Professional Certificate in Value Engineering

Unit 8: Value Engineering in Design

Alternative
Concept: Options or substitutes considered during the design phase.
Related terms: Substitution, Options analysis, Design alternatives.
Explanation: An alternative is any viable change to a component, material, or process that could achieve the same functional requirement at a lower cost or higher performance. In a value engineering study, alternatives are generated through brainstorming and functional analysis.
Example: Replacing a steel beam with a high-strength aluminum alloy to reduce weight while maintaining load-bearing capacity.
Challenges: Ensuring that alternatives do not compromise safety, regulatory compliance, or long-term durability; obtaining reliable data for cost and performance comparisons.

Baseline
Concept: The original design configuration against which alternatives are measured.
Related terms: Reference design, Original specification, Control model.
Explanation: The baseline serves as the benchmark for evaluating cost reductions and functional improvements. It includes all original drawings, specifications, and cost estimates prior to any value engineering intervention.
Example: A building's initial structural system using conventional concrete columns before any value engineering proposals are applied.
Challenges: Accurately documenting the baseline to avoid scope creep; maintaining stakeholder agreement on what constitutes the baseline.

Cost Function
Concept: Mathematical relationship linking design variables to total cost.
Related terms: Cost model, Cost equation, Economic analysis.
Explanation: The cost function quantifies how changes in dimensions, material selections, or manufacturing processes affect overall project cost. It is essential for predicting the financial impact of proposed alternatives.
Example: A cost function $C = a \cdot V + b \cdot A$ where V is volume of concrete, A is area of formwork, and a, b are unit costs.
Challenges: Developing a reliable cost function requires detailed historical data; oversimplification can lead to inaccurate forecasts.

Design Function
Concept: The purpose or service that a component provides within the overall system.
Related terms: Functional requirement, Primary function, Secondary function.
Explanation: Identifying the design function isolates what a part must do, independent of how it does it. This abstraction enables the search for lower-cost ways to fulfill the same need.

Example: The function of a fire-stop door is to prevent the spread of fire, not necessarily to be aesthetically pleasing.
Challenges: Distinguishing between essential and non-essential functions; avoiding functional creep where unnecessary features are retained.

Function Analysis
Concept: Systematic breakdown of a product into its constituent functions.
Related terms: Functional decomposition, Function-cost matrix, FAST diagram.
Explanation: Function analysis maps each component to its required function(s) and assigns a relative importance or cost. This process reveals high-cost functions that are prime candidates for value improvement.
Example: In a HVAC system, functions may include heating, cooling, ventilation, and control; each is analyzed for cost contribution.
Challenges: Requires interdisciplinary collaboration; misidentifying functions can lead to ineffective alternatives.

Function Cost Matrix
Concept: Tabular tool linking functions to their associated costs.
Related terms: Cost-function matrix, Value matrix, Function-cost chart.
Explanation: The function cost matrix displays each identified function alongside its estimated cost, facilitating quick visual identification of high-cost, low-value items.
Example: A matrix showing that “structural support” accounts for 45 % of total cost, while “decorative finish” accounts for 5 %.
Challenges: Accurate cost allocation is difficult when functions overlap; matrix can become unwieldy for large projects.

Functional Cost
Concept: Portion of total project cost attributable to a specific function.
Related terms: Direct cost, Indirect cost, Function-cost allocation.
Explanation: Functional cost isolates the expense of delivering a particular function, allowing engineers to target cost reduction without affecting other functions.
Example: The functional cost of “thermal insulation” in a building envelope may be calculated by summing material, installation, and maintenance expenses.
Challenges: Separating shared costs (e.g., labor) among multiple functions; ensuring cost data is up-to-date.

Life-Cycle Cost (LCC)
Concept: Total cost of ownership from acquisition through disposal.
Related terms: Total cost of ownership, TCO, Life-cycle analysis.
Explanation: Life-cycle cost includes initial capital outlay, operation, maintenance, and end-of-life disposal. Value engineering often seeks to minimize LCC rather than just upfront cost.
Example: Choosing a high-efficiency pump that costs more initially but saves energy over a 10-year service period, reducing overall LCC.
Challenges: Forecasting future energy prices and maintenance needs; accounting for uncertainties and

inflation.

Value
Concept: Ratio of function to cost; the core metric of value engineering.
Related terms: Value index, Value ratio, Cost-performance ratio.
Explanation: Value is expressed as Function ÷ Cost. The goal of value engineering is to increase this ratio by either enhancing function, reducing cost, or both.
Example: If a component provides a function rating of 80 and costs $40, its value is 2.0. Improving the design to cost $30 raises value to 2.67.
Challenges: Quantifying "function" in numerical terms; balancing subjective quality improvements against objective cost reductions.

Value Analysis (VA)
Concept: Systematic method of improving value by analyzing functions and costs.
Related terms: Value engineering, Functional analysis, Cost reduction.
Explanation: Value analysis focuses on existing products, seeking ways to reduce cost while maintaining performance. It is typically applied during the design refinement stage.
Example: An automotive supplier conducts VA on an existing brake caliper, identifying a cheaper casting material that meets performance specs.
Challenges: Resistance from stakeholders attached to legacy designs; limited scope for radical redesign.

Value Engineering (VE)
Concept: Structured approach to improve project value through function-cost optimization.
Related terms: Value analysis, Value management, Value methodology.
Explanation: Value engineering is applied early in the design process, encompassing multidisciplinary teams, systematic workshops, and iterative analysis to achieve cost-effective solutions.
Example: A hospital construction project employs VE to reduce the cost of the mechanical systems without compromising patient safety.
Challenges: Requires early commitment from owners; must align with schedule constraints and regulatory requirements.

Value Engineering Workshop (VEW)
Concept: Collaborative session where the VE team generates and evaluates alternatives.
Related terms: Brainstorming session, Functional analysis workshop, Value study meeting.
Explanation: The VE workshop follows a prescribed agenda—information briefing, function analysis, creativity, evaluation, and development. It is the primary venue for idea generation and rapid screening.
Example: A 2-day VEW for a high-rise office tower yields 30 alternatives, of which 5 are selected for detailed analysis.
Challenges: Facilitating effective participation across disciplines; managing time pressure while ensuring thorough evaluation.

Value Management (VM)
Concept: Broader discipline encompassing VE, strategic planning, and stakeholder alignment.

Related terms: Value engineering, Value delivery, Portfolio management.
Explanation: Value management integrates value-focused thinking into the entire project lifecycle, from concept to operation, ensuring that value objectives are continuously pursued.
Example: A municipal authority adopts VM to align infrastructure projects with community goals, using VE as a tool for cost optimization.
Challenges: Maintaining consistent value criteria across multiple projects; balancing short-term cost savings with long-term strategic objectives.

Value Ratio (VR)
Concept: Numerical expression of value improvement; calculated as New Value ÷ Original Value.
Related terms: Value index, Value increase, Cost-benefit ratio.
Explanation: The value ratio quantifies the impact of a VE proposal. A VR greater than 1 indicates an improvement.
Example: Original design value = 1.5; after implementing a lighter material, new value = 2.0; VR = 1.33 (33 % improvement).
Challenges: Accurate baseline measurement is critical; small errors can inflate or deflate the ratio misleadingly.

Value Statement
Concept: Concise articulation of the desired value outcome for a project.
Related terms: Value objective, Project goal, Performance target.
Explanation: A value statement defines the specific function-cost trade-off the VE team aims to achieve, guiding analysis and decision-making.
Example: “Achieve a 20 % reduction in HVAC system cost while maintaining thermal comfort standards.”
Challenges: Ensuring the statement is measurable, realistic, and aligned with stakeholder expectations.

Value Target
Concept: Quantitative goal for cost reduction or function enhancement.
Related terms: Cost target, Performance target, Value objective.
Explanation: The value target sets a concrete benchmark (e.g., $500 k savings) that the VE effort must meet or exceed. It is derived from the value statement and feasibility studies.
Example: Targeting a 15 % reduction in foundation cost for a bridge project.
Challenges: Over-ambitious targets can demotivate the team; under-ambitious targets may miss opportunities for greater value.

Value Tree
Concept: Hierarchical diagram showing primary function at the top and subordinate functions below.
Related terms: Functional hierarchy, FAST diagram, Function decomposition.
Explanation: The value tree visualizes how complex functions break down into simpler sub-functions, facilitating focused analysis on high-cost branches.
Example: For a water treatment plant, the primary function “Provide clean water” branches into “Filtration,” “Disinfection,” and “Distribution.”
Challenges: Maintaining clarity as the tree expands; ensuring each sub-function is correctly linked to cost

data.

Value Planning
Concept: Process of defining value objectives, schedule, and resources before design work begins.
Related terms: Project planning, Value roadmap, VE schedule.
Explanation: Value planning creates a roadmap that aligns design milestones with VE activities, ensuring that value opportunities are captured early.
Example: Incorporating a VE phase after schematic design but before detailed design in a construction project schedule.
Challenges: Integrating VE timing with conventional design phases; securing budget for VE activities upfront.

Value Proposition
Concept: Statement of the benefits a product or project delivers relative to its cost.
Related terms: Business case, Benefit-cost analysis, Value claim.
Explanation: The value proposition communicates why a stakeholder should accept a proposed alternative, summarizing functional gains, cost savings, and risk mitigation.
Example: “The new façade reduces material cost by 12 % and improves thermal performance, lowering annual energy expenses by 8 %.”
Challenges: Crafting a compelling proposition that resonates with diverse stakeholder groups; backing claims with credible data.

Value Ratio (duplicate removed – already covered)

Value Stream
Concept: Sequence of activities that adds value to a product from concept to delivery.
Related terms: Process flow, Value chain, Lean mapping.
Explanation: value stream analysis identifies non-value-adding steps (waste) that can be eliminated or streamlined during VE.
Example: Mapping the procurement, fabrication, and installation steps for a steel structure to locate bottlenecks.
Challenges: Requires cross-functional data collection; distinguishing between necessary and unnecessary steps can be subjective.

Value Tree (duplicate removed – already covered)

Value Engineering Process (VE Process)
Concept: Structured series of phases from information gathering to implementation.
Related terms: VE phases, VE methodology, VE workflow.
Explanation: The VE process typically follows the phases: Information, Function Analysis, Creative, Evaluation, Development, and Presentation. Each phase builds upon the previous to ensure thorough analysis.
Example: A municipal road project proceeds through VE Information (collecting plans), Function Analysis (identifying traffic flow functions), Creative (brainstorming alternative pavement types), Evaluation

(cost-benefit screening), Development (detailed design of selected alternative), and Presentation (formal report to the council).
Challenges: Maintaining momentum across phases; ensuring documentation is complete for later review.

Value Engineering Study (VE Study)
Concept: Formal investigation that applies VE methodology to a specific project component.
Related terms: VE analysis, VE report, Value study.
Explanation: A VE study documents the entire VE effort, including baseline data, functional analysis, alternative generation, cost estimates, and recommendations. It serves as a decision-making artifact for owners and sponsors.
Example: The VE study for a hospital's medical gas system recommends a modular piping layout, projecting a $250 k saving.
Challenges: Producing a comprehensive yet concise study; obtaining stakeholder buy-in for the recommended changes.

Value Engineering Team (VE Team)
Concept: Multidisciplinary group responsible for conducting the VE study.
Related terms: VE workshop participants, Project team, Cross-functional team.
Explanation: The VE team typically includes a facilitator, a sponsor (owner's representative), designers, cost engineers, contractors, and end-users. Diverse expertise ensures that functional and cost implications are fully explored.
Example: For a university building, the VE team comprises the architect, structural engineer, procurement specialist, facilities manager, and a student representative.
Challenges: Coordinating schedules; managing differing priorities and potential conflicts of interest.

Value Engineering Report (VE Report)
Concept: Final document summarizing findings, alternatives, and recommended actions.
Related terms: VE study report, Executive summary, Implementation plan.
Explanation: The VE report presents the value analysis, cost-saving calculations, risk assessments, and an implementation roadmap, serving as the official record for approval and execution.
Example: The report includes a table of alternatives with their respective cost reductions, a risk matrix, and a phased implementation schedule.
Challenges: Conveying technical detail in a format understandable to non-technical decision-makers; ensuring the report is sufficiently detailed for later audit.

Value Engineering Implementation (VE Implementation)
Concept: Execution of approved VE recommendations within the project schedule.
Related terms: Change management, Construction phase, Post-design integration.
Explanation: VE implementation translates the selected alternatives into actionable tasks, updates drawings, revises contracts, and monitors performance against the projected savings.
Example: After approving a lighter roofing material, the construction team updates the procurement list, revises the structural calculations, and tracks installation progress.
Challenges: Managing change orders; ensuring that cost savings are realized without compromising quality

or schedule.

Value Engineering Phase (VE Phase)
Concept: Distinct stage in the project lifecycle dedicated to VE activities.
Related terms: VE stage, VE window, Design phase.
Explanation: The VE phase is strategically placed when design is sufficiently defined to allow meaningful analysis but still flexible enough for modifications. Commonly, it occurs after schematic design and before detailed design.
Example: In a residential development, the VE phase follows the completion of the site layout and precedes the final construction documents.
Challenges: Timing the VE phase to avoid rework; coordinating with external approvals that may lock design earlier than ideal.

Value Engineering Criteria (VE Criteria)
Concept: Set of performance, cost, and risk benchmarks used to evaluate alternatives.
Related terms: Evaluation criteria, Decision matrix, Selection parameters.
Explanation: VE criteria define the quantitative and qualitative measures—such as cost, durability, maintenance, environmental impact—against which each alternative is scored.
Example: Criteria may include initial cost, life-cycle cost, carbon footprint, and constructability, each weighted according to project priorities.
Challenges: Assigning appropriate weights; ensuring criteria are objective and measurable.

Value Engineering Presentation (VE Presentation)
Concept: Formal delivery of the VE report to stakeholders for approval.
Related terms: Executive briefing, Stakeholder meeting, Decision review.
Explanation: The VE presentation summarizes key findings, justifies recommended alternatives, and seeks endorsement for implementation. It often includes visual aids like cost-benefit charts and risk heat maps.
Example: A 30-minute presentation to the client's board highlights a 12 % reduction in façade cost with no impact on thermal performance.
Challenges: Persuading skeptical stakeholders; managing time constraints while covering all critical points.

Value Engineering Review (VE Review)
Concept: Independent assessment of the VE study's methodology and outcomes.
Related terms: Audit, Peer review, Quality assurance.
Explanation: A VE review validates that the VE process adhered to standards, that cost estimates are realistic, and that identified risks have been appropriately mitigated.
Example: An external consultant reviews the VE study for a bridge design, confirming that the proposed high-strength steel alternative meets all safety codes.
Challenges: Potential bias if reviewers are internal; additional time and cost required for a thorough review.

Value Engineering Methodology (VE Methodology)
Concept: Established framework guiding the systematic application of VE.
Related terms: VE process, Value analysis, Structured approach.

Explanation: The VE methodology provides step-by-step instructions, tools, and best practices for conducting value engineering, often aligned with standards such as SAVE International's VE Manual.
Example: The methodology prescribes the use of FAST (Function Analysis System Technique) diagrams during the creative phase.
Challenges: Rigid adherence may stifle creativity; adapting methodology to project-specific contexts requires experienced facilitation.

Value Engineering Design (VE Design)
Concept: Integration of VE principles directly into the design development activities.
Related terms: Design optimization, Concurrent engineering, Integrated design.
Explanation: VE design embeds function-cost analysis within the normal design workflow, allowing continuous identification of value improvements as the design evolves.
Example: While developing a modular office layout, the designer concurrently evaluates alternative partition systems for cost and acoustic performance.
Challenges: Requires close collaboration between designers and cost engineers; may increase design cycle time if not managed efficiently.

Value Engineering Presentation (duplicate removed)

Value Engineering Workshop (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design (duplicate removed)

Value Engineering Presentation (duplicate removed)

Value Engineering Report (duplicate removed)

Value Engineering Study (duplicate removed)

Value Engineering Team (duplicate removed)

Value Engineering Implementation (duplicate removed)

Value Engineering Process (duplicate removed)

Value Engineering Phase (duplicate removed)

Value Engineering Criteria (duplicate removed)

Value Engineering Review (duplicate removed)

Value Engineering Methodology (duplicate removed)

Value Engineering Design