



METHODOLOGY APPLICATION

APPLICATION NO: VM/VE001
APPLICATION TITLE: Value Improvement Practices (VIP's)
INDUSTRY: Project Applications
VALUE METHODOLOGY APPLIED: Value Management & Value Engineering

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1 Introduction to Value Improving Practises.

1.1 *What is it? – Description*

VIPs are out of the ordinary practises which can provide measurable and statistically demonstrable effects on cost, schedule and/or reliability of the constructed asset.

- Each VIP will follow a distinct and defined work process
- The VIP is not merely a detailed review of any given aspect of the project
- The results of VIP exercises will be recorded such that it is possible to assign accountability for the incorporation of those results in a project.

- **The results** of VIP application **must be documented**. This provides a basis
 - a) for team alignment of resultant objectives
 - b) against which the project team can evaluate the effectiveness of the practise, and
 - c) for lessons learned and root cause analysis
 - D) for gate release approval (FEL)

The key categories of VIP's are defined as follows:

1. **Technology selection**
2. **Process simplification**
3. **Predictive maintenance**
4. **Reliability Simulation and modelling**
5. **Customising standards and specifications**
6. **Design-to-capacity.**
7. **Classes of Facility Quality**
8. **Value Engineering**
9. **Constructability Reviews**
10. **Energy Optimisation**
11. **Waste Minimisation**
12. **3D CAD**



1.2 What is it for? – Purpose

The key purposes of the application of VIP's during a capital project development and implementation life cycle are:

1. To improve cost performance
2. To improve schedule performance
3. To improve the potential for effective operational performance
4. Contributing to “Best in Class” project performance
5. Alignment of expectations between stakeholders

1.3 Why VIP's? – Justification

According to I.P.A. Inc. VIP's are one of three key leading indicators which have been demonstrated to contribute towards a successful project outcome.

The three Key Leading Indicators:

- Front End Loading
- Use of Value Improvement Practices
- Alignment and Team Integration

Each of the category listed VIPs has a specific contributory purpose, but for maximum benefit as many of them as possible should be **applied as appropriate to the specific scope of any given project**, in a way that is customised on a best for project basis. The approach to the application of VIPs needs to be flexible and creative, yet project specific.

1.4 Who does what? – Responsibilities & Ownership

Project Manager

The Project Manager is responsible to plan and execute the required VIP's. The Project Management function needs to be present at all the VIP's.

Quote by Aidan Schoonbee (THE STRUCTURED USE OF VALUE IMPROVING PRACTICES (VIP's) IN PROCESS PLANT DESIGN)

It seems obvious at first glance that the project team and/or the project manager own all VIP's which are conducted on their specific project, but it is advised that the question of ownership should not be taken for granted. It may be true that the project manager and his team are accountable for VIP's, but this does not imply that they should own the VIP's. The aim should be to ensure as many of the stakeholders as possible develop an ownership of the VIP process. Ownership over a broad cross-section results in buy-in which results in participation, trust and the willingness to show perseverance.



VIP Facilitator

The Facilitator’s role is to guide the project team on VIP applications and methodologies to be applied.

It is recommended that a neutral and independent VIP Practitioner is appointed to facilitate the VIP’s.

Independent facilitation avoids the apprehension of some of the team members that the process was manipulated by certain elements within the team, and both client and shareholder representatives might find it easier to buy-in to the ‘agenda’.

1.5 How many VIP’s need to be applied? – Quantity

Currently the Industry Average of VIP usage (among Benchmarked companies) is 32%

Recommended usage range is between 30 and 60%. (4 – 7 VIP’s)

Best Practical usage range is between 40 and 60%. (5 – 7 VIP’s)

There is some overlap in VIPs, so 100% usage is not recommended.

- The twelve categories of VIPs are not entirely independent of each other. For example, both Value Engineering and Customising Standards and Specifications seek to eliminate non-value-adding standards or items of scope. Similarly, the intent of both the Process Simplification and Waste Minimisation is to optimise the operational process.
- Research has shown that optimal benefit is derived when a project applies at least 40-60% (5-7 VIP’s) of those twelve VIPs that are appropriate to a given project.

1.6 When is the selected VIP applied? – Timing

- VIPs are optimally applied in the relevant FEL stages as reflected in Fig 1 below.

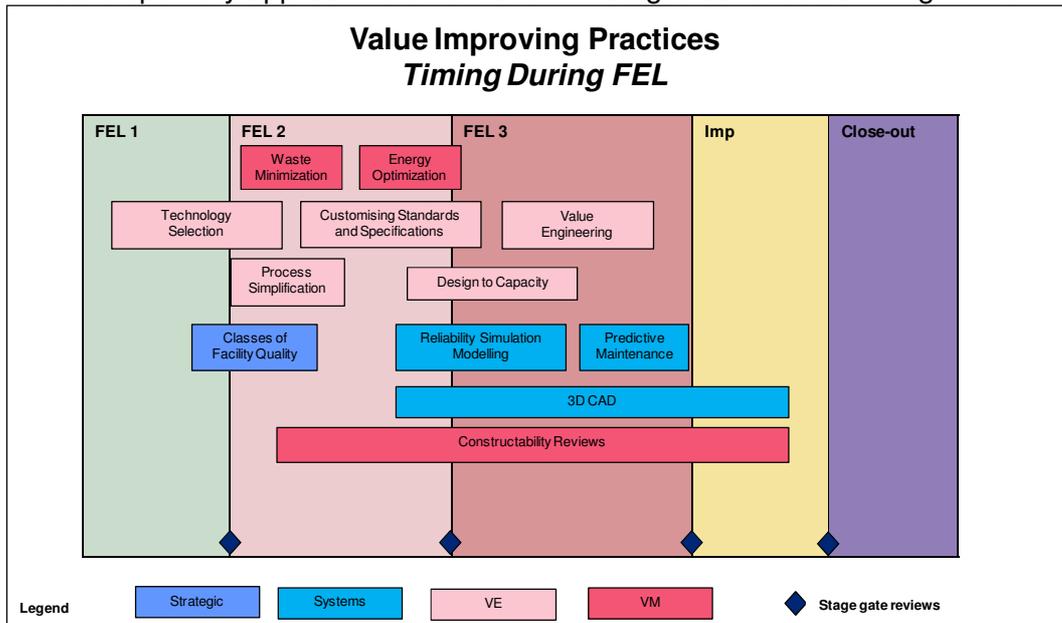


Figure 1 – Staged Application of VIP Processes



2 Summary of Key Elements

	WHAT – what is it that must be done (requirements).
<u>Key Element 01</u> – Technology Selection	<ul style="list-style-type: none">• A Formal process to ensure that all alternative technologies for accomplishing a particular task are rationally considered.
<u>Key Element 02</u> – Process Simplification	<ul style="list-style-type: none">• A formal rigorous process to search for opportunities to eliminate or combine process steps or equipment.
<u>Key Element 03</u> – Predictive Maintenance	<ul style="list-style-type: none">• Use of advanced monitoring techniques for equipment and processes to anticipate impending failure.
<u>Key Element 04</u> – Process Reliability Simulation	<ul style="list-style-type: none">• Computer simulation of the mechanical reliability of plant:• Enables identification of bottlenecks.• Assists sparing optimisation.• Assists in sizing.
<u>Key Element 05</u> – Customising Standards & Specifications	<ul style="list-style-type: none">• A systematic analysis to ensure that facility costs are not increased by applying codes, standards and specifications that exceed the actual needs of the particular case.
<u>Key Element 06</u> – Design-to-Capacity	<ul style="list-style-type: none">• Design to capacity requires the evaluation of the maximum capacity of each major piece of equipment and / or process element, instead of the traditional practice of designing with a “safety factor” to allow for additional catch-up capacity or some production increases.
<u>Key Element 07</u> – Classes of Facility Quality	<ul style="list-style-type: none">• This practice establishes what quality facility is needed to meet project objectives.
<u>Key Element 08</u> – Value Engineering	<ul style="list-style-type: none">• Value Engineering is a rigorous examination what functional requirements are needed to meet business objectives of a project at the least cost and the elimination of non-adding investment.
<u>Key Element 09</u> – Constructability Reviews	<ul style="list-style-type: none">• Systematic examination of the design as it affects construction efficiency.• Alignment of various stakeholders prior and during construction.• Alignment of any <u>new</u> team members.
<u>Key Element 10</u> – Energy Optimisation	<ul style="list-style-type: none">• Energy Optimisation is a disciplined process of examining energy use by a process and facility and optimising the trade-off between capital and energy costs.
<u>Key Element 11</u> – Waste Minimisation	<ul style="list-style-type: none">• A stream-by- stream analysis of how waste is generated by a chemical process and how those waste streams can be eliminated reduced or turned into saleable by-products.
<u>Key Element 12</u> – 3D CAD	<ul style="list-style-type: none">• The use of the three-dimensional computer-aided design (3D CAD) during Frond-End Loading and detailed design.



3 Planning and Execution

The planning of VIP’s needs a systematic approach to enhance execution of the various studies.

It is suggested that;

- all appropriate VIP’s for the total project life cycle need to be selected early (FEL1)
- motivation and justification for all selected VIP’s is determined for the total projects life cycle
- the appropriate VIP’s to be planned within specific project life cycle stages
- the requirement stipulates that a minimum of 5 VIPs need to be addressed in order to obtain “best practices” status for the project.

Below are the application templates;

3.1 Base Line Data – Appropriate VIP Selection

VIP Area	Baseline Data	Strategies for Success
Technology Selection	Bench mark against similar	Early work decisions
Design to Capacity	Fit for Purpose approach	Minimum requirements versus design
Classes of Facility Quality	Operational performance levels e.g. output, maintenance costs, downtime etc.	Life cycle consideration
Value Engineering	10% reduction in capital cost	Integrate recommendations into projects
Constructability Reviews	Zero harm, schedule	Application of XYZ etc.

3.2 Motivation / Justification and Timing (example)

VIP	Motivation / Justification	Timing
Value Engineering	Possibility of non required functional elements included in the design	Concept, PFS, FS
	Possibility of functions to be performed omitted in the design	
	Function could be performed more cost effective in an alternative way	



3.3 VIP Implementation Schedule (example)

VIP Area	Timing	Resources Required	Dates	Coordinator
Technology Selection	Concept Pre-feasibility	Project Team, Owners Team, Contractor, Facilitator, other Stakeholders		
Design to Capacity	Pre-feasibility & Feasibility	Project Team, Owners Team, Contractor, Facilitator, other Stakeholders		
Classes of Facility Quality	Pre-feasibility	Project Team, Owners Team, Contractor, Facilitator, other Stakeholders		
Value Engineering	Concept Pre-feasibility Feasibility Implementation	Project Team, Owners Team, Contractor, Facilitator, other Stakeholders		
Constructability Reviews	Pre-feasibility Feasibility Implementation	Project Team, Owners Team, Contractor, Facilitator, other Stakeholders		

Include in project schedule

3.4 VIP Champions

(List the designated Owner's Team VIP Champions who will drive the implementation of the Value Improvement Practices. The Owner's Project Manager must ensure that the Stakeholder Register and Management Plan is updated accordingly)

VIP Area	VIP Champion	Designation	Signature
Technology Selection			
Design to Capacity			
Classes of Facility Quality			
Value Engineering			
Constructability Reviews			



3.5 Incorporating Lessons Learned

(Outline the lessons learned incorporated from other projects and the strategy for collecting lessons learned at the end of the project)

The capturing of lessons learned will follow the process below:

Identify lesson/practice
Document
Validate
Communicate
Extract
Transfer
Apply

This will be done on a progressive basis rather than waiting for close-out and the close-out report. Each VIP Champion will be responsible for the lessons learnt process in his area.



4 Application Examples

4.1 Value Management

Value Management is not simply another problem solving approach, but a value adding, innovative thinking methodology that equips one with much needed creative decision-making and group interaction skills.

Value Management incorporates techniques for cost optimisation - product / process / system design & improvements – procurement - customers interacts - industry forums - team building (with strategic focus/alignment), whilst overcoming problems associated with people, be they engineers, accountants, sales people, customers, suppliers or anyone requiring creative solutions for difficult problems.

This dynamic methodology focuses the collective wisdom of a divergent group, where the process enables them to systematically define common objectives, functionally prioritising what needs to be done and then creatively identifying how best to achieve the desired results.

The unique and paradoxical combination of functional focus & creative thought will ensure that you are equipped to manage projects successfully.

Value Management is based on the principles of the Value Engineering Methodology.

4.1.1 VIP Energy Optimisation

Establishing a Purpose

This refers to the purpose of the study.

Clearly scope the area of investigation thus ensuring a focused approach when selecting appropriate technology for the project & determine how many days the workshop / study will take.

Reduce power and water cost at XY Mine

Selecting the right participants for the workshop.

VM studies are done by teams or groups who operate under the premise that two heads are better than one and that the discussion of ideas stimulates individual minds.

The following characteristics should be represented in the group:

- Stake Holders, who are in possession of information related to the project.
- Stake Holders who will be directly affected by decisions made during the workshop (Client Representatives).
- Stake Holders who has an interest in the Project and can contribute to the VIP Energy Optimisation
- Stake Holders representing functional disciplines



Listing Issues and Concerns

List all the Issues & Concerns applicable to the project.

Include real & perceived Issues & concerns.

Leaks in compressed air pipes

Leaks in water pipes

Excessive use of equipment:

Fans (too many)

Pumps (too many)

Pipes (pressure)

Winders (unnecessary trips)

Wrong schedule of pumping hours (peak periods)

Unnecessary stops of mills and unscheduled start ups (peak period)

Lack of knowledge on power / water business

Open valves (lack of control)

Lights burning at night / day

Air conditioners / heaters



Establishment of a clear Objective

Establish an objective with measurable target and being time bound.

Include “Results to Achieve”. “Results to Prevent”, Available Resources” & “Constraints”

Environmental complexity of scope is referenced in terms of current risks and available support.

Objective: Reduce current average power cost by 15% and reduce Water cost by 5% (with improvements in operational conditions) before the end of June 200x

RESULTS TO ACHIEVE	RESULTS TO PREVENT
<i>Measure unit consumption</i> <i>Optimise maximum demand</i> <i>Reduce compressed air consumption</i> <i>Rationalise equipment use</i> <i>Reduce water consumption</i> <i>Schedule effective start-up of equipment</i> <i>Educate user on power and water savings</i> <i>Improved power factor</i> <i>Reduce choking of pumps / pipes</i> <i>Reduce smelting cost</i> <i>Revisit 3rd party user</i> <i>Correct cost allocation</i>	<i>Production loss</i> <i>Retrenchment</i> <i>Prevent flooding</i> <i>Closure of mine</i> <i>In-adequate supply of power and water</i>
AVAILABLE RESOURCES	CONSTRAINTS
<i>Maximum demand controllers & equipment (4 #)</i> <i>Mine water (dolomite)</i> <i>Skilled people</i> <i>Other miner (experience)i.e. Western Deep Levels)</i> <i>Environmentalist</i> <i>Planned maintenance</i> <i>Equipment</i>	<i>Capital</i> <i>Time</i> <i>Actual mine plan (resources)</i> <i>Government / legislation</i> <i>Unions</i> <i>Lack of education</i> <i>Lack of motivation</i> <i>Ignorance (power / water cost)</i> <i>RC factor</i>



Establish and evaluate functional requirements

The identification of the Functional Requirements to achieve the Objective and priorities

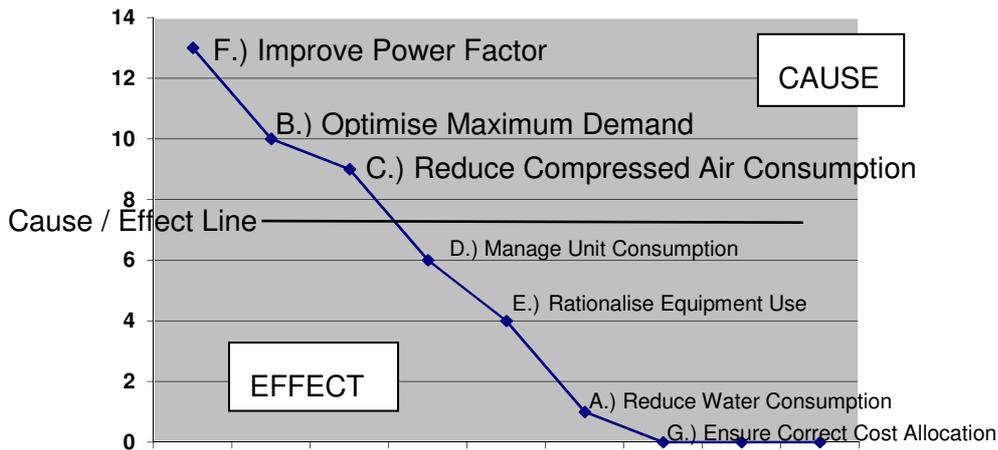
List all the Functions that need to be addressed in Verb / Noun statements

Evaluate all functional requirements against each other to define priorities and the cause and effect scenario.

Numerical Evaluation

Functions							Scr	Rnk	
A	B3	C3	D3	E2	F2	A1	Reduce Rand Water Consumption	1	
	B	B1	B1	B2	F2	B3	Optimise Maximum Demand	10	2
		C	C2	C2	F2	C2	Reduce Compressed Air Consumption	9	3
			D	D1	F2	D2	Manage Unit Consumption	6	
				E	F2	E2	Rationalise Equipment Use	4	
					F	F3	Improve Power Factor	13	1
						G	Ensure Correct Cost Allocation	0	

Cause / Effect Graph



Address the functions above the line and 80% of the Objective is achieved



Listing and Evaluation of Recommendations

Choose the highest rated functional requirement first and brainstorm for better solutions, recommendations & alternatives.

Apply a “Star rating” to each recommendation

Alternatively the “Perspective Modeling Matrix can be applied

Finalisation of Action Plan with Responsibilities and Time frames.

Establish an action plan for all high rated recommendations for implementation, feasibility studies etc. (who and when)



4.2 Value Engineering

Value Methodology is a rigorous examination of **what** is needed (functional requirements) to meet business objective of a project **at the least cost** and the elimination of non-adding investment. The methodology is applied as the Value Management and Value Engineering approach.

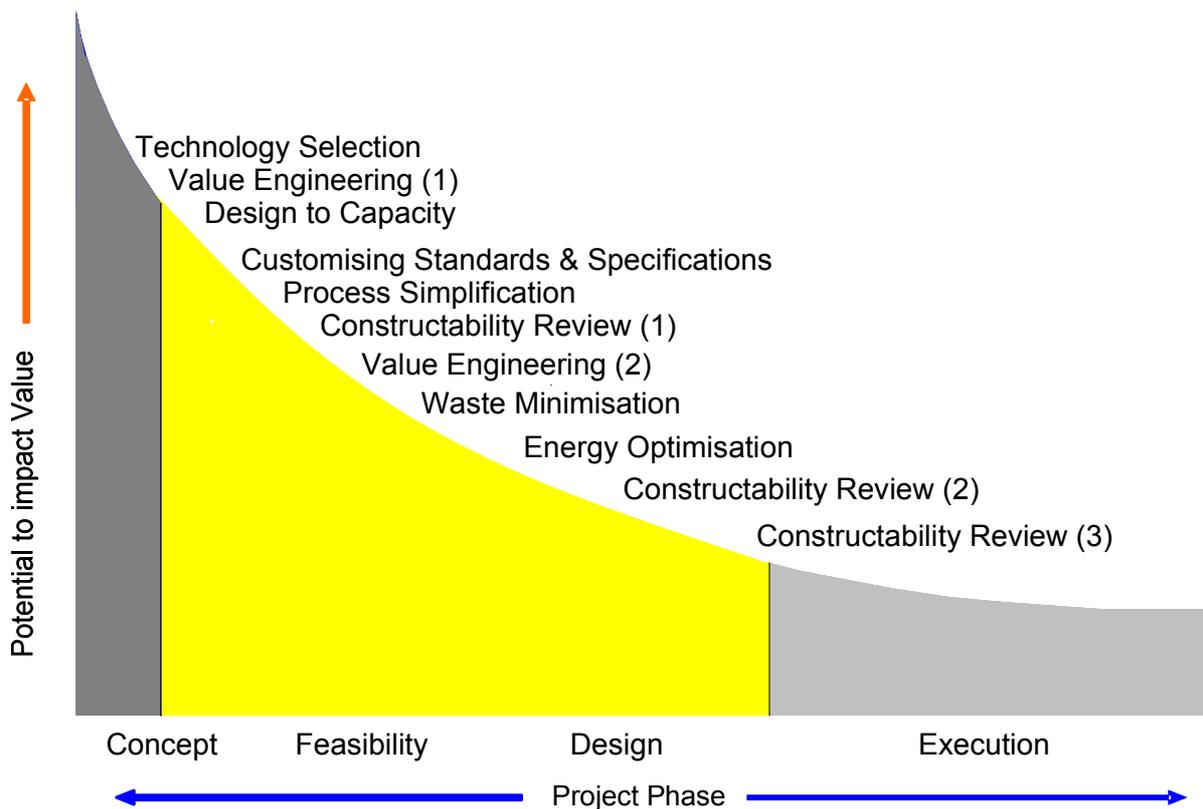
Value Management will focus on Strategic Project Management Functions whereas Value Engineering will apply to Technical Design Functional Requirements.

Note:

Value Engineering is the core methodology used for achieving the defined deliverables of most Value Improvement Practices.

Most VIPs are in fact the objectives or focus of the application of the Value Methodology, which may be applied in the context of Value Analysis, detailed Value Engineering or the broader context of Value Management. A typical Value Study will encompass the objectives of several VIPs.

There can be some overlapping of individually applied VIPs. Several of these objectives may be achieved through integration within the Value and Risk Management process





Benefits?

- Value Engineering measures value by providing best functional performance for the least cost.
- Improvement in capital and / or operational cost
- Preventing “Cut & Paste” approach
- Avoiding potential duplication of process functions

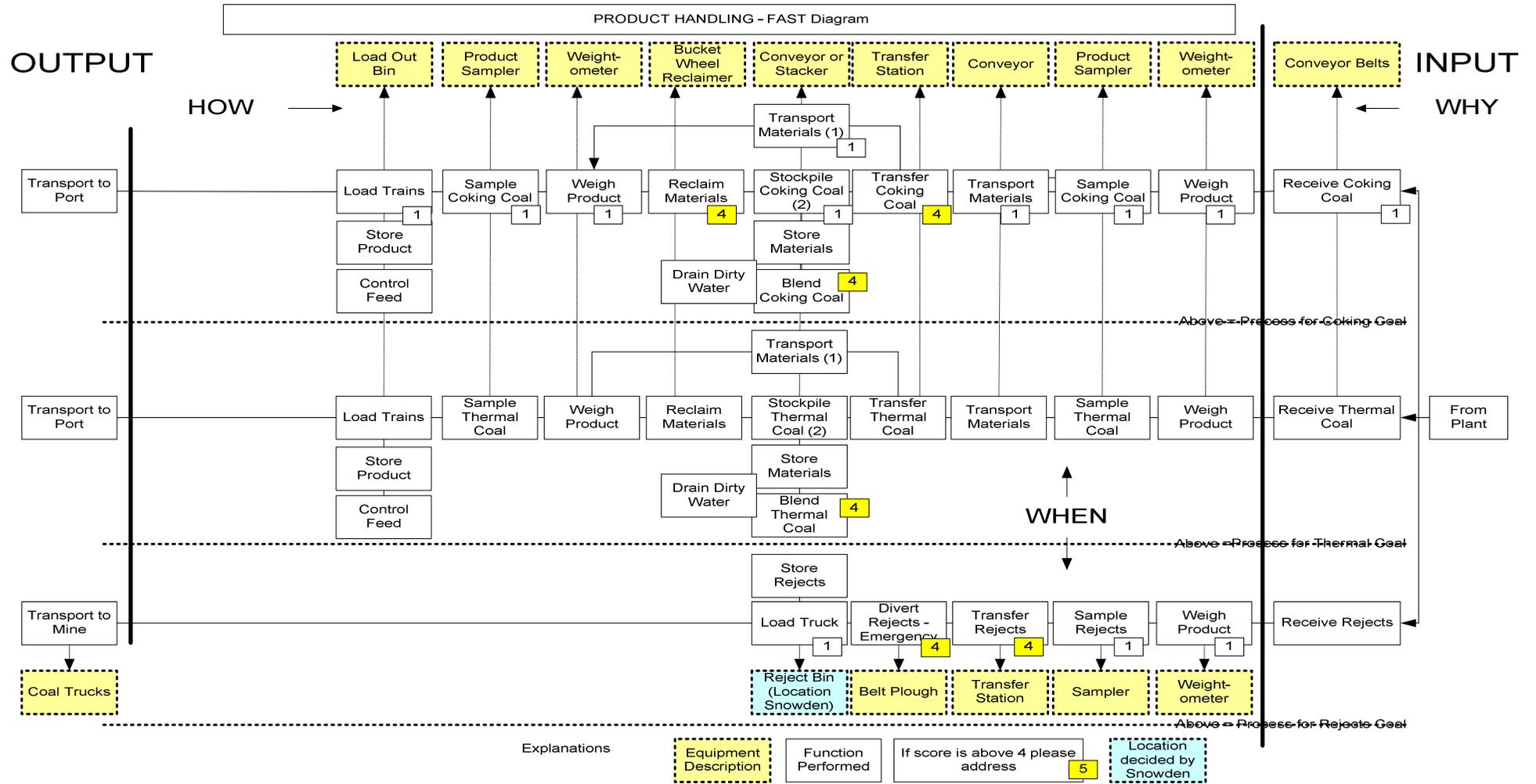
Application Methodology

- Application of Value Engineering principles
- FAST Diagram (Function Analysis System Technique)
- Function / Cost Analysis with Technology Selection, Specification, Standards and Capacity Requirement
- Recommendations with Action Plan



4.2.1 FAST Diagram

MINING: Coal Product Handling





4.2.2 Function / Cost Analysis

(including Technology Selection, Design to Capacity and Customising Standards & Specifications)

MINING: Acid Storage Plant

Ref No:	Function	Secondary Function	Elements / Cost Drivers	Technology / Concept Selected	CAPEX (millions)	Capacity Requirements (Phase 1)	Actual Design Capacity	VE Yes/No	Alternative / Recommendations	Positive	Interesting	Negative	Estimated CAPEX Savings	Comments	Action Plan	When	Who
1.02.1	Create Vertical Access	Create Vertical Shaft (Sinking and Equipping)	Sinking of final portion of shaft. Equipping of Shaft. Contractor performance. Contract	Conventional sinking method	R 600	Sinking rate 20m/month	Sinking rate 20m/month	Yes	Establish best moth balling option for the shaft infrastructure	Impact on Capex.		?		New technology was attempted and failed. Not part of this scope.	Separate session to workshop moth balling option. Review...	end March	George Vase

MINING: Create Vertical Access

Area	Ref No:	Function	Elements / Cost Drivers	Technology / Concept / Specifications Selected	Cost Indicators High/ Medium / Low	Capacity Requirements (nominal)	Capacity Requirements (maximum)	Design Capacity	VE Yes/No	Alternative / Recommendations	Estimated CAPEX Savings	Comments	When	Who
Acid Storage and Load Out	4.01	Store Acid	Product Acid Storage Tanks	Vendor Supplied (Carbon Steel) 2 Tanks	High	0.5 m ³ /hr Acid Liquid Flow Rate		0.9 m ³ /hr Acid Liquid Flow Rate	Yes	Make provision for future installation of anodic protection system		To be able to reduce corrosion rates	end October 20XX	George Vase
			Product acid load-out pump (4x)	Centrifugal Pumps 1 Operating, 1 Standby for each tank	Low	40 m ³ /hr Acid Liquid Flow Rate		40 m ³ /hr Acid Liquid Flow Rate	No			4 pumps required due to two different specification grades between the tanks		



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