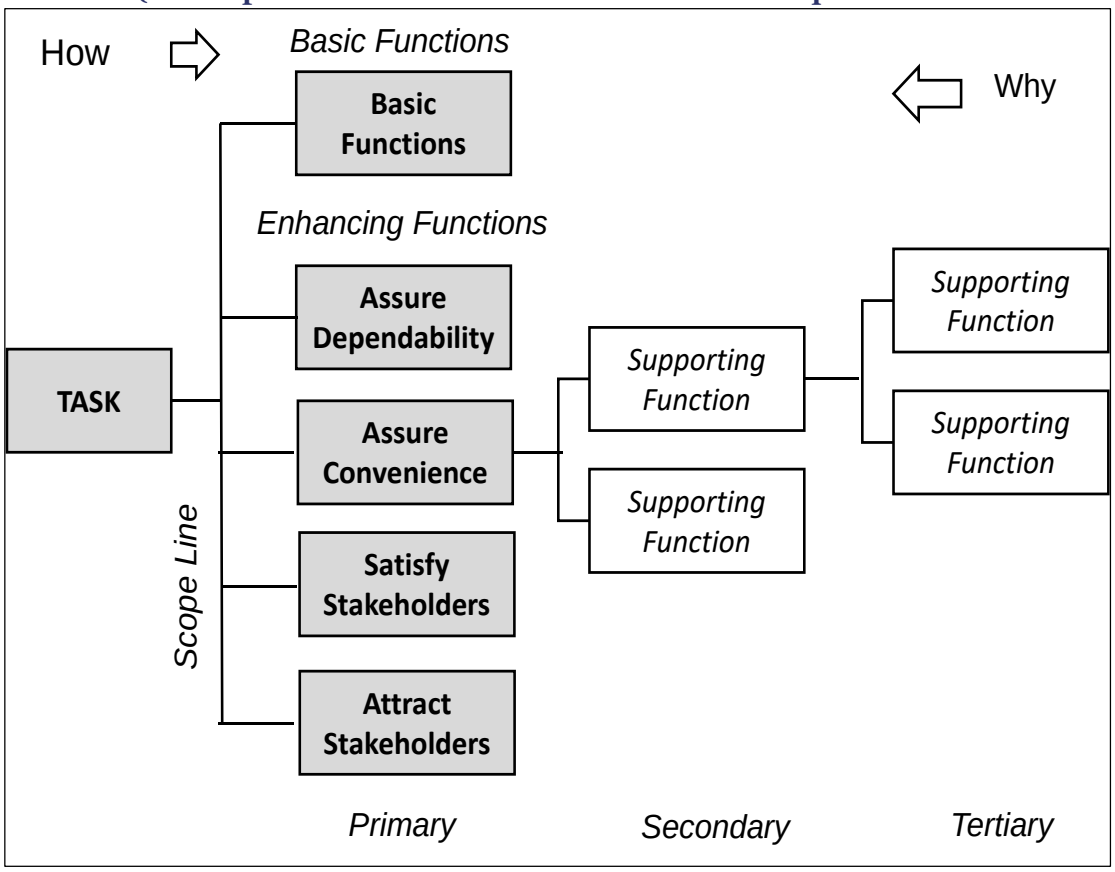
Sl.	KPI	Baseline	Target

2.0 INFORMATION PHASE

2.1 Describe existing Component/Process/Service or System to be value analysed (BOQ, BOM, Application, Present procedure, Design, Performance requirements etc.)
2.2 CUSTOMER AND STAKEHOLDER ANALYSIS (Assess Need, Desire and Constraints, voice of Customer and Stakeholders in stated and unstated form as per the table given below):

Sl.	Customer / Stakeholder	Stated requirement	Unstated requirement	Define Functions for requirement fulfilment	Need / Desire / Constraints
1	Operation				
2	Maintenance				
3	Quality Assurance				
4	Logistics				
5	Others				

Customer FAST (Develop Customer Centric FAST for Function requirement visualisation):



Identification of Functions from the above FAST for Creativity:

Sl.	Category of Enhancing Function	Functions identified for Creativity
1	Basic Function	
2	Assure Dependability	
3	Assure Convenience	
4	Satisfy Stakeholders	
5	Attract Stakeholders	

2.3 COST DATA

Before VAVE

2.3 DOCUMENT ABSTRACT

(List books, documents, specifications and drawings used for information)

Reference / Source of information	Abstract of necessary Data

3.0 FUNCTION PHASE

3.1 FUNCTION ANALYSIS COMPONENTWISE / PROCESSWISE

Sl.	Component/Process	Function		Basic/Secondary (at Component/ Process level)
		Active Verb	Measurable Noun	
1	Component / Process / Sub process 1			
2	Component / Process / Sub process 2			
3	Component / Process / Sub process 2			
4	Component / Process / Sub process n			

3.2 LIST OF UNIQUE FUNCTIONS

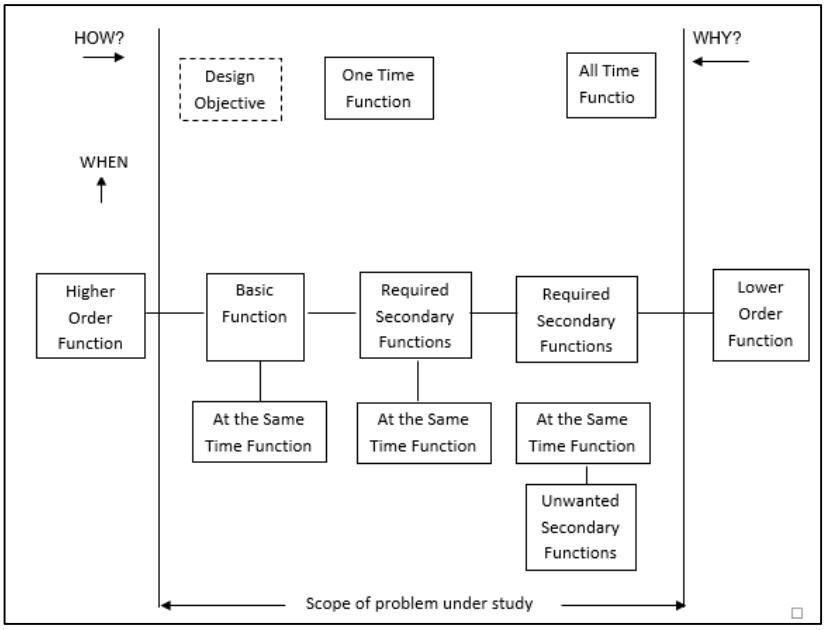
Sl.	Basic Functions	Secondary Functions

3.3 INDENTIFICATION OF HIGHER ORDER & LOWER ORDER FUNCTION

Higher Order Function (Customer Function):

Lower Order Function (Causative Function):

3.4 FUNCTION ANALYSIS SYSTEM TECHNIQUE DIAGRAM (FAST DIAGRAM)



3.5 FUNCTION COST DISTRIBUTION WORKSHEET

Component	Cost (INR)	Function - Cost - Worksheet				
		Function 1	Function 2	Function 3	Function 4	Function n
Component 1	20.00	5.00		6.00		9.00
Component 2	100.00	75.00	10.00	5.00	10.00	
Component 3						
Component 4						
Component 5						
Total	120.00	80.00	10.00	11.00	10.00	9.00

3.6 LIST OF FUNCTIONS FOR CREATIVITY

Sl.	A. Critical Path Functions of Tech FAST diagram (Ref. 3.4)	B. High Cost Functions (Ref. 3.5)	C. List of Functions identified from Customer FAST	Unique Functions out of A, B and C (superimposed functions)
				Function 1
				Function 2
				Function n

4.0 CREATIVE PHASE

4.1 FUNCTION WISE IDEA GENERATION

Unique Functions	Idea No.	Idea description	Benchmark/Reference
Function 1	1	Idea 1	
	2	Idea 2	
Function 2	3	Idea 3	
	4	Idea 4	
Function n		Idea n-1	
		Idea n	

4.2 FEASIBILITY CHECK OF IDEAS

FEASIBILITY RANKING MATRIX						
Parameters →	State of Art	Probability of Implementation	Cost to Develop	Time to Implement	Potential Cost benefit	Total
Idea No. ↓	10: Off the shelf 1: New technology	10: High Chance 1: No Chance	10: Low Cost 1: High Cost	10: No Time 1: Max Time	10: High 1: Low	

Cut off Score:
VAVE Solution (Group of feasible ideas):
NOTE:
1. Feasible Ideas = Ideas having score greater than cut off score
2. VAVE Solution must be replacement of existing

5.0 EVALUATION PHASE

5.1 IDENTIFY CRITERIA FOR EVALUATION

Sl.	Customer and Stakeholders' Name	Parameters (Constraints, Needs & Desires)	Symbol
			A
			B
			C
			D
			E

5.2 DETERMINATION OF WEIGHTAGE OF PARAMETERS (PAIRED COMPARISON MATRIX)

	B	C	D	E	Weightage
A					a
B					b
C					c
D					d
E					e

Scale for Comparison

Comparison	Pts
Major Difference	3
Medium Difference	2
Minor Difference	1
No difference	0

5.3 DECISION MATRIX

Alternative	Parameter	A	B	C	D	E	Total	Rank
	Weightage	**a**	**b**	**c**	**d**	**e**		
Existing	Excellent (5)							
	Very Good (4)	4		4				
	Good (3)		3		3	3		
	Fair (2)							
	Poor (1)							
	Subtotal	**=a*4**	**=b*3**	**=c*4**	**=d*3**	**=e*3**	**=a*4+b*3+c*4+ d*3+e*3**	
VE Solution	Excellent (5)							

	Very Good (4)							
	Good (3)							
	Fair (2)							
	Poor (1)							
	Subtotal	**=a*4**	**=b*3**	**=c*4**	**=d*3**	**=e*3**	**=a*4+b*3+c*4 +d*3+e*3**	

5.4 Life Cycle Cost Analysis (LCC)

Cost Elements	**Life of the project: Year**	
	Present Value: Existing	**Present Value: VAVE Solution**
A) INITIAL COST (Design Cost, Purchase Cost, Construction Cost, Installation or Commissioning Cost etc.)		
B) ANNUAL OPERATION COST (Raw Materials, labours, Overheads etc.)		
C) ANNUAL MAINTENANCE COST (Mechanical, Electrical etc.)		
D) REPAIR & REPLACEMENT COST		
E) SALVAGE VALUE		
LIFE CYCLE COST = A+B+C+D-E		
SAVING OVER EXISTING		

Note: Present Value (PV) = Sum (Cost Estimate X Discount factor) over the life cycle
Where, Discount factor = $1/(1 + r/100)^n$ and r = rate of interest & n = year
Best Alternative (based on 5.3 & 5.4):

6.0 DEVELOPMENT PHASE
6.1 DESIGN & ENGINEERING OF BEST ALTERNATIVE

7.0 PRESENTATION PHASE
7.1 MANAGEMENT APPROVAL FOR IMPLEMENTATION
8.0 IMPLEMENTATION PHASE
8.1 IMPLEMENTATION PLAN VS ACTUAL

Sl.	**Actions**	**Persons/Agency**	**Planned Date**	**Actual Date**	**Remarks**

9.0 AUDIT PHASE
9.1 IMPLEMENTATION AUDIT
Implemented by:
Verified by:

9.2 COMPARISION BETWEEN BEFORE & AFTER

Sl.	**Brief Description (Before VAVE)**	**Brief Description (After VAVE)**
Photo/Drawing (Before VAVE) (Indicate scope of study)		**Photo/Drawing (After VAVE) (Indicate modification done)**

9.3 COST/FINANCIAL AUDIT

Sl .	**Scheme No.**	**Cost Elements**	**A = Before Cost (Rs.)**	**B = After Cost (Rs.)**	**Saving (Rs.) = A - B**	**Recurring /One time**	**Annexure for Cost back up**

Submitted by SPOC/Project Lead: Contact No.: