Updated Value Methodology (VM) Handbook

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NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

Updated Value Methodology (VM) Handbook
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CHAPTER

1

Executive Summary

"A relentless barrage of 'why's' is the best way to prepare your mind to pierce the clouded veil of thinking caused by the status quo. Use it often." — Shigeo Shingo, Japanese industrial engineer who was considered the world's leading expert on manufacturing practices and the Toyota Production System

This handbook is a reference guide on the principles of the Value Methodology (VM) and its application to project development. The handbook is intended for government agencies in the Philippines, particularly implementing agencies, local government units and oversight agencies.

1.1 VM Handbook Purpose & Need

Many books have been written on the theory and technique of the value methodology (synonymous with the terms value analysis, value engineering, value management). This handbook is an update to the 2009 Value Analysis Handbook and is intended to be a reference for government agencies for the conduct/review of VM studies, and for the technical staff of the National Economic and Development Authority (NEDA) who will be charged with the review and validation of these value studies conducted and submitted by proponent agencies. The essential goal of conducting value studies and of the evaluation to be done by NEDA is to ensure that the Government of the Philippines is receiving the best value for money in major development projects. This includes projects that are eligible for evaluation under the Guidelines of the NEDA Investment Coordination Committee (NEDA-ICC).

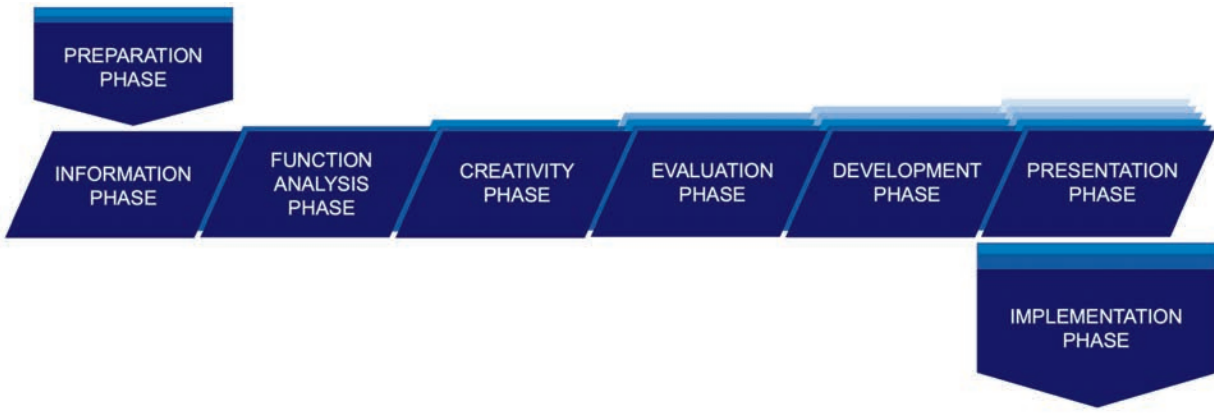
The purpose of the VM Handbook is to:

- Present an update of the practical application of VM for infrastructure projects based on recent developments in the value methodology
- Provide recent information on international best practices and key lessons learned in the use and application of VM
- Serve as a reference for agencies implementing VM within their organizations
- Guide agencies in conducting independent VM studies for infrastructure projects
- Provide a standard for the use of VM across the Philippines
- Serve as a guide for Value Methodology Fundamentals (VMF) 1 training and certification requirements

1.2 VM Handbook Organization

The Updated VM Handbook generally follows the Value Methodology (VM), as prescribed by SAVE International, to lead a team through a structured way of thinking. Each chapter provides specific guidance for conducting value studies in accordance with internationally accepted standards and practices, and includes the following chapters:

- Chapter 1 (this section) presents the purpose and need of the handbook, and how it is organized
- Chapter 2 introduces VM fundamental concepts
- Chapter 3 introduces the first phase of the VM Job Plan, the Preparation Phase (pre-workshop)
- Chapters 4 through 9, introduce the Value Study (workshop), phases 2 through 7
  - Chapter 4, Information Phase
  - Chapter 5, Function Analysis Phase
  - Chapter 6, Creativity Phase
  - Chapter 7, Evaluation Phase
  - Chapter 8, Development Phase
  - Chapter 9, Presentation Phase
- Chapter 10 introduces the last phase of VM Job Plan, the Implementation Phase (post-workshop)



In addition, this Updated VM Handbook includes Appendices that provide resources, checklists, and templates for the VM practitioner.

According to SAVE International, the "Value Methodology (VM) is a systematic process used by a multi-disciplinary team to improve the value of a project, product, process, service or organization through the analysis of functions"

CHAPTER

2

Value Methodology (VM) Fundamentals

"All cost is for function." — Lawrence D. Miles, founder of Value Analysis

The Value Methodology was officially created and named "Value Analysis" in 1947. The founder and "Father of Value Analysis" (as he originally called it) is Lawrence Delos Miles. Miles developed the technique while working at General Electric in its purchasing department. During World War II, Miles needed to find and procure electronic parts that were in extremely high demand. He thought, "If I cannot get the material that isspecified, could I get something else that would do the job?" He would ask the question, "If I can't get the product, I've got to get the function. How can you provide the function by using some machine or labor or material that you can get?" Time and time again during the war, Miles was able to deliver the needed functions to General Electric. To his credit, he also determined that many times, the replacement parts cost less and performed better than those originally specified. This was the birth of function analysis, as we know it today, and remains the single most important distinction of VM as compared with other improvement processes or options analysis.

2.1 Concept of Value

2.1.1 Value Defined

Miles defined value in terms of the relationship between function and cost. He stressed that value is established by the user's, or the customer's, needs and wants. He stated that a product or service is considered to have good value only if it has appropriate performance and cost. He also made the following observations:

- Value is always increased by decreasing costs while maintaining performance
- Value is increased by increasing performance due to customer needs/wants, and there is willingness to pay for added performance

Other ways to improve value:

- Increase performance while increasing costs, such that the improvement in performance is greater than the increase in cost
- Decrease performance while decreasing costs, such that the decrease in cost is greater than the decrease in performance while still delivering the functions and minimal performance needed by the customer

The figure below shows the value concept as defined by function / resources, and illustrates the ways that value can be improved:

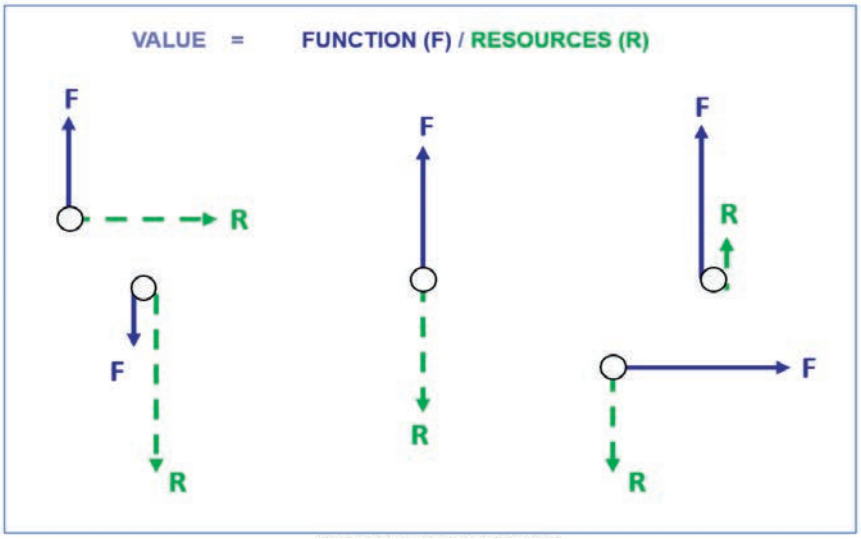


Figure 2.1 Value Concept Illustrated

It is not uncommon to find decision makers using the word “value” interchangeably with “price” or “cost.” This common misunderstanding may lead to the wrong decision(s) being made, cutting corners, and cheapening or damaging the performance of the project. This misconception has also led many to refer to any cost reduction activity as “value engineering.” The concept of value cares for both the customer’s needs and the organization’s interests in better using the available resources to satisfy these needs. Function is the means to describe the customer’s needs and wants which broadens the understanding of the problem or opportunity in such a way that it drives the generation of creative alternatives.

2.1.2 Who Determines Value?

Value is frequently extrinsic and depends upon an individual’s point of view. Seldom is value singular in nature and it usually involves several perspectives, including customers, users, stakeholders, design/development/delivery team, and decision makers.

2.1.3 Elements of Value include:

- Performance – the capacity of a project to fulfill its functional requirements
- Quality – synonymous with performance; conformance to standards and/or specifications
- Time – project delivered in a timely manner
- Cost – resources required to realize the project (initial costs, life cycle costs)
- Risk – the impact of uncertainty on cost and schedule

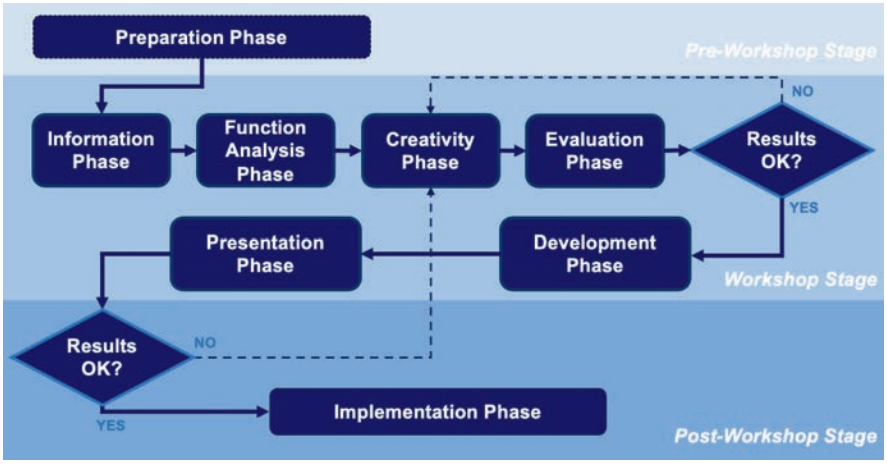
2.2 Function

Function is the element of value that focuses on achieving the customer’s needs and broadens the mind of the team performing the VM activity. Function is defined as a non-specific abstraction, consisting of an action verb and a measurable noun, that describes what an element of a project, product, process, services or organization does or should do. VM acknowledges that customers do not buy things, but the function, or result that they receive from those things.

2.3 The Value Methodology

Since its creation, the Value Methodology has received different names (e.g., value engineering or value analysis). The Value Methodology (VM) follows a sequence of phases, or steps, designed to lead a multidisciplinary team through a structured way of thinking. This process is referred to as the Value Methodology Job Plan. The VM Job Plan must be followed, from start to finish, to fully create the benefits of value improvement.

The VM Job Plan is illustrated and explained below, as well as its phases, functions, objectives and outcomes.



THE VALUE METHODOLOGY

(Synonyms: Value Analysis, Value Engineering and Value Management) is a function-oriented, systematic, team approach to add customer value to a program, facility, system, or service. Improvements like performance, quality, initial and life cycle cost are paramount in the value methodology. The workshop is conducted in accordance with the methodology as established by SAVE International, the value society, and is structured using the Value Methodology as illustrated at left and outlined in the table below.

Value Methodology Stage/Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
Phase 1 Preparation Phase	• Identify Subject • Identify Goals • Define Value • Organize Effort	• Identify study project • Identify study roles and responsibilities • Define study scope, goals and objectives • Select team leader • Conduct pre-study meeting • Select value study team members • Identify stakeholders, decision-makers, and technical reviewers • Obtain time commitment • Identify data collection • Select study dates • Determine study logistics, agenda • Collect and distribute data • Perform technology dry-run for virtual workshop • Send team primer to value study team • Value team members to complete Key Issue Members (KIM)	• Fosters understanding of value study priorities • Define and manages expectations • Organizes the value study • Offers a thorough review of the project • Tests meeting platform and virtual tools to maximize engagement and collaboration • Primes the team for the value workshop

Value Methodology Stage/Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
Phase 2 Information Phase	• Analyze Information • Transform Information • Orient Participants	• Present design concept • Present stakeholders' interests • Review project issues and objectives • Discuss deviation from design standards • Define project performance metrics • Discuss problems the project must solve; identify issues the design may not address • Visit project site/virtual site tour	• Bring all value study team members to a common understanding of the project, including its challenges and constraints • Establishes the benchmark for which to identify alternatives • Gains a real-world perspective of the project and builds foundation for function analysis
Phase 3 Function Analysis Phase	• Define Functions • Allocate Resources • Allocate Performance • Prioritize Functions	• Identify and classify functions • Apply cost and risk relative to performance • Prioritize functions • Select specific functions for study	• Provides a comprehensive understanding by focusing on what the project does rather than what it is • Identifies what the project must do to satisfy needs and objectives • Focuses on functions with the greatest opportunity for project improvements
Phase 4 Creativity Phase	• Generate Ideas	• Brainstorm to generate performance -focused ideas for alternative ways to perform functions • Discuss, build-on and clarify ideas	• Value team develops a broad array of ideas that provides a wide variety of possible alternative components or methods to improve project value

Value Methodology Stage/Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
Phase 5 Evaluation Phase	• Evaluate Ideas • Select Ideas	• Eliminate obvious “fatal flaw” ideas • Score ideas based on meeting performance criteria, value key and project/study goals • Discuss conflicting ranking, further clarify ideas and determine final rankings • Discuss ideas with client decision-makers (midpoint review) • Assign alternatives for development phase	• Prioritize ideas for development, focusing on those with the highest potential for performance improvement and cost savings • Determine value: performance/ cost • Focuses team’s effort to develop alternatives that best meet client study objectives
Phase 6 Development Phase	• Transform Ideas • Develop Information	• Validate and refine idea concepts • Compare to original design concept • Define implementation considerations • Prepare sketches and calculations • Measure performance • Estimate costs, life-cycle cost benefits /costs	Provides side-by-side comparison of baseline and alternative – concepts, initial costs, life-cycle costs, sketches, performance metrics
Phase 7 Presentation Phase	• Present Information • Propose Change	• Present developed ideas to client, designers, decision-makers, stakeholders • Document feedback • Produce draft report	Ensures management and other key stakeholders understand the rationale of the value alternatives and design suggestions
Phase 8 Implementation Phase	• Implement Change • Manage Change • Realize Value	• Document process and study findings • Develop and distribute Value Study Summary Report • Review Study Summary Report • Assess alternatives for acceptance • Prepare draft implementation dispositions • Resolve conditionally accepted alternatives • Develop implementation plan with project manager • Project manager sign-off on value implementation plan • Final presentation of study results	• Involves those who will implement and increases likelihood of implementation • Improves actual value of the project

2.4 Value Enhancing Methods (VEMs)[1]

VEMs are methods, tools and techniques that are complementary to the value methodology and can be used to continue to enhance the value of a program, project or process. VEMs are characterized as relating to the planning, design and construction of government facilities and processes and are formal, repeatable best practices. The following VEMs may benefit the use of the formal value methodology process as described in this handbook.

- Weighted Evaluation Techniques – The purpose of the weighted evaluation technique is to provide a more objective method to evaluate subjective / qualitative attributes and rank competing ideas for consideration. The criteria and attributes should be defined during the preparation or information phase of the VM study, and then rated and ranked by using a paired comparison to determine the weight to be used for each criterion.
- Voice of the Customer/User – it is essential to understand the qualitative and quantitative wants of the customer/user to determine critical design features, concerns and wants. This can be accomplished during interviews, surveys and feedback. This information should be provided to the VM study team, however, it should be determined if the information provided is defined as desired scope for the project.
- Leadership in Energy and Environmental Design (LEED) Checklist – This checklist was first developed by the U.S. Green Building Council. The checklist can be used during the creativity phase of the VM job plan to identify ideas for improving building sustainability (green buildings). It can also be used for owners interested in lowering life cycle costs. Website: www.usgbc.org
- Envision Rating Tool – The principles of sustainable development are fundamental to how civil engineers and the public can more successfully address return on investment, critical societal needs, environmental pressures, and the impacts of climate change. This led APWA, the American Council of Engineering Companies (ACEC), and the American Society of Civil Engineers (ASCE) to launch a not-for-profit organization dedicated to sustainable infrastructure; Institute for Sustainable Infrastructure (ISI). ISI's sustainability rating tool, Envision, provides a holistic framework for evaluating and rating the community, environmental, and economic benefits of all types and sizes of infrastructure projects. This is a unique focus on sustainability through project planning, environmental review, final design, specification development and construction. Website: www.apwa.net
- Life-cycle Costing (LCC) – Defined as "an economic assessment of competing design alternatives, considering all significant costs over the economic life of each alternative expressed in equivalent dollars." Life-cycle costing is an important tool in conducting the VM study. This includes the sum of all recurring and one-time (non-recurring) costs over the full lifespan or specified period of a project, process or organization. It includes the initial (capital) costs, operating costs, maintenance and upgrade costs, and remaining (residual or salvage) value at the end of ownership or its useful life, including salvage or decommissioning costs.
- Choosing by Advantages (CBA) – Is a tested and effective decision-making system. It simplifies, clarifies and unifies the art of decision-making. CBA organizes the art of decision-making into three areas: sound decision-making, congruent decision-making, and effective decision-making.

- Constructability – Adding constructability elements into a VM program during the design phase can aid in designing value into the project in lieu of designing and then determining that what has been designed will be much more expensive to construct or may be much more difficult to construct, increasing costs and schedule. Additionally, a Value Engineering/Constructability, Stage 2 workshop, as described by the Metropolitan Water District of Southern California, can be performed at the 60% phase of a design. The goal of this workshop is to focus on constructability issues that may have caused an increase in cost, lengthens the construction schedule, increases the liability to the owner, and increases risk to the contractor, which may increase construction bids and/or reduce the number of qualified bidders.
- Lean Construction – The Lean Project Delivery System (LPDS) uses an approach to project delivery that uses physics to dissect design and construction in order to remove waste from each component in design. Website: www.leanconstruction.org
- Partnering – A management tool for design and construction to develop a better team approach to working together to reduce conflict and claims on a project. This is a formal workshop geared towards a team approach to delivering a project with the team developing a common understanding of the project values and goals, as well as developing a Conflict Management Plan to resolve project issues throughout the design and construction process.
- Alternative Delivery Project Delivery – Additional tools are available for delivering projects other than the Design-Bid-Build project delivery method. This includes Design-Build (DB) and Construction Manager/General Contractor (CMGC). If these methods are used, the value methodology is a good tool to be applied during the design and pre-construction phases of these two project delivery methods. The benefit of this is that the contractor that will be building the project is a part of the process and they bring a wealth of means and methods as well as construction experience to the formal workshop.
- Value Engineering Change Proposals (VECPs) - This VEM is used during the construction of a project and differs from the formal VM used during the planning and design phases of a project. Using VECPs on a project to continue to promote adding value to a project during the construction phase. There is a formal specification that is provided in the construction specifications with the procedures and the definition of a VECP. VECP savings are usually shared between the contractor and the owner, and cannot have a focus on saving money that will negatively impact project performance. A sample VECP specification can be found in Appendix A-2.

2.5 Programmatic Use of VM

The value methodology can be applied to aid the organization in developing and prioritizing a program to be implemented. The VM job plan, as described throughout this handbook, will be the same for a program versus a project. The direction provided to accomplish a programmatic value study should consider the following:

- A definition of the program under study; as an example, if there is an existing or new airport, what are all of the projects that need to be included to meet the full development program? Include the critical factors for the study team to understand the phasing requirements to allow for partial use.
- Determine the timeline or schedule for the completion of the program.
- Determine the annual budgets available for development of the program over the established timeline.
- Define the constraints associated with the development of the program.
- Define the goals associated with the development of the program, including requirements and needs for partial use of the facility.

The focus of the programmatic study will be to aid the organization in an overall development plan, selecting projects, and identifying when they should be integrated into the capital investment program but still allow partial use, as needed, of the program being implemented.

Other programmatic uses may include similar types of projects whereby similar improvements may be required on multiple facilities. For example, there may be several existing dams that all require rehabilitation and repair. A programmatic value study could focus on all potential types of repairs and rehabilitation approaches that might be available to accomplish the goals of each of the individual dams, although the level of work required may vary. This way, only one value study would be needed, with the report providing the documentation and a “laundry list” of possible repair and rehabilitation options that can be selected from to meet the specific goals of each facility.

2.6 International Best Practices and Lessons Learned in VM

The value methodology is used around the world. Various organizations supporting the value methodology and training can be found within the following organizations:

- SAVE International, including international chapters Eastern Mediterranean/Africa, New Zealand/Australia, Gulf, Mexico and Taiwan.
- Affiliate Organizations in countries with signed agreements with SAVE International to promote the benefits derived from the value methodology as endorsed by SAVE International. These include the Society of Japanese Value Engineers (SJVE), Society of Hungarian Value Engineers (SHVE), Indian Value Engineering Society (INVEST), Society of Korean Value Engineers (SKVE) and the Value Management Institute of Taiwan (VMIT).
- Inter-Society Agreements with SAVE International promoting the benefits of value management and value enhancing methods including:
    - Association for the Advancement of Cost Engineering (AACE International)
    - Association of German Engineers (VDI)
    - DACE Cost & Value (DACE)
    - Hong Kong Institute of Value Management (HKIVM)
    - Society of Product Cost Engineering & Analytics (SPCEA)
    - Society of American Military Engineers (SAME)
    - Value Analysis Canada (VAC)
    - Value Engineering Society of China (VESC)

Additional international organizations that support the value methodology include the following:

- Value for Europe

2.7 International Best Practices and Lessons Learned in Government

During the update of this Handbook, several international VM organizations and governments were contacted to be able to provide best practices and lessons learned in the development, use and management of VM. It has been determined that very few international government organizations have an established VM program. However, for the few that do have a formal program, the following have been noted:

Ministry of Ontario, Canada Experience

The Ontario Ministry of Transportation (MTO) completed its first Value Engineering (VE) study in 1995. Early successes on highway projects helped to expand the program. MTO now does VE studies on highway standards, business processes, as well as highway projects. Since 1998, accepted savings from the Ministry's VE program exceeds $150 Million. Other benefits obtained from the program include:

- Business process improvements
- Innovative ideas
- Collaboration with partners
- Better project performance
- Improved safety
- Maximized value for taxpayers

Typically, eight to ten studies are undertaken each year, with over 350 personnel trained in VM.
MTO's VE program was nationally recognized by the Canadian Society of Value Analysis through an award for its contribution to the advancement of Value Management in Canada.

Success Stories

Many of MTO's success stories have been published in Road Talk, Ontario's Transportation Technology Transfer Digest. Excerpts from these articles are linked below.

- VE Change Proposals in Construction
- Connecting Across Boundaries
- CSVA Award: MTO Nationally Recognized for Value Engineering Program
- Teamwork Delivers New Design Concept
- 2004 CSVA Conference - Value Solutions: A Path to Sustain Infrastructure
- SAVE International Award for MTO Employee
- Functional Performance Specifications

VM Program Lessons Learned

1. Part-time staff will get part-time results. If resources are dedicated, the salaries will easily be paid by the Return of Investment (ROI).
2. Annual written reports on results will keep the program going and give the staff goals. These are invaluable later when someone inevitably asks why a program is needed.
3. It is important to educate decision-makers and others who will be involved at the periphery of the program. This can be achieved by developing a range of training courses for people not wanting to get certified through SAVE training.
4. ROI can be captured by ensuring that workshop results get implemented into individual projects. This can be achieved by developing and managing a formal implementation process.
5. It is good to start small with easy targets. Wait to take on complex things like organizational change and programmatic approaches, until there are specific successes within the organization.

ProRail, Netherlands Experience (Adopting Value Management in the Organization: Challenges for VM Champions – Paper)

The VM program of ProRail, Manager of the Dutch Railway Infrastructure was established 20 years ago and is still evolving. Today, VM within ProRail includes 55 in-house Value Engineers and over 200 completed value studies resulting in a total potential cost saving of around €800 million.

ProRail's development of VM includes three stages signified by the growth of Value Management in an organization. These are Orientation, Adoption and Integration.

- When these stages are related to the work of Champions, the Orientation stage starts when the organization has appointed someone to explore VM (the Champion) and to probe if there is amino for the methodology within the organization. Alongside exploring VM, the Champion also needs to find out whether there is sufficient support among employees of the organization. The key focus of this stage is to determine whether VM is beneficial for the organization, there is sufficient support, and it is worth further investment.
- The second stage of development, the Adoption stage, describes the situation when VM has taken root, but needs to grow further. This is the point at which the Champion needs to generate additional support, and tries to establish and embed the VM methodology further in the organization.
- In the third stage, the Integration stage, the methodology has arrived at a point where it is, more or less, fully embedded in the organization. It needs to be monitored, updated and maintained. This is also the stage when VM may affect strategic plans of the organization.

VM Program Lessons Learned – Multi European Organizations (Adopting Value Management in the organization: Challenges for VM Champions – Paper)

A survey was conducted of approximately 49 individuals following a presentation on this subject at the VDI Wertanalyse conference on 22 May 2019 in Mannheim, Germany (Hendriksen, 2019). Nine (9) VM Champions responded. The Champions represented a wide variety of organizations, varying from public civil engineering organizations to private multinationals in different industries. Based on the responses of the survey participants, five (5) categories of success were defined:

1. The degree of VM management support;
2. The extent to which VM is embedded in the internal processes of the organization;
3. The organizational awareness of VM;
4. VM knowledge and training; and,
5. The number of success cases.

The success indicators that the Champions use are tailored to specific stages of development. This means that in the Orientation stage, the success criteria are quite moderate and humble, but become more challenging in the Adoption and Integration stages that follow. Also apparent is that the success indicators gradually change in character, from ad hoc informal indicators, via structured organizational indicators, to VM maintenance indicators. By “informal”, this means indicators or actions that are not embedded in organizational policies and procedures; for example, the number of people that know the VM Champion, corridor talk, and the number of training programs that are offered ad hoc. In the Adoption stage, the VM success indicators become more formal or more linked to organizational procedures and policies, indicating the return of investments (ROI) of VM, and stressing the efficiency and effectiveness of VM. Regarding the Integration stage, the nature of the indicators change to VM maintenance, as is indicated, although VM is fully embedded, it can also erode.

Ministry of Land, Infrastructure, Transport and Tourism (MOLIT) Experience (data from SJVE 2021)

The following represents their background into the introduction of VM into their organization:

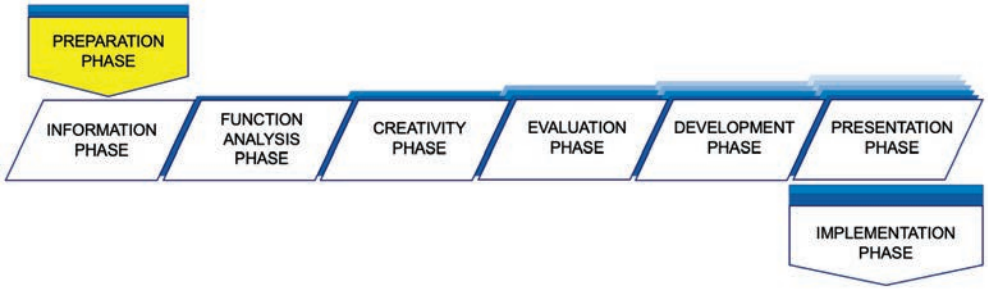
1. After the economy bubble burst, there was a social background established that required quality assurance and cost reduction within the organization;
2. A basic philosophy of Design-phase VE was established in 2000;
3. Design-phase VM was institutionalized in the Cost Structure Reform Program (2003);
4. The program currently relates to VM applied in the design phase and VE at the construction stage. (at the time of bidding and again after contract award);
5. Based on the design phase VM Guidelines, trial implementation of VM nationwide was carried out for public works; and
6. With the help of VM experts, in-house VM has been carried out by the owners throughout public works.

CHAPTER

3

Preparation Phase

“Nobody plans to fail. They just fail to plan.” — Anonymous



The Preparation Phase is the first phase of the Value Methodology (VM) Job Plan. It is the phase that sets the study up for success and occurs prior to the start of the workshop.

3.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Preparation Phase.

Table 3.1 Preparation Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Identify Subject • Identify Goals • Define Value • Organize Effort	• Identify value study subject • Identify value study roles and responsibilities • Define value study scope, goals and objectives • Select value study team leader • Conduct value pre-study meeting • Select value study team members • Identify stakeholders, decision-makers, and technical reviewers • Obtain time commitment • Identify data collection • Select study dates • Determine study logistics, agenda • Collect and distribute data • Perform technology dry-run for virtual workshop (virtual study) • Send team primer to value study team • Value team members to complete Key Issue Memo (KIM)	• Fosters understanding of value study priorities • Defines and manages expectations • Organizes the value study • Offers a thorough review of the project • Tests meeting platform and virtual tools to maximize engagement and collaboration (virtual study) • Primes the team for the value study

3.2 Identify Project for VM Study

There are certain qualities or aspects of a project that may serve as an indicator for possible VM. The following areas of high cost (or causes of high cost) may indicate poor value and may be a good target for the VM study effort:

- Great complexity in the design—Generally, the more complex the design, the more opportunity for improving value and performance.
- Advancement in the state-of-the-art—Those aspects of design that go beyond the state-of-the-art usually offer potential value savings.
- High degree of time compression in the design cycle—A project having an accelerated design program may contain elements of poor/over design.
- A component or material that is critical, hard-to-get, or expensive
- Intricate shapes, deep excavations, high embankments, steep slopes, etc.
- Components that appear to be difficult to construct
- Overly long material haul (excessive borrow / excessive waste)
- Expensive construction
- Long foundation piles
- Excessive reinforcement
- Cofferdam dewatering
- Architectural embellishment or historic preservation
- Record seeking designs (longest span, highest piers, deepest cut, etc.)
- Large safety factors
- Curb, gutter, and sidewalk (rural)
- Specially designed components that appear to be similar to low-cost off-the-shelf items
- Components that include non-standard fasteners, bearings, grades, and sizes
- Sole-source materials or equipment
- Processes or components that require highly skilled or time-consuming labor
- Items with poor service or cost history
- Items that have maintenance and field operation problems
- Project costs that exceed the amount budgeted
- Standard plans that are in use for more than three or four years

3.3 Goals & Objectives

Once the study subject has been decided, it is time to determine the criteria to measure the value study success. In other words, define the value study's key performance indicators and then set a clear baseline and target for them.

Set tough, measurable goals. An easily achieved goal represents no challenge to the team's collective ability and affords no opportunity to build team commitment. Goals can be further described as objectives identifying specific results. Examples of a value study's goals and objectives:

Table 3.2 Sample Value Study Goals & Objectives

Goal	Objective
Reduce project costs by x%	Get the project within the authorized project budget
Reduce project risk	Identify specific mitigation strategies to reduce risks
Meet sustainability requirements	Identify specific sustainable strategies to meet requirement (i.e., LEED Gold)

Often, the problem at hand requires more time than the workshop permits. In these cases, it is important to scope the value study to assure that the team has adequate time to study the problem and offer alternatives.

3.4 Team Structure & Selection

Depending on the scope of the project and time constraints for completion, value studies can vary from a small to a large team effort, and may also have several people assigned to support the team if and when their particular skills are needed. Factors to consider when assembling a value team include:

- Identify the correct team size needed
- Identify subject matter experts needed
- Determine if subject matter experts will serve on the value study part-time or full-time
- Determine if the value study is best served with the participation of an internal team, external team or a hybrid
- Know when to use more than one facilitator
- Know when to request the appropriate stakeholder participation

Personnel from several different departments should be considered when structuring a value team because “value” is not any one department’s responsibility but is shared by the entire organization. Teams consisting of representatives from engineering, project management, operations and maintenance, cost engineering and schedulers may be assigned to value studies. Although there is no set size for an efficient value team, five- to seven-person teams work well in value studies. Information of members to perform the study may be based on the following criteria:

- Use staff / employees who have had VM training to support the value team. Team members should have attended an appropriate VM workshop training seminar and should have familiarity with the value methodology. If such experience is unavailable, include a suitable orientation during or prior to the value study.

- Identify work experience or background of the team members related to the project under study. A mix of talent is desired to achieve different points of view. Typical team members might include a soils engineer, right-of-way specialist, materials specialist, environmental specialist, structural engineer, design engineer, landscape architect, traffic operations specialist, maintenance engineer, or resident engineer. An experienced cost estimator can also be valuable to the team. Many studies suffer from overreaction to popular concerns for the environment, liability, and public opinion. If any of these conditions impact the value study, the team leader should consider including representatives of these "adversary groups" as active team members. (See Appendix B-4 for a sample, based on project type)

The selection of individual team members is of paramount importance. At a minimum, the team should be staffed with a higher level of experience and expertise than the team that prepared the project study or technical design. Team members must have excellent communication skills and work easily within a team environment. It is very important that the team be interdisciplinary. The particular makeup of team members will vary depending on what point of project design or implementation the value study is occurring. At the preliminary planning or "options" stage, more emphasis would be on staffing the team with planning expertise rather than heavy with technical expertise. When VM is done at the project design and implementation stages, the criteria for selecting the value team members shift towards the technical qualifications.

3.4.1 What makes a good value team?

Recognizing that “Quality In” ensures “Quality Outcomes” is critical and part of the entire workshop. ***Criteria to consider for quality team members include:***

Table 3.3 What Makes a Good Value Team Criteria & Description

Criteria	Description
Technical Knowledge	Appropriate technical skills associated with the needs of the specific project that will be under study.
Availability	A consideration will be made in relationship to geographical location and the time and travel required for the team member. The focus is to aid in keeping travel costs to a minimum, but ensuring the right technical staff member is available. Virtual workshops have made it very favorable to obtain specialized expertise at a much lower cost. In addition, the ability of a team members to commit the time necessary to participate in the study is key to workshop success.
Team Member Rotation	It is important to ensure that team members stay fresh and creative. Having a large technical team portfolio allows flexibility to effectively rotate team members which can help to keep energy levels up and new ideas flowing.
Unbiased Opinions	This is very important for all team members and especially the team leaders. The elimination of any ties to the project under study is a critical success factor as well as ensuring that team members maintain creativity throughout the study.

Criteria	Description
Leading Edge	Team members must understand the latest technology including potential means and methods. They will also possess the ability to think “outside the box” to look at new approaches and opportunities.
Life Cycle	It is important that team members have a basic awareness of the impacts of life cycle analysis to be able to apply to ideas and alternatives. Included in these matters are “green-built,” LEED, energy considerations, long-term operations and maintenance costs, etc.

3.4.2 Value Team Guidelines for Engagement

Table 3.4 Value Team Guidelines for Engagement

Guideline	Description
Desire to Learn	Have an open mind on the project and a willingness to learn VM techniques.
Mutual Trust	Ability to express views and differences openly without fear of ridicule or retaliation and tolerance for others to do the same.
Mutual Support	Accept help from others on the team.
Team Objectives	Be personally committed and work together toward the workshop goals and objectives.
Communication	Ability to openly discuss and constructively respond to problems impeding the team’s progress toward goals. This means active listening as well as speaking.
Conflict Resolution	Accept conflicts as necessary and desirable. Do not suppress them or ignore them. Work through them openly as a team.
Utilization of Member Resources	Utilize individual and team abilities, knowledge, and experience fully. Accept and give advice, counsel and support to each other while recognizing individual accountability and specialization.
Control Methods	Accept responsibility for keeping discussions relevant and maintain the integrity of the team operation.
Organizational Environment	Respect individual differences. Do not push each other to conform to central ideas or ways of thinking. Work hard. Keep the “team climate” free, open and supportive of each other.

3.5 Coordination & Logistics

One of the most critical success factors to a value study is the coordination with the parties involved to ensure that the value team can operate at an optimum level when the workshop begins. Coordination activities may include the following:

- Pre-workshop coordination meeting to discuss objectives for the value study, confirm value study agenda, confirm level of participation by stakeholders, and logistics for the value study
- Locate, reserve and/or confirm a meeting room that is adequate for conducting the value study
    - Appropriate place for projecting a presentation
    - Adequate open wall area to post flipchart sheets
    - Adequate open wall area to display large format drawings
    - Four to six lineal feet of table space for each full-time team member
    - Comfortable chairs
    - Adequate lighting
- Coordinate site access requirements, both for a site visit and for the value study location, as necessary. For example,
    - Tour a recently completed facility similar to the one being studied
    - Access an area of a project that may be difficult to construct
- Orientation meeting (Best Practice) conducted in advance of value study and reviewing project documentation to facilitate greater understanding and comprehension of the documentation during the value team's pre-workshop review. Topics to be covered may include:
    - Review the planned value study procedure and agenda
    - Discuss stakeholder objectives for the project and the value study
    - Present an overview of the project design
    - Discuss participation levels by key stakeholder representatives during the value study
    - Identify project aspects that need to be discussed in more detail at the value study
    - Review the project's risk register and identify any additional risks
    - Identify key project issues for value team focus
    - Identify any constraints on the scope of the value study
    - Discuss project documentation that will be provided and identify any additional documentation needed
- Coordinate distribution of value study materials, including meeting invitations, agenda, team roster, presentation guidance
- Coordinate distribution of project documents to value team. The timing of distribution of documents is critical to the study team having adequate time to review the documents prior to the value study. It is recommended that documentation be available a minimum of seven (7) to ten (10) days prior to the start of the value study.

3.6 Information Gathering & Distribution

A general list of the documents required for a value study could include (see Appendix B-4 for examples of project documents by project type):

- Basis of Design documents
- Project drawings
- Specifications
- Programing documents
- Current working cost estimate (with breakdown of costs)
- System narratives
- Supporting documents (e.g., geotechnical reports, design standards, economic criteria, etc.)
- Review of similar study reports and lessons learned
- Risk Register

3.7 Document Review and Key Issues Memo

It is a good practice for the value team members to review the project documents prior to the value study to facilitate their understanding of the project. The purpose of this review is to come into the value study better prepared to ask clarifying questions of the stakeholders during the Information Phase of the workshop. Documents should be in the hands of the value team at least one week in advance of the value study to allow for adequate review time and documentation.

Key Issues Memo “KIM” **(Best Practice)** - Following the review of the project documentation, each value study team member prepares a memorandum documenting issues, questions, risks, and targets of opportunities for the value study. These KIM can be collected by the value study facilitator and distributed to the entire value team.

3.8 Information Models

In preparation for the workshop, the value study facilitator should generate various information models based on available time and data. These models can then be used in the workshop to help focus the value team on the potential targets of opportunity for value improvement. These models can include:

- Cost models (capital, maintenance, life cycle, operations)
- Energy models
- User cost models

These models are critical to displaying opportunities that the value team may not have seen before. They may communicate new perspectives on viewing the project, both from a cost and value perspective.

3.9 Reasons for Unsatisfactory Results in VM Studies

This section describes the numerous reasons why a value study may lead to unsatisfactory results. These reasons are as follows:

Table 3.5 Reasons for Unsatisfactory Results in VM Studies

Reason	Description
Lack of Information	The amount of accurate and up-to-date information limits the effectiveness of VM. Failure to get sufficient and relevant facts may be due to, and may lead to, a misunderstanding of the full requirements of the original project or a lack of knowledge about available resources.
Wrong Beliefs	Decisions that are based on erroneous beliefs, rather than facts, compromise the effectiveness of VM. For example, planners who make decisions on what a design should accomplish might not properly sense the public's needs. Another example is a designer that holds an inaccurate prejudice against a specific resource might make an improper choice of the best technological alternative.
Habitual Thinking	It is essential that the value team keep up with the state-of-the-art technology and methodology because thinking and doing things in the same way is a frequent cause of poor value. Most people have a tendency to re-use what worked the last time, or to copy the standard set by others without considering the situation. Habitual thinking is also inadvertently promoted by management through the rigid use of a given set of standard designs, procedures, and customs.
Risk of Personal Loss	The tendency of risk averse decision-makers to stick with previously successful methods, as opposed to more relevant methods, reduces the effectiveness of VM. When decisions are based on past experience of "nearly-related" data rather than on something new or unfamiliar, it is difficult for the best new ideas generated in a value study to be chosen.
Reluctance to Seek Advice	Designers and planners are often very reluctant to seek advice from others because they fear it may be seen as a sign of incompetence. Architects, planners and engineers should seek the advice of other competent experts, as they may be able to provide additional insight into the problem. By consulting others, they will be better able to achieve maximum design value.
Time Constraints	When a project appears on a long-range or annual construction program, there is often a critical demand that the project stay on schedule. Frequently, the time pressure is so great that it is impossible to consider properly, if at all, the value of the design approach in development. In cases like these, the designers usually find it necessary to accept the first workable solution to a problem in order to complete the job on time. Seldom is there time to contemplate ideas, or to design for value by developing alternative approaches. When designs are developed under these conditions, they are normally good candidates for a value study.

Reason	Description
Negative Attitudes	VM will not work when decision makers are reluctant to make a change of any kind regardless of the merits of the proposal, especially if the change directly affects their plan or design. The same is true when value teams feel they always provide the best value in their approach, even when only a few of the VM techniques and procedures were used in their studies.
Changing Technology	When a value team fails to recognize and consider rapid strides in the development of processes, products, and materials, it limits the potential for uncovering higher value-adding alternatives. The team must remain cognizant of the constantly changing, and, many times, more inexpensive, ways of performing necessary functions.
Strict Adherence to Requirements	Requirements and published standards are often unrealistically specific regarding performance, materials, safety or procedures. Sometimes the planner or designer assumes requirements are specified when they are not. Traditionally, designers have concentrated on developing designs that exceed all known and assumed requirements. The net result is over-design, with attendant waste of funds. The value team must challenge the requirements to determine if they best meet a need of the project, or just satisfy the published standards.
Performance at any Cost	When a problem is identified, the natural reaction is to develop a design that will solve it completely. However, this may lead to a solution with a cost that far exceeds its value. The cost of solving 95 percent of the problem may be within reason but solving the remainder can unreasonably increase the cost. Solving 95 percent of the problem and using the remaining funds to solve other critical problems may be a more prudent approach.
Poor Human Relations	If the various specialists on complex projects do not work together, they are likely to work at cross-purposes, wasting a great deal of effort, with a final product that lacks value. Lack of good communication, misunderstanding, jealousy and normal friction between human beings is a frequent source of unnecessary costs. Infrastructure projects require the talents of many people, and good human relations are especially critical.

Being well prepared by understanding the project before the workshop is essential for the success during the workshop. It is also important to have each participant feel comfortable about the workshop, know what to expect, and answer any questions that they may have.

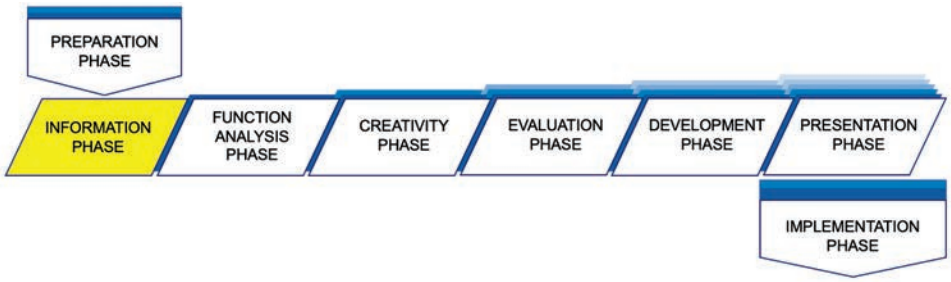
The key is to have everyone fully prepared and ready to begin working towards the desired objectives when the workshop begins.

CHAPTER

4

Information Phase

"A problem well stated is half solved" — attributed to Charles Kettering, head of research at General Motors from 1920 to 1947



The Information Phase is the second phase of the Value Methodology (VM) Job Plan. It is the phase that allows the value team to understand the problem that needs to be solved and is the first phase that occurs during the value workshop. It is followed by Function Analysis, Creativity, Evaluation, Development and Presentation, all occurring during the value workshop.

This phase should provide a thorough understanding of the program, project, system, or operation under study by an in-depth review of all of the pertinent factual data. Complete information is essential to provide a solid foundation for the value study. The complexity of the project, the quality and amount of information made available, and the study schedule will all influence the level of effort devoted to the Information Phase, as well as the outcome of the value study.

4.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Information Phase.

Table 4.1 Information Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Analyze Information • Transform Information • Orient Participants	• Present design concept • Present stakeholders' interests • Review project issues and objectives • Discuss deviation from design standards • Define project performance metrics • Discuss problems the project must solve; identify issues the design may not address • Visit project site / virtual site tour	• Brings all value study team members to a common understanding of the project, including its challenges and constraints • Establishes the benchmark for which alternatives need to be identified • Gains a real-world perspective of the project and builds foundation for function analysis

4.2 Value Process Presentation

After introductions, the value study facilitator should provide an overview of the value methodology and process. This overview should include the definition of Value (Value = Function / Resources), an explanation of the eight phases of the VM Job Plan, and the objectives of the value study. This provides context for the stakeholders, especially those with limited to no previous value study experience. It is also an opportunity for the workshop facilitator to reinforce that a value study is not a cost cutting exercise; rather, it is about adding value to projects.

4.3 In-brief Presentation

Relevant information about the project should be presented to the value team by the customer, designer and/or key stakeholders. This information is typically conveyed in an interactive presentation so that the value team:

- Understands the goals and objectives established for the value study
- Understands the stakeholders' goals and objectives for the project, including budget and schedule
- Understands how the design team has chosen to accomplish those goals and objectives
- Becomes knowledgeable of the specific design elements and the reasons for choosing the selected solution
- Identifies project issues or concerns that need specific focus during the value study
- Identifies constraints on the value study or aspects of the project that would be difficult, if not impossible, to change
- Identifies key criteria influencing the design solution
- Identifies key assumptions that influenced the design or limited alternative solutions
- Recognizes where a status quo or "we have always done it that way" mindset has influenced the design solution
- Identifies any other unique criteria that have included the design solutions
- Clarifies what decisions have been made and which may not be revisited due to stakeholder requirements. Such decisions may include environmental permitting issues that have been settled, firm local construction codes, security requirements, commitments to the public, or funding source-based necessities.

4.4 Site Visit

If a site visit is determined to be feasible and beneficial during the Preparation Phase, the site visit will provide the value team with an opportunity to better understand the physical aspects and context of the project. The workshop facilitator should make sure the site visit moves at an appropriate pace, the value team is engaged in the discussions, and further explanations are provided by the design team. Ideally, the site visit should be attended by the entire value study team, the project manager, key stakeholder representatives, and key design team representatives.

The value team should use the site visit as an opportunity to:

- Validate or clarify their understanding of the information provided.
- Take note of any construction and operational challenges associated with implementing the project.
- Visualize how the project will interface or interact with the existing facility or site.
- Ask questions of the site staff and stakeholders on what is important to them. For example, perhaps certain functional requests were not considered in the current design, and if the value team is able to reduce the project cost during the workshop, then these additional functions could potentially be incorporated into the design.

In some cases, the site visit may be conducted virtually using Google Earth, drone videos, and/or photos.

4.5 Project Analysis

Following the presentations and site visit, the value team should conduct a project analysis session to discuss project issues identified by each value team member to begin the cross-discipline information-sharing process and to identify major areas for the value team's attention. This is an opportunity for the value team to share any thoughts and observations from the document review, presentations, issues memorandums, or site visit.

During this review session, the value team should also review the cost or other informational models that were prepared during the Preparation Phase activities to assist in identifying those project elements with the greatest potential for value improvement. The value team should not be identifying creative ideas at this time. Rather, they should be identifying areas of opportunity for consideration during the Creativity Phase.

The workshop facilitator should review the list of key assumptions and constraints and augment or adjust, as required, based on further insights and enhanced understanding of the project. Such list(s) should be maintained throughout the workshop and integrated into the value study report.

4.6 Risk Identification (Best Practice)

As part of the project analysis, the value team may identify project risks that they noted during their document review, the presentations, or site visit. If the project manager or design team has provided a risk register to the value team, then the identified risks can be added to the existing risk register. If a risk register does not already exist, a new risk register may be created and integrated into the value study report and then provided to the project management team for management throughout the life of the project.

Formal risk identification and population of the risk register is not a requirement for the value study; however, it is a best practice that could be included in the scope of the value study when time and budget allow for it. It is most relevant when the project manager and/or design team considers the project to be exceptionally high risk, typically due to project cost and/or schedule concerns, or for larger / complex projects. This effort is defined as a qualitative risk analysis in lieu of a quantitative risk analysis.

During the course of the value workshop, the value team members may offer suggestions for planned risk responses and identify other risks to include in the register. This register input is an opportunity to access the experience of the value team to better address uncertainties on the project.

When time and budget is an issue for the updating/development of a risk register, the value team should still identify project risks – both threats and opportunities – during the workshop (Note: when discussing functions, it is often beneficial to identify high risk functions that can be further understood during the workshop). In this case, the project manager would be responsible for revising/creating the risk register based on the risks and planned risk responses stated in the value study report.

4.7 Cost Reconciliation (Best Practice)

Following the project presentations, the value team's cost estimator and the design team's cost estimator may meet to reconcile any discrepancies or questions identified during the value team's review of the project scope and the cost estimate. This discussion may be a face-to-face meeting or a teleconference. The objective is for the estimators to reconcile any differences so that both parties agree on the baseline project cost.

A baseline cost estimate is necessary for the value study. This baseline cost estimate will be used as the basis for developing cost comparisons of value proposals.

During the course of the value study, other discrepancies or cost adjustments may be identified. These items should also be documented, and the baseline estimate adjusted accordingly. The final adjusted baseline construction cost and any additional adjustments made during the workshop should be presented at the conclusion of the value workshop.

The cost reconciliation meeting with the value team's cost estimator and the design team's cost estimator is not a requirement but should be considered for every workshop. Some projects may not warrant a formal meeting, but it is dependent upon if the value team's cost estimator is comfortable with the estimate as is or feels that a discussion with the design team's cost estimator is warranted. It is particularly relevant for larger, more complex projects, and/or when there is a lot of uncertainty associated with the current working estimate.

4.8 Key Considerations to Understanding the Project Under Study

There are three important actions to take in order to fully understand the project under study:

- Gather all types of information
- Get the facts
- Get all available costs

4.8.1 Gather All Types of Information: The value team should gather all relevant information, regardless of how disorganized or unrelated it may seem when gathered. The data should be supported by credible evidence, whenever possible. Where supported facts are not obtainable, the team should obtain the opinions of knowledgeable persons. The information sought is seldom found in comprehensive form in one place. The by-words for any value study are "Record Everything."

Information gathering may be subdivided into separate tasks and assigned to individual team members. Various types of data which may be obtained are:

- Physical data such as shape, dimensions, material, skid resistance, color, weight, density, fire resistance, weather resistance, sound absorption capability, deflection resistance, and horizontal and vertical alignment.
- Methods data (i.e., about how it is operated, constructed, fabricated, developed, installed, maintained, and replaced)
- Performance data concerning present performance requirements and actual performance needs in areas of design, operation, maintenance, safety, and utility

- Restrictions (relating to detailed specifications) concerning methods, performance, procedures, operations, schedule, and cost
- Cost data, including a detailed breakdown of costs of labor, material, and markups for both construction and other elements of life cycle cost
- Quantity data relating to the anticipated volume or repetition of use for this project and future uses

The team should obtain information from credible sources. There are two basic principles in this area. The first is to seek information from multiple sources, and the second is to seek the best source for the information desired. The following are typical sources from which the required information might be obtained:

- People Source - Project managers, designers, operators, maintenance, architects, contractors, fabricators, suppliers, and expert consultants.
- Data Source - Planning documents, drawings, computations, design analyses and calculations, specifications, material lists, cost estimates, schedules, A&E scope of work, handbooks, analysis and maintenance manuals, commercial and government standards and codes, test and maintenance reports, user feedback, catalogs, technical publications, previous study data files, management information systems, conference and symposium proceedings, and universities.
- Complete, Pertinent Information - The type of data available will depend upon the status of the design in its overall life cycle, i.e., whether it is in preliminary or final/detailed design or under construction.

A set of design objectives and a statement of requirements may be all that is available early in a project cycle. For an older standard design, such useful data as performance under use, maintenance characteristics, failure rates, and operational costs may be available. In addition to specific knowledge of the project, it is essential for the team to have all relevant available information concerning the technologies involved, and to be aware of the latest applicable technical developments. The more that factual information is brought to bear on the problem, the higher the possibility of a substantial cost reduction.

4.8.2 Get the Facts: Get specific information about the item. Avoid generalities, which serve only to protect the status quo. Work on each function individually before attempting to combine them into a single multi-functioning project. The danger in a generalized statement is that if one exception can be found, the statement is proven wrong. If the proposal depends upon a generalized statement, the validity of the entire study could be compromised.

4.8.3 Get All Available Costs: To make a complete analysis of any project, the total cost of the project and a breakdown of the cost of each design component are needed. The team should use accurate and itemized cost estimates for each proposed design to determine the alternative that offers the greatest cost reduction.

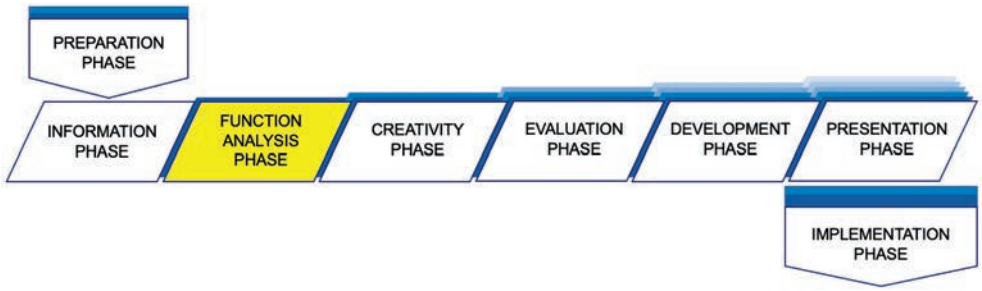
The Information phase focuses on the review and transformation of that information by the value team. It is important to remember that the Information phase is not a one-way street; developing a thorough understanding of the project is best achieved through active dialogue between the design team, customers, users, owners, stakeholders, and the value team.

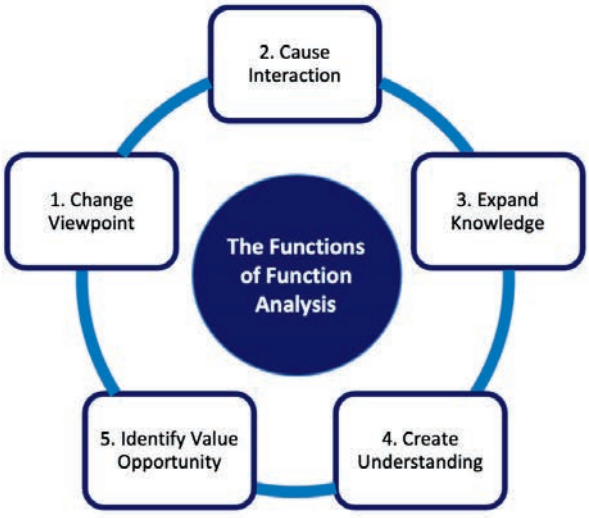
CHAPTER

5

Function Analysis Phase

"Without changing our pattern of thought, we will not be able to solve the problems we created with our current patterns of thought." — Albert Einstein





The Function Analysis Phase is the third phase of the Value Methodology (VM) and is the heart of VM. It is the primary activity that separates VM from all other analysis techniques and sets it apart from traditional cost reduction and other problem-solving efforts. A function is the specific purpose or intended use for any product, process, service, organization, or project that makes it work and sell; it is the reason why the owner, customer, or user needs a thing.

The main purpose of the Function Analysis Phase is to identify the areas that provide the best opportunity to improve value. Function Analysis allows one to view the project objectively in terms of what it does or must do, rather than in terms of what it currently is or how it is currently designed. Function Analysis allows people of diverse backgrounds and interests to communicate and understand each other and the project, simply and clearly in a common language, void of technical jargon. The figure above illustrates "The Functions of Function Analysis."

5.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Function Analysis Phase.

Table 5.1 Function Analysis Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Define Functions • Allocate Resources • Allocate Performance • Prioritize Functions	• Identify functions • Classify functions • Organize functions • Apply cost and risk relative to performance • Prioritize functions • Select specific functions for study	• Provides a comprehensive understanding by focusing on what the project does (or must do) rather than what it is (or how it is designed) • Identifies what the project must do to satisfy needs and objectives • Focuses on functions with the greatest opportunity for improvement

5.2 Elements of Function Analysis

The Function Analysis Phase encompasses the following activities:

- Define Functions – identify, classify and organize functions
- Allocate resources and performance – correlate resources and risk to functions
- Prioritize function – identify and select functions that present the best opportunity to improve value

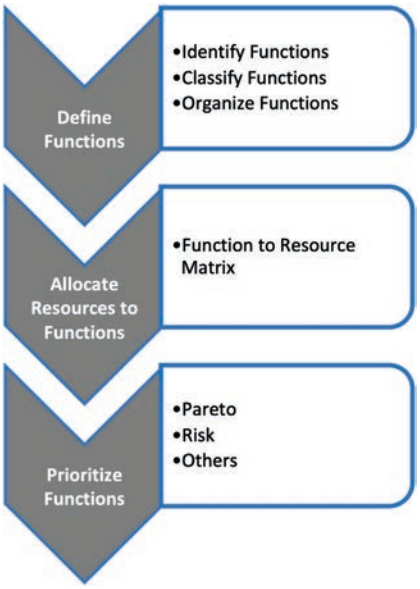


Figure 5.2 Elements of Function Analysis

5.2.1 Define Functions

Attempts to arbitrarily define the functions of the VM study subject can often result in several long descriptions that are neither concise nor workable enough for the VM approach to function.

In VM, function is expressed using two words: an "active verb" and a “measurable noun.”

- The "active verb" defines the action required (it may apply, collect, limit, move, protect, transfer, etc.) and should answer the question “What does it do?”
- The "measurable noun" describes what is acted upon (electricity, load, temperature, force, liquid, surface, sound, etc.) by the active verb, answering the question “What does it do this to?”

For example, the function of a water service line to a roadside rest area could be defined as "provides service." This service, not being readily measurable, does not enable us to seek alternatives intelligently. On the other hand, if we define the function as " transport liquid," the noun in the definition is measurable, and accepted alternatives can be determined based on the quantity of liquid being transported.

The system of defining a function in two words, a verb and a noun, is known as a two-word abridgment. This abridgment represents a skeletal presentation of relative completeness and simplicity. Advantages of this system are that it forces conciseness and avoids combining functions or attempting to define more than one simple function at a time.

5.2.1.1 Identify Functions

Identifying functions is the first and most important step of the Function Analysis Phase. The most common technique used to do this is the random function identification. In this step, the team determines and lists down all possible verb-noun combinations that describe the function of the subject under study.

5.2.1.2 Classify Functions

Once the functions have been identified, they can be classified into the following types:

- Basic functions define the specific purpose for which a subject exists and answers the question, “What must it do?”
- Secondary functions answer the question, “What else does it do?” and usually result from the design or approach selected to perform the basic function.
- Unwanted functions occur as a byproduct, or unintended consequence, of the way another function(s) is performed.
- Higher-order functions represent the specific need(s) or overarching goal(s) that the basic function(s) exists to satisfy and are beyond the scope of the study.
- Lower-order functions describe functions that lie beyond the scope of the VM study and are inputs for a project, product, process, service or organization.

In addition, there are three additional types of functions that are considered when using FAST diagrams:

- Objectives are functions that express specific, compulsory requirements or articulate broader goals of the subject.
- One-time functions are those secondary functions that only happen once.
- All-the-time functions are secondary functions that happen continuously.

5.2.1.3 Organize Functions

Once the functions have been identified, and perhaps classified, it is usually necessary to review, organize, and edit them.

If random function identification is used, then it is highly probable that the VM study team will have stated functions in a number of different ways that have roughly the same meaning. The VM study team should discuss all the functions and arrive at a consensus about which functions to carry forward, which are redundant, and which should be eliminated.

Another way to organize functions is using the Function Analysis System Technique, or FAST, a powerful diagramming technique for analyzing the relationship of functions. FAST diagrams:

- Reveal the specific relationships of all functions with respect to one another
- Test the validity of the functions under study
- Help identify missing functions
- Broaden the knowledge of all team members with respect to the project

5.2.2 Allocate Resources

This step of Function Analysis allocates project resources and potential risk to the functions so that the VM study team can identify opportunities for value improvement. Common project characteristics that can be correlated with functions include performance/quality; cost; time; space (area); volume or weight; or personnel. It is this technique that identifies where unnecessary cost exists within the item under study.

A technique commonly used is the function resource matrix. Steps to construct the matrix include:

1. Start by listing all functions between the scope lines across the top of the form
2. List the major cost groups down the left-hand side of the form with the associated incremental costs
3. Check off which function or functions are impacted by each major cost group
4. Determine how much of the cost or resource belongs to each function
5. Add all columns vertically to determine how much cost or resource is allocated to each function

Examples of function-resource matrices are provided below.

Subject / Project: Warehouse
Resource Type (cost, time, weight, etc.): Space - Gross Square Feet (GSF)

% OF RESOURCE ALLOC.	COMPONENT	QTY	U/M	UNIT	TOTAL	FUNCTION (active verb + measurable noun)														
						Ship Material	Retrieve Material	Store Material	Manage Inventory	Report Inventory	Transport Material	Receive Material	Classify Material	Receive Visitors	Maintain Hygiene	Manage Facility	Maintain Comfort	Energize Warehouse	Maintain Safety	Enclose Space	Ensure Efficiency
100%	Entry/Reception Area	600	GSF		600.00									95%						5%	
100%	Office Area	2000	GSF		2,000.00				20%	20%						35%			10%	5%	10%
100%	Toilets	400	GSF		400.00										95%					5%	
100%	Mechanical/Elect. Eq. Area	1000	GSF		1,000.00												75%	20%		5%	
100%	Truck Dock Area	4000	GSF		4,000.00	45%						50%								5%	
100%	Material Storage Area	52000	GSF		52,000.00		5%	61%			30%		1%						1%	2%	
RESOURCE TOTALS:					60,000.00	1,800.00	2,600.00	31,720.00	400.00	400.00	15,600.00	2,000.00	520.00	570.00	380.00	700.00	750.00	200.00	720.00	1,440.00	200.00
FUNCTION - PERCENTAGE:					100.00%	3.00%	4.33%	52.87%	0.67%	0.67%	26.00%	3.33%	0.87%	0.95%	0.63%	1.17%	1.25%	0.33%	1.20%	2.40%	0.33%

Subject / Project: Warehouse

Resource Type (cost, time, weight, etc.): Space - Gross Square Feet (GSF)

Basic Function: Ship Material

Higher Order Function: Distribute Material

Component	Resource (space GSF)	Function		Function Type	Resource Allocation
		Verb	Noun		
Entry / Reception Area	600	Receive	Visitors	Secondary	95%
Entry / Reception Area		Enclose	Space	Secondary	5%
Office Area	2,000	Manage	Inventory	Secondary	20%
Office Area		Report	Inventory	Secondary	20%
Office Area		Manage	Facility	Secondary	35%
Office Area		Maintain	Safety	Secondary	10%
Office Area		Enclose	Space	Secondary	5%
Office Area		Ensure	Efficiency	Secondary	10%
Toilet Area	400	Maintain	Hygiene	Secondary	95%
Toilet Area		Enclose	Space	Secondary	5%
Mechanical/Elect. Eq. Area	1,000	Maintain	Comfort	Secondary	75%
Mechanical/Elect. Eq. Area		Energize	Warehouse	Secondary	20%
Mechanical/Elect. Eq. Area		Enclose	Space	Secondary	5%
Truck Dock Area	4,000	Ship	Material	Secondary	45%
Truck Dock Area		Receive	Material	Secondary	50%
Truck Dock Area		Enclose	Space	Secondary	5%
Material Storage Area	52,000	Retrieve	Material	Secondary	5%
Material Storage Area		Store	Material	Secondary	61%
Material Storage Area		Transport	Material	Secondary	30%
Material Storage Area		Classify	Material	Secondary	1%
Material Storage Area		Maintain	Safety	Secondary	1%
Material Storage Area		Enclose	Space	Secondary	2%
TOTAL	60,000				

5.2.3 Prioritize Functions

The purpose of this step is the select the functions that have the greatest opportunity for value improvement. The function-resource relationships provide the VM study team direction related to areas of the greatest opportunities for value improvement. At this point, the VM study team will be able to identify which functions are not providing good value. Having completed Function Analysis, the VM study team is ready to key-in on specific functions and brainstorm ideas that will perform the necessary functions.

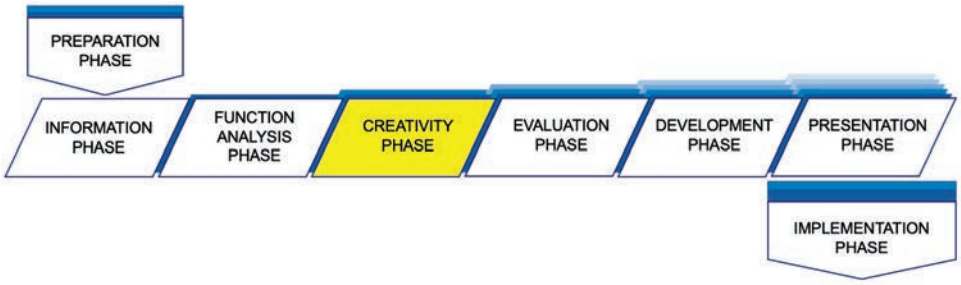
Proper execution of Function Analysis by a multi-disciplined team produces a more creative, comprehensive understanding of an object's functions, enhancing results to achieve or exceed the study objectives.

CHAPTER

6

Creativity Phase

"There is no doubt that creativity is the most important human resource of all. Without creativity, there would be no progress, and we would be forever repeating the same patterns." — Edward de Bono, physician, psychologist, author, inventor, philosopher, and consultant. He originated the term lateral thinking, wrote the book Six Thinking Hats



The Creativity Phase is the fourth phase of the Value Methodology (VM). Its purpose is to generate a large number of ideas or alternatives to accomplish the functions identified in the previous phase, Function Analysis. Key questions to be answered during this phase:

- What else will perform the function?
- What else will do the job?
- Does the job need to be done at all?

The two approaches to solving a problem are analytical and creative. In the analytical approach, the problem is stated exactly and a direct, step-by-step approach to the solution is taken. An analytical problem is one that frequently has only one solution that will work. The creative approach is an idea-producing process specifically intended to generate a number of solutions, each of which solves the problem at hand. All solutions could work, but one is better than the others; it is the optimum solution among those available. Once a list of potential solutions is generated, determining the best value solution is an analytical process.

Creative problem-solving techniques are an indispensable ingredient of effective VM. By using the expertise and experience of the study team members, some new ideas will be developed. The synergistic effect of combining the expertise and experience of all team members will lead to a far greater number of possibilities.

6.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Creativity Phase.

Table 6.1 Creativity Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Generate Ideas	• Brainstorm to generate performance-focused ideas for alternative ways to perform functions • Discuss, build-on and clarify ideas	• Value team develops a broad array of ideas the provide a wide variety of possible alternative components or methods to improve project value

6.2 Discourage Creativity Inhibitors

For these processes to work well, mental attitudes that retard creativity must be overcome. The facilitator should point out creativity inhibitors to the study team. Awareness of these inhibitors encourages people to overcome them. In his book, Value Engineering Theory, Donald E. Parker, identifies the following as common habitual, perceptual, cultural, and emotional blocks to creativity:

Table 6.2 Blocks to Creativity

Habitual Blocks	• Continuing to use “tried and tested” procedures even though new and/or better ones are available. • Rejection of alternative solutions that are incompatible with habitual solutions. • Lack of positive outlook, lack of effort, conformity to custom, and reliance on authority.
Perceptual Blocks	• Failure to use all the senses for observation. • Failure to investigate the obvious. • Inability to define terms. • Difficulty in visualizing remote relationships. • Failure to distinguish between cause and effect. • Inability to define the problem clearly in terms that will lead to the solution of the real problem.
Cultural Blocks	• Desire to conform to proper patterns, customs, or methods. • Overemphasis on competition or cooperation. • The drive to be practical above all else, thus making decisions too quickly. • Belief that all indulgence is fantasy and a waste of time. • Faith only in reason and logic.
Emotional Blocks	• Fear of making a mistake or of appearing foolish. • Fear of supervisors and distrust of colleagues. • Too much emphasis on succeeding quickly. • Difficulty in rejecting a workable solution and searching for a better one. • Difficulty in changing set ideas (no flexibility) depending entirely upon judicial (biased) opinion. • Inability to relax and let incubation take place.

Other attitudes to avoid (adapted from Michel Thiry's "Value Management Practice") are:

- It is not realistic.
- It is technically impossible.
- It does not apply.
- It will never work.
- It does not correspond to standards.
- It is not part of our mandate.
- It would be too difficult to manage.
- It would change things too much.
- It will cost too much.
- Management will never agree.
- We do not have time.
- We have always done it that way.
- We already tried it.
- We never thought of it that way.
- We are already too far.

It should be emphasized that the Creativity Phase does not necessarily identify final solutions or ideas ready for immediate implementation. It often provides leads that point to final solutions.

6.3 Establish Ground Rules

The ground rules for creative idea generation (adapted from J. Jerry Kaufman and James D. McCuish, "Getting Better Solutions with Brainstorming," SAVE International Annual Conference Proceedings, Volume XXXVII, Denver, Colorado, 5-8 May 2002) are summarized as follows:

- Do not attempt to generate new ideas and judge them at the same time. Reserve all judgment and evaluation until the Evaluation Phase.
- Focus on quantity, not quality. Generate a large quantity of possible solutions.
- Seek a wide variety of solutions that represent a broad spectrum of attacks upon the problem; the greater number of ideas conceived, the more likely there will be an alternative that leads to better value.
- Freewheeling is welcome. Deliberately seek unusual ideas.
- Watch for opportunities to combine or expand ideas as they are generated. Include them as new ideas; do not replace anything.
- Do not discard any ideas, even if they appear to be impractical.
- Do not criticize or ridicule any ideas.

6.4 Generate Alternative Ideas

In this phase of the study, it is important to generate a free flow of thoughts and ideas for alternative ways to perform the functions selected for study, not how to design a product or service. While creativity tools are available for problem-solving situations, no specific combination of techniques is prescribed for all VM efforts, nor is the degree to which they should be used predetermined. The selection of specific techniques and the depth to which they are used is primarily a matter of judgment and varies according to the complexity of the subject under study.
The following describes some idea-generation techniques commonly used in the VM context:

- **Classical Brainstorming.** Classical Brainstorming, as developed by Alex Osborn, is the most common idea-generating technique in use. Although it is universally known, specific rules govern the brainstorming process that may not be so well known or practiced; these include (1) criticism is forbidden; (2) freewheeling is encouraged; (3) go for lots of ideas (quantity); (4) combine, expand and hitchhike on ideas. Brainstorming is a free-association technique that teams use to solve specific problems by recording the ideas as individuals in the group spontaneously contribute. Brainstorming is primarily based on the premise that one idea suggests others, and these suggest others, and so on. Brainstorming could be done by an individual, but experience has shown that a group can generate more ideas collectively than the same number of persons thinking individually. It is also possible to combine group and individual brainstorming. For example, after the group brainstorming process is complete, individual brainstorming can generate additional ideas of comparable quality.
- **Gordon Technique.** The Gordon technique is closely related to brainstorming. The principal difference is that no one except the group leader knows the exact nature of the problem under consideration. This difference helps avoid premature ending of the session or egocentric involvement. A participant may cease to produce additional ideas or devote energy only to defending an idea if convinced that one of the already proposed ideas is the best solution to the problem. It is more difficult to select a topic for such a session than for a brainstorming session. The subject must be closely related to the problem at hand, but its exact nature must not be revealed until the discussion is concluded.
- **Checklist.** This technique generates ideas by comparing a logical list of categories with the problem or subject under consideration. Checklists range in type, from the specialized to the extremely generalized.
- **Attribute Listing.** This approach lists all the various characteristics of a subject first and then measures the impact of changes. By so doing, new combinations of characteristics (attributes) that will better fulfill some existing need may be determined.
- **Input-Output Technique.** The input-output technique (1) establishes output, (2) establishes input as the starting point, and (3) varies combinations of input/output until an optimum mix is achieved.

When using any one of these techniques, review (and rearrange) the elements of the problem several times. If possible, discuss the problem with others to get a new viewpoint. Try different approaches if one technique is not effective. Before closing the book on possible solutions, take a break to allow time for subconscious thought on the problem while consciously performing other tasks.

During the Creativity Phase, the VM study team may also dedicate a portion of the brainstorming to mitigation strategies for the concerns identified during the Information Phase (refer to Chapter 4, section 4.6 “Risk Identification”).

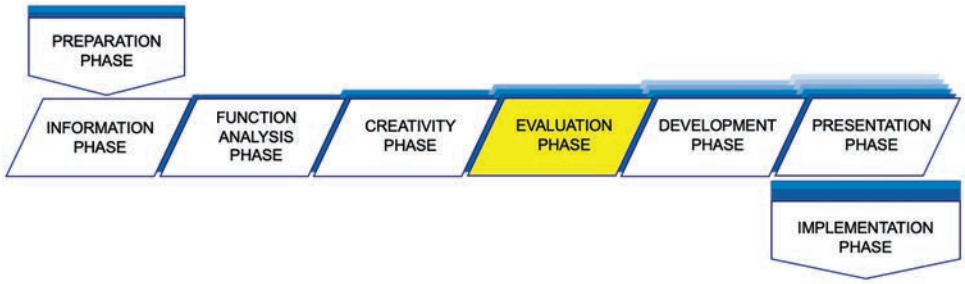
Once the VM study team has a thorough understanding of the project (through the previous VM Job Plan phases), they should examine, test, challenge, and question everything

CHAPTER

7

Evaluation Phase

"Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted." — Albert Einstein



The Evaluation Phase is the fifth phase of the Value Methodology (VM). Its purpose is to refine and select the best ideas for development into specific value proposals. Ultimately, the decision-maker should be presented with a small number of choices.

In the Creativity Phase, there was a conscious effort to prohibit judgmental thinking because it inhibits the creative process. The Evaluation Phase must critically assess all the ideas/alternatives to identify the best opportunities for value improvement. Although this phase is not the last chance to defer ideas (the analysis of costs and benefits conducted in the Development Phase leads to the final set of choices presented to the decision-makers), an appropriate amount of time should be dedicated to evaluation.

7.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Evaluation Phase.

Table 7.1 Evaluation Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Evaluate Ideas • Select Ideas	• Eliminate obvious "fatal flaw" ideas • Score ideas based on meeting performance criteria, value key and project/study goals • Discuss conflicting rankings, further clarify ideas and determine final rankings • Discuss ideas with client and decision-makers (midpoint review) • Assign alternatives for development phase	• Prioritized ideas for development, focusing on those with the highest potential for performance improvement and cost savings • Determined value: function/resources • Focused team's effort to develop alternatives that best meet client study objectives

7.2 Eliminate Low Potential Ideas

Eliminate from further consideration ideas that are not feasible, not promising, or do not help to perform the basic function. A useful approach to this activity is to classify the ideas into three categories:

- **Yes:** These ideas appear to be feasible and have a relatively high probability of success.
- **Maybe:** These ideas have potential but appear to need additional refinement or work before they can become proposals.
- **Not Now:** These ideas have little or no potential at this time.

At this point, eliminate only the “not now” ideas.

7.3 Group Similar Ideas

Group the remaining ideas into several (three or more) subject-related categories. Examine the ideas to determine if they should be modified or combined with others. Sometimes the strong parts of two different ideas can be developed into a winning idea. In other cases, several ideas may be so similar that they can be combined into a single all-encompassing idea. Some workshops employ a “forced relationships” technique that deliberately attempts to combine ideas from the different subject-related categories in order to discover new, innovative alternatives.

7.4 Establish Idea Champions

The remaining activities in this phase are designed to prioritize the ideas for further development. An idea champion is a study team member who will serve as a proponent throughout the prioritization process. If an idea has no champion, it may be eliminated at this point.

7.5 List the Advantages and Disadvantages of Each Idea

Advantages and disadvantages of each idea may already be identified/discussed at this point, to include the relative ease of change, cost, savings potential, time to implement, degree to which all requirements are met, and likelihood of success. Try to anticipate all of the effects, repercussions, and consequences that might occur in trying to implement a solution.

It is also useful to suggest how to overcome the disadvantages. No matter how many advantages an idea has, disadvantages that cannot be overcome may lead to its rejection.

7.6 Rank the Ideas

Develop a set of evaluation criteria to judge the ideas using the factors considered when listing advantages and disadvantages (e.g., cost, technical feasibility, likelihood of approval, time to implement, and potential benefit). Rank the ideas according to the criteria developed. No idea should be discarded; all should be evaluated as objectively as possible. Ratings and their weights are based on the experience and judgment of the people performing the evaluation. Techniques such as evaluation by comparison, choosing by advantages, numerical evaluation, or team consensus may be used.

This initial analysis will produce a shorter list of alternatives, each of which has met the evaluation standards set by the team. At this point in the Evaluation Phase, it may be useful to use Force Field Analysis to measure the sensitivity of the VM study team regarding controversial project issues. For the higher ranked ideas, the VM study team should suggest ways to improve upon the disadvantages and enhance the advantages. This exercise can lead to the following potential benefits:

- Ideas may be revised to improve their potential for success.
- Insight into implementation issues may be obtained from the suggested ways to improve the disadvantages.
- Insight into the acceptability of the idea and the likelihood of management approval may be derived from suggested ways to enhance the advantages.

This approach can therefore serve as a basis for distinguishing among the higher ranked ideas (i.e., re-ranking them) and, consequently, simplifying and strengthening the process of selecting ideas for further development.

7.7 Select Ideas for Further Development

Typically, a cut-off point is established for identifying ideas for further development. If there is a natural break in quantitative evaluation scores, a cut-off point may be obvious. If only qualitative evaluation scores are used, or quantitative scores are very close, a more refined ranking scheme may be needed to make the selection. However, if several alternatives are not decisively different at this point, they should all be developed further.

Alternatives with the greatest value potential will normally be among those selected. If that is not the case, re-examine those ideas to determine whether they should also be developed further. It is also useful to retain at least one idea from each of the subject-related categories used to group ideas at the beginning of the Evaluation Phase.

7.8 Other Considerations for the VM Evaluation Phase

The following should be considered during the VM Evaluation Phase:

- All team members are participating in the selection process
- The selection process does not allow one or more dominant team members to overly influence the opinion of the team
- A structured process is used to select ideas
- Ideas are selected to address any specific issues or focus areas given to the VM study team, where appropriate
- Ideas that have the largest value improvement potential are selected
- Ideas that the VM study team members would be willing to incorporate (if it were their own design) are selected
- Ideas that have a high probability of acceptance are selected
- Ideas that challenge the status quo are selected
- Ideas selected correlate to the functions identified during Function Analysis or a “miscellaneous” category should be considered
- An appropriate number of ideas are selected to allow time for adequate development of these ideas by the VM study team during the Development Phase. It is better to have fewer well-developed alternatives than several alternatives with minimal development (i.e., quality over quantity)
- It is important to use evaluation techniques that:
    - Require full participation by all team members
    - Are time-efficient
    - Promote the consensus of the VM study team, where one or more dominant personalities do not overpower the opinion of the team

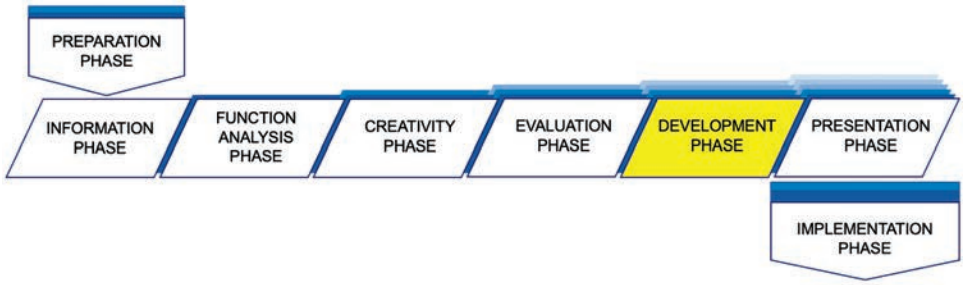
The goal of the Evaluation Phase is to protect potentially good ideas (young and tender), not to see how many ideas can be discarded.

CHAPTER

8

Development Phase

"Ideas don't come out fully formed, they only become clearer as you work on them. You just have to get started." — Mark Zuckerberg, Chief Executive Officer of Facebook



The Development Phase is the sixth phase of the Value Methodology (VM). It is the phase that provides an objective appraisal of the alternatives that provide the best value for reliably performing the required functions.

The best alternatives are completely developed, with the assistance of the subject matter experts, as required. Recommended design changes, materials, procedures, new forms, changes to standards and policy, fixed costs, operation and maintenance (O&M) costs, and implementation requirements should be documented. Each alternative is developed with enough data to support it is a sound alternative to the baseline design. If there are other similar alternatives that are also options to the baseline design, they can also be developed. Ultimately, the decisions to implement an alternative is a management/stakeholder decision. If management rejects the team's preferred alternative, another alternative may serve as a recommendation that is still an improvement over the existing design.

8.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Development Phase.

Table 8.1 Development Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Transform Ideas • Develop Information	• Validate and refine idea concepts • Compare to original design concept • Define implementation considerations • Prepare sketches and calculations • Measure performance • Estimate costs, life-cycle cost benefits/costs	• Side-by-side comparison of baseline and alternative—concepts, initial costs, life-cycle costs, sketches, performance metrics

8.2 Development Phase Process & Techniques

The Development Phase process is very simple: 1) assign ideas to the value team members, 2) develop VM proposals, and 3) review VM proposals. The following techniques should be considered when developing alternatives for management/stakeholder consideration:

- The value team members should accurately communicate the concept as it was intended.
- The VM proposals are developed with sufficient explanation and supporting documentation, such as sketches and calculations, to communicate the concept clearly and completely to the reader.
- The workload is balanced among the value team members.
- The value team members have adequate time to complete the number of alternatives selected. If not, then they should be prioritized in case time does not permit for all selected ideas to be developed. It is better to have fewer well-developed alternatives than several alternatives with minimal development (quality over quantity).
- The recommendations are carefully analyzed to ensure that stakeholders' needs are satisfied.
- Ensure that the alternative solution is technically adequate within the workshop time constraints.
- Develop cost comparisons between the original design and the alternative.
- Analyze impacts on the operations and maintenance costs.
- Analyze impacts on the life cycle cost of the project.

The recommendations should be complete with:

- Narrative explaining the elements or features of the original design which are affected by the change;
- Narrative explaining the alternative solution;
- Discussion of advantages and disadvantages of the proposed change relative to the original design, including time or schedule impacts, performance and quality impacts, and risk assessment;
- Discussion of the basis for the recommendation, context, and explanation on how the recommendation adds value (i.e., sell the idea);
- If stakeholders had comments on the recommendation during the mid-point review, then those comments should be addressed in the narrative;
- Sketch of the original and alternative designs;
- Calculations supporting the proposed change, including quantities shown in the baseline cost estimate;
- Estimates of operations and maintenance costs, where applicable;
- Estimates of capital costs of the original and the alternative designs; and,
- Life cycle cost analysis, when applicable.

8.3 Life Cycle Cost Considerations

In considering the value of an item or process, the team should consider the overall life cycle cost of the item or process. In some cases, a higher initial cost of an item could result in reduced life cycle costs. Similarly, a lower initial cost may result in more frequent maintenance and shorter life cycle than a higher initial cost item.
Consider the following major factors when determining the life cycle cost of an item:

- Expected life of an item
- Construction (initial or first) cost
- Operation and maintenance cost
- Salvage value
- Time value of money
- Discount rate

The **expected life** of any object is, simply put, how long the item is expected to last. Some items are used up at the end of their life cycle, but most can be maintained indefinitely. However, when the cost of maintenance becomes excessive, these items are replaced. Roads, bridges, drainage structures, etc., can be maintained indefinitely but, at some point, the cost of repair becomes so high that replacement is more cost effective. This point of replacement or major reconstruction is the life cycle of that item.

Construction cost is simply the cost to construct the item. Identify this during the Preparation Phase of a value study, usually from the construction estimate. If an item is purchased rather than constructed, use the purchase cost of the item.

Operation and maintenance (O&M) costs are the costs associated with owning, maintaining, operating, and using an item or system. There are two types of O&M costs, recurring and non-recurring. Recurring O&M costs are ordinary, routine, repetitive maintenance expenses. On a highway, they include mowing, replacing traffic markings, and the cost of electricity for lights, drainage maintenance, and guardrail maintenance. Consider these costs as a lump sum, annual payment. Non-recurring O&M costs include replacement or irregular activities, such as resurfacing a highway, re-decking a bridge, and crack and joint sealing. Consider these costs individually at the required times in the life cycle of the project.

Salvage value is the value of selling or re-using items and material at the end of the life cycle. For example, some items with salvage value are guardrails, recycled pavement, bridge beams, rails, etc.

Another type of salvage value occurs when a highway's life cycle is completed, and a major reconstruction is undertaken. The salvage value of the old road would be the right-of-way, grading, sub-base, grindings, etc., that will not have to be purchased or performed for the reconstruction.

Perhaps the most difficult part of life cycle cost analysis to understand is the tim**e value of money**. Put simply, money in the future is not as valuable as money today. This has nothing to do with inflation, but with the flexibility of having the money now, and the opportunity costs of not having the money now. For example, in economic terms the cost of money is 4% per year. That means that the value decreases by 4% for every year in the future (e.g., PHP 100 in one year is worth PHP 96 today).

Over the life cycle of different items or systems, costs are incurred at different times. Because of the time value of money, it is not fair or consistent to compare these costs at face value. For a fair comparison, refigure costs to today's Peso, by applying a discount rate to bring future costs back to their value today.

To find the life cycle cost of an item or system, the following steps are generally followed:

1. Identify the expected life of the project element. This can be based on background information, experience, policy, or by arbitrarily selecting an expected life.
2. Identify construction costs of all alternatives. In most cases, the baseline construction cost information will be provided in the Preparation Phase. If not, ask the management/stakeholder team during the Information Phase of the workshop.
3. Identify recurring maintenance costs by year. This information is available from maintenance staff, repair records, material usage, or accounting records.
4. Identify non-recurring maintenance costs by year. This information is also available from maintenance staff, repair records, mate rial usage, or accounting records.
5. Identify salvage values, if any. For items such as right-of-way, grading, etc., the initial cost can be used for the salvage value. Other items may require an estimate on the part of the value team.
6. Using the discount rate chart, multiply recurring costs by the Uniform Series present worth factor for the appropriate final year. For an item with a 20-year life span, multiply the total annual recurring cost by the Uniform Series present worth factor for 20 years. This gives the total of all annual recurring costs for the 20-year period.
7. Using the discount rate chart, multiply non-recurring costs by the Single Payment present worth factor for the appropriate year. Multiply a cost occurring during the fifth year by the Single Payment present worth factor for year 5. This gives the present value of that payment in year 5 only. Multiply other non-recurring costs by the appropriate factor individually.
8. Using the discount rate chart, multiply the total salvage value by the Single Payment present worth factor for the appropriate (last) year. Find the salvage value of an item in the last year of the lifespan which is a single event. The present value of the salvage is a NEGATIVE cost, since it returns money to the owner. Subtract the salvage value from the total life cycle cost of ownership when finding the total cost.
9. Total the results of the computations; this is the present worth of the life cycle cost of the item or system.

The following tables present an example of life cycle cost of two alternatives for constructing pavement.

Table 8.1 Development Phase Functions, Objectives & Outcomes

Year	Item Description	Cost
0	Initial	₱383,835
6	Patch (5%, both lanes, 1.5")	₱2,000
8	Mill & Resurface (both lanes, 1.5")	₱32,000
12	Patch (5%, both lanes, 1.5")	₱2,000
16	Mill & replace 15% both lanes (3" base, 1.5" surface)	₱39,500
20	Patch (5% both lanes, 1.5")	₱2,000
24	Mill & replace 3" truck lane, overlay both lanes 1 .5"	₱62,200
28	Patch (5 % both lane s, 1.5")	₱2,000
	Estimated Salvage Value	₱191,917

Table 8.3 Alternative No. 2: Jointed Portland Cement Pavement with Rigid Shoulders

Year	Item Description	Cost
0	Initial	₱512,000
4	Seal defective joints	₱1,525
6	Patch	₱16,000
8	Seal all joints	₱6,100
12	Seal defective joints	₱1,525
16	Seal all joints, patch	₱28,600
20	CPR-3" or 3" overlay	₱150,000
24	Seal defective joints	₱1,525
28	Seal all joints, patch	₱28,600
	Estimated Salvage Value	₱256,000

Table 8.4 Alternative No. 1: Life Cycle Calculation

DEVELOPMENT PHASE				
Project ID		LCC ANALYSIS -- Alternative No. 1		
4% Discount Rate		Flexible pavement		
30 Years Life Cycle		with flexible shoulders		
Year	**Description**	**Cost**	**PW**	**Present**
0	Initial	₱ 383,835	1.0000	₱ 383,835
1				
2				
3				
4				
5				
6	Patch (5% both lanes, 1.5")	₱ 2,000	0.7903	₱ 1,581
7				
8	Mill & Resurface (both lanes, 1.5")	₱ 32,000	0.7307	₱ 23,383
9				
10				
11				
12	Patch (5% both lanes, 1.5")	₱ 2,000	0.6246	₱ 1,249
13				
14				
15				
16	Mill & Repl. (15% both lanes, 3" base, 1.5" surface)	₱ 39,500	0.5339	₱ 21,089
17				
18				
19				
20	Patch (5% both lanes, 1.5")	₱ 2,000	0.4564	₱ 913
21				
22				
23				
24	Mill & Repl. (3" truck lane, overlay both lanes 1.5")	₱ 62,200	0.3901	₱ 24,264
25				
26				
27				
28	Patch (5% both lanes, 1.5")	₱ 2,000	0.3335	₱ 667
29				
30				
Total Non-Recurring Costs				₱ 456,982
Annual Maintenance Costs		₱ 5,600	17.2920	₱ 96,835
Estimated Salvage Value		₱ 191,917	0.3083	₱ (59,172)
Total Life Cycle Cost of Alternative No. 1				**₱ 494,645**

Table 8.4 Alternative No. 2: Life Cycle Calculation

DEVELOPMENT PHASE				
Project ID		LCC ANALYSIS -- Alternative No. 2		
4% Discount Rate		Joined Portland cement pavement with		
30 Years Life Cycle		rigid shoulders		
Year	**Description**	**Cost**	**PW**	**Present**
0	Initial	₱ 512,000	1.0000	₱ 512,000
1				
2				
3				
4	Seal defective joints	₱ 1,525	0.8548	₱ 1,304
5				
6	Patch	₱ 16,000	0.7903	₱ 12,645
7				
8	Seal all joints	₱ 6,100	0.7307	₱ 4,457
9				
10				
11				
12	Seal defective joints	₱ 1,525	0.6246	₱ 953
13				
14				
15				
16	Seal all joints, patch	₱ 28,600	0.5339	₱ 15,270
17				
18				
19				
20	CPR-3" or 3" overlay	₱ 150,000	0.4564	₱ 68,460
21				
22				
23				
24	Seal defective joints	₱ 1,525	0.3901	₱ 595
25				
26				
27				
28	Seal all joints, patch	₱ 28,600	0.3335	₱ 9,538
29				
30				
Total Non-Recurring Costs				₱ 625,221
Annual Maintenance Costs		₱ 1,700	17.2920	₱ 29,396
Estimated Salvage Value			0.3083	₱ (78,930)
Total Life Cycle Cost of Alternative No. 2				**₱ 575,687**

From this example, one can see that the two pavement alternatives experience different life cycle costs. It appears that Alternative No. 1, Flexible Pavement with Flexible Shoulders with a total cost of ₱383.8K, offers the lowest life cycle cost. The value team would recommend Alternative No. 1 as the best value in pavement for this project.

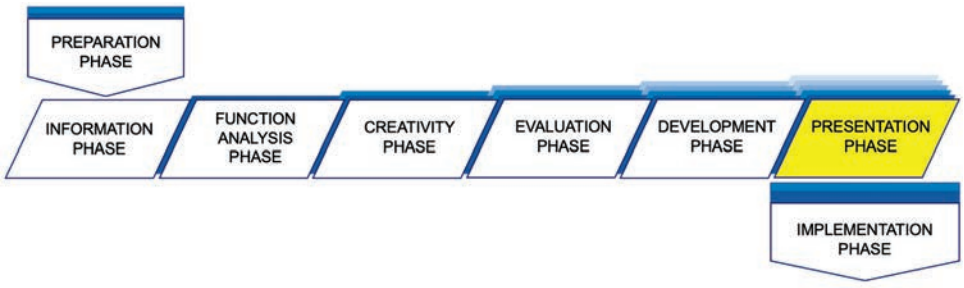
During this phase, the most promising alternatives selected during the Evaluation Phase will be developed into detailed alternatives. These ideas should be expanded from a simply stated idea from the brainstorming list to a fully communicated proposal for change. The intent is to obtain and present convincing data regarding design changes and cost for presentation to management and stakeholders in order for them to make decisions as to their implementation.

CHAPTER

9

Presentation Phase

“If you don't know what you want to achieve in your presentation your audience never will.”
— Harvey Diamond, public speaker and author



The Presentation Phase is the seventh phase of the Value Methodology (VM) and the last phase of the value study workshop. Its purpose is to sell the VM team’s ideas to the stakeholders and convince them to consider and further investigate the value proposals.

9.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Presentation Phase.

Table 9.1 Presentation Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Present Information • Propose Change	• Present developed ideas to client, designers, decision-makers, and stakeholders • Document feedback • Produce draft report	• Ensures management and other key stakeholders understand the rationale of the value alternatives and design suggestions

9.2 Out-brief Presentation Considerations

A presentation to the decision-maker (or study sponsor) is made at the conclusion of the workshop. This presentation is normally the first step (not the last step) in the approval process. Typically, a decision to implement is not made at the time of the briefing. Additional steps include:

- Answering additional questions
- Collection of additional data
- Review of supporting documentation
- Involvement of other decision-makers

The sole activity in this phase is preparation of a presentation to encourage commitment. An oral presentation can be the keystone to selling a proposal. It should make an impact and start the process of winning management and other stakeholder support. The presentation gives the VM study team a chance to ensure that the written proposal is correctly understood and that proper communication exists between the parties concerned. The presentation's effectiveness will be enhanced if:

- The entire team is present, is introduced, and participates in the presentation
- The presentation lasts no longer than 45 minutes with time for questions at the end
- The presentation is illustrated through use of visual tools such as mockups, models, presentation slides, or flip charts
- The team is prepared with sufficient backup material to answer all questions during the presentation

The presentation should:

- Identify the VM team
- Describe the workshop objectives and scope
- Identify functions studied
- Present costs of functions
- Explain the methodology used
- Describe the "before" and "after" conditions for each alternative
- Present the costs and benefits/advantages and disadvantages/impact of each alternative
- Identify how to overcome roadblocks
- Demonstrate the validity of the data sources
- Suggest an action plan and implementation schedule

Many suggestions may be offered to improve the probability of success and reduce the time required for acceptance and implementation of proposals. Those that appear to be most successful are as follows:

- **Consider the reviewer's needs.** Use terminology appropriate to the training and experience of the reviewer. Each proposal is usually directed toward two audiences: First is the technical authority that requires sufficient technical detail to demonstrate the engineering feasibility of the proposed change; Second are the administrative reviewers for whom the technical details can be summarized while the financial implications (implementation's cost and likely benefits) are emphasized. Long-range effects on policies, procurement, and applications are usually more significant to the administrator than to the technical reviewer.

- **Address risk.** Decision-makers are often more interested in the risk involved in making a decision than the benefits or value that might be achieved. Do not confuse decision-making risk with technical risk. Decision-making risk encompasses the uncertainty and complexity generated from making change. Therefore, consider the organizational culture and behavior when characterizing the recommendation.
- **Relate benefits to organizational or project objectives.** If the proposal represents advancement toward some approved objective, it is most likely to receive favorable consideration from management. Therefore, the presentation should exploit all the advantages a proposal may offer toward fulfilling organizational objectives and goals. When reviewing a proposal, the manager normally seeks either lower total cost of ownership or increased capability at the same or lower cost. The objective may be not only savings but also the attainment of some other mission-related goal of the manager.
- **Show collateral benefits of the investment.** Often, VM proposals offer greater benefits than the cost improvement specifically identified. Some of the benefits are collateral in nature and may be difficult to quantify. Nevertheless, collateral benefits should be included in the proposal. The likelihood of acceptance of the proposal is improved when all its collateral benefits are clearly identified and completely described.

The Presentation Phase should end with a list of actions leading to approval:

- Preparation and submission of a final workshop report with all the necessary supporting documentation
- Briefings to other key stakeholders
- A schedule for a follow-up meeting to approve the value proposals

9.3 VM Study Report

Following the out-brief presentation and the conclusion of the formal VM study, a written VM study report is prepared for submission to the project's decision makers and stakeholders.

A VM study report typically includes:

- Executive Summary
- VM Proposals
- Subject Analysis (function analysis, FAST diagram, cost models and other information developed using VM techniques)
- Subject Description (narrative of the baseline scope, schedule, cost, and risk that formed the basis for the VM study)
- Idea Evaluation (listing of all the ideas generated by the VM study team during the Creativity Phase and annotated with information concerning their evaluation)
- VM Process

A VM study report outline and guide is found in Appendix H.

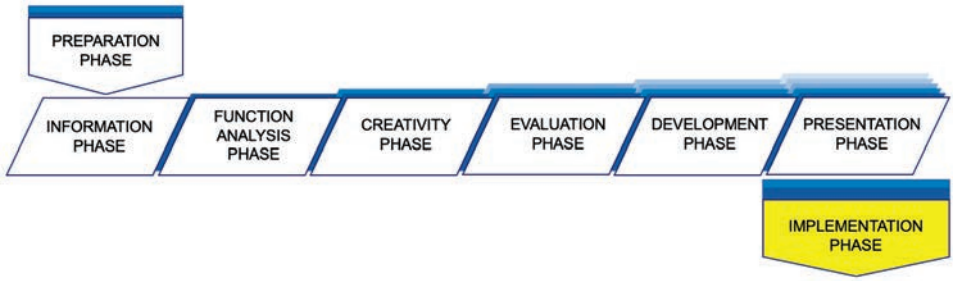
During this phase, key outputs are the out-brief presentation to stakeholders by the VM study team; and the VM study report that is created after the workshop.

CHAPTER

10

Implementation Phase

"The best big idea is only going to be as good as its implementation."— attributed to Jay Samit, an American digital media innovator, he has pioneered advancements in music and video distribution, social media, and e-commerce



The Implementation Phase is the eighth and last phase of the Value Methodology (VM). It is the phase that focuses on determining the disposition of the VM proposals and validating their effect on the value of the subject. Once the decision-makers have had a chance to review the value study report and may have provided their preliminary feedback toward each VM proposal to the VM program manager, an implementation meeting should be scheduled to agree upon the disposition of each proposal.

Even after the formal out-brief presentation, delivery and review of the value study report, the objectives of a value study have not been fully attained. The recommendations must be converted into actions. Those who performed the study, and the manager who requested the study, must all maintain an active interest until the value proposals are fully incorporated into the next phase of project development. Where unexplained delays are encountered, a polite follow-up note may serve as a reminder to the responsible authority, pointing out that those who made the study are available for assistance. An approved value proposal should not be permitted to die because of inaction in the implementation process.

Successful implementation depends on placement of the necessary actions into the normal routine of business. Progress should be reviewed periodically to ensure that any roadblocks that arise are overcome promptly.

10.1 Objectives & Outcomes

The following table illustrates the functions, objectives and outcomes of the Development Phase.

Table 6.1 Creativity Phase Functions, Objectives & Outcomes

Functions Achieved	Objectives of this Phase	Outcomes of this Phase
• Implement Change • Manage Change • Realize Value	• Document process and study findings • Develop and distribute value study summary report • Review study summary report • Assess alternatives for acceptance • Prepare draft implementation dispositions • Resolve conditionally accepted alternatives • Develop implementation plan with project manager • Project manager sign-off on value implementation plan • Final presentation of study results	• Involves those who will implement and increases likelihood of implementation • Improves actual value of the project

10.2 Strategies for Successful Implementation

10.2.1 Preliminary Implementation Meeting

After the draft value study report has been distributed and appropriate review time has occurred, a preliminary implementation meeting should be held. The purpose of this meeting is to make preliminary decisions in a timely fashion on the implementation status of the VM proposals to continue the progress of the project. All responses may not be final at this point, and that is acceptable. The decisions made at this meeting are only preliminary, and, if selected for full or partial implementation, they will undergo further evaluation by the project team as the project design progresses.

A successful preliminary implementation meeting involves the appropriate stakeholders and decision-makers who have fully reviewed and understand the recommended VM proposals. The meeting participants should discuss and reach agreement on the preliminary implementation path forward (e.g., accept, partially accept, further study, or reject) for each VM proposal presented in the value study report. Any recommendation not selected for full acceptance should include a description of either how it is partially accepted, what is the further study plan for reaching a decision, or why the alternative was rejected.

All rejected alternatives must have a stated rationale for why they were rejected. This supporting information is important to document in the final value study report, so it should be captured and agreed to during this meeting.

10.2.2 Develop the Implementation Plan

The VM proposals selected for implementation require a plan to ensure proper integration of the changes. An implementation plan should be developed for each VM proposal identified as “accepted.” The implementation plan needs to identify implementation responsibilities, action dates, modifications to the project schedule, and any additional project development activities that may be required.

The team, or individual, responsible for managing the VM study subject must take the lead in developing the implementation plan, assisted by others, as necessary. Implementation plans vary widely and depend upon the unique nature of the changes themselves, as well as the organization involved in implementing the changes. There are common elements that usually need to be considered in implementing the change, including:

- Responsibility — Who will be responsible for managing the changes called for in the VM proposal? What authority do they have? Whom will they report to? What resources will be assigned to them to assist in implementing the change?
- Design / system integration — How will the changes be integrated into the project? What approvals, clearances, or testing will be necessary to implement the change? Will the changes necessitate modifications to other aspects of the system or design?
- Schedule — How will the project schedule be impacted by implementing the change? What other projects or processes will be affected by any anticipated delays? Will critical budgeting or funding milestones be affected?
- Implementation costs — What will it cost the project to implement the changes? Will there be redesign or testing costs? Will there be impacts to existing suppliers or other contracts already in place?

10.2.3 Follow-up: Monitoring the Changes and Documenting the Results

A team coordinator once said, “Our recommendation tells us what we’re going to get out of this study while our Action Plan tells us how to go about getting it.”
That statement underscores the need for a concrete, finalized recommendation, and a well-conceived, specific action plan. Without them, follow-up becomes an exercise in blame-fixing rather than an achievement in problem-fixing.

Follow-up is essentially a combination of monitoring the changes that need to be made and documenting the results of those changes. Consequently, follow-up and implementation could be considered as “same time functions.”
Monitoring changes involves answering three interrelated questions:

1. Did the events we established in our action plan take place?
2. Did the events take place when specified?
3. Did we get the improvement we expected when the events took place?

A negative answer to any of these questions usually means that the team needs to reconvene and do some additional brainstorming, T-charting, etc.

Documenting results is nothing more than building a file of documents that verify that the required changes were made and documents that define the amount of improvement realized.

Depending on the type of study, the file may contain appropriation requests, engineering releases, process description sheets, material specifications, performance reports, etc.

The file should also include documents that validate the improvement(s) realized; typically, these are obtained from Finance and Accounting.

10.2.4 Progress Reporting

Throughout the Implementation Phase, brief progress reports should be made. As was mentioned, the Team Coordinator should send these reports, as well as the final presentation/report, to the study sponsor, the team members and their management groups, and the assigned value study facilitator.

The value study facilitator is interested in these reports from three standpoints:

- The reports are incorporated into an overall status reporting system maintained by VM;
- They often give insight into ways to improve VM training; and,
- The reports furnish a valuable background for those cases where the team needs a “refresher” on VM tools and techniques.

10.2.5 Typical Problems with Successful Implementation

- Failure to Properly Budget and Plan for value studies
  - Study timing is too late to be effective
  - Number of days not enough to do the job right
- Accelerated Design
  - Project is progressing into plans, specifications, and estimates (PS&E) on a fast track that inhibits the ability to make changes
- VM Study Resources
  - Team Members – Not providing quality team members
  - Meeting room available for the length of the study can be difficult to get
- Implementation
  - Stakeholder Buy-in
  - Management support
  - No follow-through and incorporation into the design

10.2.6 Measurements of Success

- Monetary measurements – reduce initial costs
  - Return on investment
  - Simple payback
- Monetary measurements – reduce life cycle cost
  - Reduce initial capital costs
  - Reduce replacement / cyclical costs
  - Reduce annual costs
- Quality of the team experience
  - Would team members want another value workshop experience?
- Non-Monetary
  - What performance areas were improved (quality, schedule, performance, operations, maintenance, etc.)?

The Implementation Phase concentrates on driving change throughout the subject understudy. Once the VM proposals have been accepted by the decision makers, those responsible for the subject understudy need to integrate the associated changes into the existing current state. Developing an implementation plan and documenting, tracking and auditing results will ensure that change is managed and value is achieved.

APPENDIX

A

VM Resources

The following resources are provided in this Appendix:

- **SAVE International's Glossary of VM Terms**
- **Sample Specification for a Value Engineering Change Proposal (VECP)**
- **International Lessons Learned**

Glossary of VM Terms

Value practitioners have developed a lexicon of words and terms that they use with a specific meaning. This Appendix contains a list of the most commonly used words and terms, and the meaning that they have in the value community.

Credit to: SAVE International

Please note that this Glossary of VM Terms is not an exhaustive list. For a more comprehensive lexicon of terms, please refer to SAVE International's VM Guide, A Guide to the Value Methodology Body of Knowledge.

Value Methodology Glossary of Terms

Activity – A specific task, action, or operation that describes how a function is performed. For example, the activity "pour coffee" describes how the function "dispense liquid" is performed. Activities are the means leading to the attainment of a function.

Annuity – A series of payments made at equal intervals. Examples of annuities used in the Development Phase and relative to life-cycle cost analysis include yearly insurance premiums, monthly mortgage payments, annual energy costs, insurance, licenses, etc.

Balanced scorecard – A technique used to document and communicate the objectives, related key performance indicators and targets, and anticipated outcomes of an organization (and/or its projects, products, and services).

Break-even point – The sales amount—in either unit (quantity) or revenue (sales) terms—that is required to cover total costs, consisting of both fixed and variable costs to the organization.

Change management – A collective term for all approaches to prepare and support individuals, teams, and organizations in implementing change. The most common change drivers include: technological evolution, process reviews, crises, changes in consumer habits, pressure from new business entrants, acquisitions, mergers, and organizational restructuring. It includes methods that redirect or redefine the use of resources, business processes, budget allocations, or other modes of operation that significantly change a company or organization.

Constraints – The state of being checked, restricted, or compelled to avoid or to perform some action. For most VM studies, there are restrictions on some parameters of a solution (e.g., laws, standards, market demand, policies, resources, commitments made, etc.). These restrictions are called constraints and can be real or perceived. VM may be an effective tool for turning perceived constraints into opportunities for value improvement.

Consultant – One who gives professional advice or services.

Convergent thinking – A mental process that focuses on coming up with the single, well-established answer to a problem. It is synonymous with the term "critical" thinking.

Cost-benefit analysis (CBA) – A method used to ascertain the soundness of any investment opportunity and provide a basis for making comparisons with other such proposals. All the positives and negatives of the VM study subject are first quantified in monetary terms and then adjusted for their time-value to obtain correct estimates for conducting a CBA.

Cost, initial – The expenditure of all the resources needed to design, deliver, produce, or establish a project, product, process, service, or organization. Cost has different dimensions that can be measured by factors such as materials, labor, equipment, time, risk, etc. and be quantified in currency. Cost should not be confused with "price," which is the amount of money exchanged or set as consideration for the sale of something. Initial cost is also frequently referred to as "capital cost."

Cost, life-cycle (LCC) – The sum of all recurring and one-time (non-recurring) costs over the full lifespan or a specified period of a project, product, process, service, or organization. It includes the initial costs, operating costs, maintenance and upgrade costs, and remaining (residual or salvage) value at the end of ownership or its useful life, including salvage or decommissioning costs.

Cost model – A resource model used to graphically depict the relationship of elements relative to their cost. For example, a cost model of a building might show the relative cost of each of the major systems (foundation, superstructure, exterior enclosure, etc.), sorted from high to low, on a bar chart. Cost models are often augmented with a Pareto distribution (see Pareto model below).

The Value Methodology Glossary of Terms was extracted from Appendix A of the VM Guide®
(Rev. 9/25/2020)

Creativity – A phenomenon whereby something new and somehow valuable is formed. It is the ability to produce original and unique ideas or to make something new or imaginative. Creativity can be supported and enhanced by the utilization of creativity methods and techniques. Creativity in VM leverages divergent thinking with a focus on functions.

Creativity techniques – Methods that promote creativity and the generation of new ideas for developing visions or to solve problems.

Criteria – Standards for evaluation upon which a decision or a judgment is based.

Customer – A person or an organization that purchases a product or service. The customer plays a critical role, if not the most important in determining value. In some cases, the customer may also be a user.

Divergent thinking – A process or method used to generate ideas by exploring many possible solutions. Divergent thinking typically occurs in a spontaneous, freely flowing, "non-linear" manner, such that many ideas are generated in an emergent, cognitive fashion. Divergent thinking requires a judgment-free environment and aims to elicit ideas that may be unconventional.

Efficiency – The ratio of useful output to total input. Efficiency refers to very different inputs and outputs depending on specific fields and industries.

Escalation – Changes in the cost or price of specific goods or services in a given economy over a period. This is similar to the concept of inflation, except that escalation is specific to an item or class of items (not as general in nature). Changes in the money supply do not usually drive changes in cost, and escalation tends to be less sustained. Note that escalation is different than inflation.

Evaluation – To determine the significance, value, or condition through careful appraisal and study.

Expected value – A quantitative measure of value expressed by multiplying an anticipated outcome by the probability of its occurrence.

Facilitator – One who is substantively neutral, has no significant decision-making authority, enables a group to improve how it identifies and solves problems, and increases the group's effectiveness. In the context of VM, one who leads the group through the VM Job Plan.

FAST – The Function Analysis System Technique (FAST) is a group process that creates a diagrammatic representation of the HOW-WHY logic of functions, and their interrelationships, of a project, product, process, service, or organization under study.

Freewheeling – A state of unrestrained, divergent thinking not bound by formal rules, procedures, or guidelines.

Function – A non-specific, two-word abstraction, consisting of a verb and noun, that describes what an element of a project, product, process, service, or organization does.

Function, all-the-time – Functions that happen continuously or occur on a repetitive, ongoing basis, relative to the project, product, process, service, or organization.

Function analysis – A detailed examination of a project, process, product, service, or organization to identify, classify, and organize its functions; allocate performance and resources; and prioritize functions for value improvement.

Function, basic – The essential function(s) that fulfill the purpose or intent for which a project, product, process, service, or organization exists and answers the question, "What must it do?" There can be more than one basic function.

Function, higher-order – The specific goals or needs that the basic function(s) fulfills and are beyond the scope of the VM study subject.

Function logic path – All functions on a FAST diagram that are connected to each other in the HOW-WHY logic direction.

Function, lower-order – Functions that are not part of the scope of the VM study and are inputs for a project, product, process, service, or organization.

Function, one-time – A function that occurs only once relative to the project, product, process, service, or organization.

Function performance specification (FPS) matrix – A technique whereby the quality or performance criteria related to the subject functions are correlated along with related specification units of measure, parameters, targets, and flexibility.

Function resource matrix – A technique whereby the functions of a project, product, process, service, or organization are correlated to its attributes, such as space, weight, cost, time, performance, risk, etc. The purpose of a function resource matrix is to develop insight into how functions contribute to value and to aid in prioritizing which functions offer the greatest potential for value improvement.

Function, secondary – A function that supports the basic function(s) and results from the approach to achieve the purpose or intent of a project, product, process, service, or organization.

Function, unwanted – A function identified by the customer, user, or stakeholder as undesirable that is caused by the approach used to achieve the purpose or intent of a project, product, process, service, or organization.

Future value – The value of a current asset at a specified date in the future based on an assumed rate of growth. Examples of factors that are often expressed as a future value (FV) in a life-cycle cost analysis include major periodic maintenance, equipment or building system replacements, salvage or demolition costs, etc.

Gantt chart – A Gantt chart is a type of bar chart that illustrates the relationship of activities to a schedule. Articulations of Gantt charts may show interdependencies of activities and define the "critical path" (the longest series of required sequential activities) of a project or process.

Grading – To classify ideas on a scale, such as by quality, size, color, etc.

Handout – A document summarizing the key information needed by both the VM study team and the stakeholders attending the presentation. It is not intended to include specifics about the Job Plan phases nor all details of each VM proposal, but to share some basic information to make the presentation run easily. In most cases, these documents will be two to five pages in length. In some cases, a PDF copy of the slideshow used by the team is distributed. Handouts generally become obsolete after the presentation ends, since the VM study team, facilitators, and other stakeholders will focus their efforts on the formal report.

Hitchhiking – The process of taking one idea and building on it to create a different idea.

Implementation meeting – A key activity of the Implementation Phase, also called a resolution meeting. The purpose of this meeting is to resolve the disposition (usually acceptance or rejection) of the VM proposals developed and presented in the previous two phases of the VM Job Plan.

Implementation plan – An overall schedule for all activities necessary to implement the results of the VM study. It typically contains detailed action plans, including schedules, milestones, tasks, resources, and level of effort required, and identification of the parties responsible for completion of the implementation actions. Schedules (e.g., Gantt charts) and other project management applications usually support the implementation plan.

Inflation – A quantitative measure of the rate at which the average price level of an array of selected goods and services in an economy increases over a period of time. Inflation is often expressed as a percentage and indicates a decrease in the purchasing power of a nation's currency.

Interest rate – The amount of money charged, expressed as a percentage of the principal, by a lender to a borrower for the use of assets. In terms of borrowed money, the interest rate is typically applied to the principal, which is the amount of money loaned. The interest rate is the cost of debt for the borrower and the rate of return for the lender. It should be noted that the term "discount rate" refers to the interest rate that Federal Reserve Banks charge commercial lenders, and that is frequently used by public sector agencies in LCC analysis. The VM study sponsor may define a preferred discount rate to be applied to their specific cash flow analysis.

Life-cycle cost (LCC) analysis – The sum of all recurring and one-time (non-recurring) costs over the full life span or a specified period of a project, product, process, service, or organization. It includes the initial costs, operating costs, maintenance and upgrade costs, and remaining (residual or salvage) value at the end of ownership or its useful life. The VM study sponsor should ultimately provide direction on the appropriate methods and factors they wish to be applied.

Life-cycle period – The length of time considered in a life-cycle cost analysis. For example, a life-cycle cost analysis performed for the useful life of a highway bridge might assume a life-cycle period of

75 years, which is a typical period used to define the "useful life" of the structure.

Neutral – Not engaged on either side.

Present value – The current value of an asset. In life-cycle cost analysis, present value (PV) is the current value of a future sum of money or stream of cash flows (an annuity) given a specified rate of return.

Pareto model – A further articulation of any resource model that graphically illustrates the cumulative distribution of values. For example, a Pareto distribution curve overlays a bar chart that shows the cumulative contribution of each element of cost. The basis of the Pareto model is the so-called 80/20 rule, which means that 80 percent of the total cost of a system can be linked to 20 percent of its elements. Pareto analysis is used to select important elements, to prioritize problems, and to highlight important issues. It also helps to see the small number of important issues as well as their relative importance to each other.

Performance – The extent to which a project, product, process, service, or organization achieves its intended function(s). Performance can be measured quantitatively or qualitatively, the measurement of which answers the question of how well the function(s) is(are) being performed.

Productivity – The rate of output per unit of input; usually for a production process, however it is used also for construction activities.

Process flowchart – Process flowcharts are tools for visualizing manufacturing, business, administration, etc. processes. Process flowcharts usually have two sides, and the processes are placed horizontally on it. All the processes in the organization are placed between customer expectations (left side, input) and customer satisfaction (right side, output). Organizational processes include management processes, value-creating processes, and supporting processes. There are many international standards for displaying process maps, such as UML (Unified Modeling Language), Event-driven Process Chain (EPC), Business Process Modeling Notation (BPMN) (ISO/IEC 19763-5: 2015), and VSM (Value Stream Map).

Project management plan – A project management plan is a tool for planning and managing a project. The document continuously evolves with the project and is always updated with the latest relevant information. The project management plan should be accessible to all project members, as it is one of the most important documents of communication.

Quality – A subjective term for which each person or sector has its own definition. In technical usage, quality can have two meanings: 1) the characteristics of a product or service that bear on its ability to satisfy stated or implied needs; 2) a product or service free of deficiencies. According to Joseph Juran, quality means "fitness for use"; according to Philip Crosby, it means "conformance to requirements."

Quality management plan – A document defining the acceptable level of quality, which is typically defined by the customer, and describes how the project, product, or process will ensure the specified level of quality. Quality control activities monitor and verify that deliverables meet defined quality standards. Quality assurance activities monitor and verify that the processes used to manage and create the deliverables are followed and are effective.

Quality model – A model that illustrates the relationship between customer satisfaction and the degree of quality provided by a project, product, process or service. One such example is quality function deployment (QFD) which is a method to transform qualitative user demands into quantitative parameters, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts and, ultimately, to specific elements of the manufacturing process.

RACI matrix – RACI is an acronym for "responsible, accountable, consulted and informed." A RACI matrix is typically used to cross reference activities and deliverables with stakeholders to define the level of involvement. For example, a public agency might be identified as "consulted" for the review of a project document. The information on a RACI matrix is used in supporting communication and managing stakeholders.

Random function identification – A technique that lists the elements, components, or parts of a project, product, process, service, or organization and then identifies the various functions related to them. Once the functions have been identified using this technique, they may be classified and organized for subsequent analysis.

Ranking – To arrange ideas by priority or importance relative to other ideas being considered.

Resistance to change – Action taken by individuals and groups to hinder change-related activities when they perceive a change as a threat to them. Keywords here are "perceived" and "threat." The threat need not be real for resistance to occur. The usual description refers to change within organizations, although it is found elsewhere. Resistance is the equivalent of objections in sales and disagreement in general discussions. Resistance may take many forms, including active or passive, overt or covert, individual or organized, aggressive or timid.

Resource model – A graphic and/or numerical representation (such as a spreadsheet, pie chart, cost model, Gantt chart, etc.) indicating resources such as cost, space, time, and energy and associated performance or risk allocated to each component of a project, product, process, service, or organization.

Resource – All inputs of cost, time, energy, space, materials, labor, etc. required to accomplish a function.

Return on investment (ROI) – A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. ROI tries to directly measure the amount of return on a particular investment, relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio.

Risk – An uncertain event that could have an impact on the cost, schedule, or performance of a project, product, process, service, or organization. Risks can either be positive (opportunities) or negative (threats). The Value Methodology must consider the impact of risks to value.

Risk model – A resource model that represents the probabilities and impacts of threats and opportunities. Risk models can be qualitative or quantitative in nature. They include tornado charts (a graphic form of risk rankings), HEAT maps, histograms, and probability density curves.

Risk register – A matrix used to record information concerning subject risks. Risk registers usually include a description of the risk, type of risk (threat or opportunity), probabilities, impacts, triggers, and possible response strategies.

Schedule – A procedural plan indicating the time, duration, and sequence of activities or operations. Schedule may be considered as an input (a resource) or an aspect of performance, depending upon the context of the project, product, process, service, or organization.

Scope – The defined parameters of the subject under study. The subject scope is often supported by various forms of information that include narratives (or a scope statement), specifications, drawings, schedules, plans, estimates, and other supporting analysis.

Simple payback – In capital budgeting, the period of time required to recoup the purchasing power of the funds expended in an investment or to reach the break-even point. For example, a $1,000 investment made at the start of Year 1, which returned $500 at the end of Year 1 and Year 2, respectively, would have a 2-year payback period. This method does not recognize the time value of money.

Specifications – A specification often refers to a set of documented requirements to be satisfied by a material, design, product, or service. The characteristics of quality and performance are usually defined by specifications for projects, products, processes, and services. Different types of specifications have different meanings. Examples include functional, technical (i.e., design and engineering), operations, and maintenance specifications.

Stakeholder – An individual, group, or organization who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of the project (i.e. VM study)."

Status reports – A status report is a document describing the situation of something, such as a project at a specific point in time during the Implementation Phase or at the end of the phase. It may utilize a variety of presentation techniques, whether in writing or verbally supported by graphics, charts, diagrams, tables, or any other forms of visualization.

Subject matter expert (SME) – A person who is an authority in a particular area, discipline, or topic.

Subject objectives – Functions that express specific, compulsory requirements, or articulate broader goals of the subject, whether it is a project, product, process, service, or organization.

Time – The measured or measurable period during which an action, process, or condition happens. Time, as an element of value, may be considered as an input (resources) as well as an output. For example, time may be considered as an input when considering the delivery of a project and as an output when experiencing a service such as a massage.

Time value of money – The time value of money is the concept that money available at the present time is worth more than the identical sum in the future, due to its potential earning capacity. This core principle of finance holds that, provided money can earn interest, any amount of money is worth more the sooner it is received.

User – An individual, group, or organization who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of the project (i.e., VM study).

Utility – An economic concept that is used to quantify the usefulness of, or level of, satisfaction derived from a thing. Utility is closely related to the concepts of performance and quality.

Value – An expression of the relationship between the performance of functions relative to the resources required to realize them. -This can be expressed as Value = (Function Performance)/Resources.

Value engineering change proposal (VECP) – A change submitted by a contractor, pursuant to a contract provision, to improve the value of the project or product under contract. VECPs are a vehicle to incentivize contractor innovation and are commonly used in public sector contracts.

Value Methodology – A systematic process used by a multidisciplinary team, led by a qualified VM facilitator, to improve the value of a project, product, process, service, or organization through the analysis of functions.

Visual presentation – For the sake of clarity among the diverse VM community members, we differentiate "presentation" and "visual presentation." In this text, we define the presentation as the overall effort to compile and communicate the VM study results to stakeholders, including preparation and the meeting held to communicate those results and data. Visual presentations, as used herein, refer to a specific type of common presentation tool used by many practitioners. They are often created in Microsoft PowerPoint and other similar software packages and are displayed on projection screens, large monitors, or in print-outs.

VM facilitator – One who is substantively neutral, has no significant decision-making authority, enables a group to improve how it defines and solves problems, and increases a group's effectiveness. In the context of VM, one who leads the group through the VM Job Plan.

VM Job Plan – A sequential approach for applying the Value Methodology, consisting of the following eight phases: 1) Preparation, 2) Information, 3) Function Analysis, 4) Creativity, 5) Evaluation, 6) Development, 7) Presentation, 8) Implementation.

VM pre-study meeting – A formal exchange of information that identifies, clarifies, and communicates the conditions of a VM study, including its subject, objectives, participants, schedule, and logistics.

VM program – A program within an organization that manages, implements, tracks, educates, trains, and advocates for the Value Methodology within the organization.

VM program elements – The components to a VM program. These are described and defined in this section. The most successful VM programs use most, if not all, these aspects. However, even programs that only use a few aspects can be effective and advantageous to the organization. This section outlines the major program elements that must be considered.

VM program manager – The individual responsible for directing, leading, and managing an organization's VM program.

VM proposal – A developed idea resulting from the application of the Value Methodology during a VM study to increase the value of a project, product, process, service, or organization. VM proposals may alternately be described as alternatives or recommendations.

VM study – A structured effort to improve the value of a project, product, process, service, or organization

through the application of the Value Methodology by a multidisciplinary team facilitated by one who is competent in VM techniques, ideally a Certified Value Specialist® (CVS®).

VM study decision maker – A person involved in determining the acceptance or rejection of VM proposals.

VM study report – A document containing all the information developed at the time of the study, needed for stakeholders to make informed decisions about which VM proposals to implement. It is recommended that the executive summary be developed in such a way that it could be a standalone document for broader circulation. Reports should include the background and description of the project under study; a complete listing of VM proposals; complete VM proposals containing all relevant data; complete analysis conducted by the team; a comprehensive listing of all ideas generated and evaluated, along with their evaluation rationale; a brief description of the VM process; agendas; and, a listing of all participants with their contact information. Audiovisual materials may be added to VM study report when prudent.

VM study sponsor – The person, or organization, responsible for defining the specific objectives of the VM study and the stakeholders' needs.

VM study subject – The subject of the VM study can be anything for which there is a desire to explore opportunities for improvement. The Value Methodology is commonly applied to define new, or enhance existing, products, processes, projects, services, or organizations.

VM team – A multi-disciplined group of participants, led by a trained facilitator, who apply the Value Methodology to the subject of a VM study.

Voice of the customer – A process and/or method of eliciting the preferences and requirements of customers and users relative to value.

Weighting – To give something (here, especially, the criteria) a specific meaning. Therefore, different criteria can be differentiated, and the importance becomes obvious.

Work breakdown structure (WBS) – A tool that splits a project into components. It identifies all the project's tasks and deliverables and breaks them down into many small, meaningful, manageable parts (work packages). A WBS helps to show the scope of the project, regulate progress, set accurate costs and timetables, and shape project teams. Once a WBS has been created, it may be transformed into a schedule

Sample Specification for a Value Engineering Change Proposal (VECP)

104.13 **Value Engineering Proposals by the Contractor:**

Proposals may be submitted to the Engineer for modifying the plans, specifications, or other requirements of the contract for the sole purpose of reducing the total costs of construction without impairing in any manner the essential functions or characteristics of the project, including service life, economy of operations, ease of maintenance, benefits to the traveling public, desired appearance or design, and safety standards. After execution of the contract, an initiative may be recommended by the contractor. The initiative must be identified as a Value Engineering Proposal (VEP), and may include modifications to the plans or specifications, construction phasing or procedures, or other contract requirements. Any cost savings generated to the contract as a result of VEP offered by the contractor and approved by the Department will be shared equally between the contractor and the Department as specified in Subsection 104.13(D) of the specifications. Bid prices are not to be based on the anticipated approval of a VEP. If a VEP is rejected, the contract shall be completed in accordance with the original terms of the contract or as otherwise modified. Any decision whether to approve or accept a VEP shall be within the sole discretion of the Department. The Department will bear no liability for any delay in considering a VEP, the refusal to accept or approve such a proposal, or any other matter connected with a VEP.

A. Submittal and Review of VEP Concept or Idea:

1. The contractor shall initially submit a brief letter proposal with graphics to the Department to illustrate the concept or idea. The contractor shall indicate whether adequate time is available in its schedule for formal submittal and review prior to VEP implementation.

2. The Department will review the concept or idea and within 10 days of the contractor's initial submittal and inform the contractor in writing whether the concept or idea has merit and should be submitted as a formal VEP.

3. If the Department determines that the time for response indicated in the contractor’s letter proposal is insufficient for review, the Department may choose to evaluate the need for a noncompensable time extension to the contract. Its evaluation will be based on the additional time needed by the Department for its review and the effect on the contractor’s schedule occasioned by the added time. The need for such a time extension will be evaluated in accordance with Subsection 108.08 of the specifications.

B. Formal Submittal of the VEP:

Within 30 days after the Department has determined the VEP concept or idea has merit, the contractor shall formally submit a proposal. The proposal shall include sufficient data for the Department to make an informed decision regarding the proposal and shall include, at a minimum, the following information:

1. A statement that the Proposal is submitted as a VEP.

2. A description of the difference between the existing contract and the proposed change and the advantages and disadvantages of each, including effects on service life, economy of operations, ease of maintenance, benefits to the traveling public, desired appearance, and safety.

3. A complete set of plans and specifications showing the proposed revisions relative to the original contract features and requirements supported by design computations as necessary for a thorough and expeditious evaluation.

4. A complete analysis indicating the final estimated costs and quantities to be replaced by the VEP compared to the new costs and quantities generated by the VEP.

5. A statement specifying the date by which a Supplemental Agreement adopting the VEP must be executed to obtain the maximum cost reduction.

6. A statement detailing the effect the VEP will have on the time for completing the contract

7. A description of any previous use or testing of the VEP and the conditions and results. If the VEP was previously submitted on another Department project, indicate the date, contract number, and the action taken by the Department.

8. A detailed statement indicating the costs for developing the changes, along with the costs for preparing the value engineering joint proposal.

C.Conditions

Value Engineering Proposals will be considered only when all of the following conditions are met:

1. A VEP, approved or not approved by the Department, applies only to the contract on which it is submitted. A submitted VEP becomes the property of the Department. The VEP shall contain no restrictions imposed by the contractor on its use or disclosure. The Department has the right to use, duplicate, and disclose in whole or in part any data necessary for the utilization of the Proposal. The Department retains the right to use any accepted VEP or part thereof on other projects without obligation to the contractor. This provision is not intended to deny rights provided by law with respect to patented materials or processes.

2. If the Department is already considering certain revisions to the contract or has considered or approved changes in the contract of a like nature on other contracts which are subsequently incorporated in a VEP, the Department may reject the VEP and may change the contract without obligation to the contractor.

3. The contractor shall have no claim for additional costs or delays resulting from the rejection of a VEP, including development costs, loss of anticipated profits, increased material or labor costs except as allowed in Subsection 104.13(D) of the specifications.

4. The Department will determine if a VEP qualifies for consideration and evaluation. It may reject any VEP that requires excessive time or costs for review, evaluation or investigation, or that is not consistent with the Department's design policies and criteria for the project.

5. The Engineer will reject all or any portion of work performed under an approved VEP if unsatisfactory results are obtained. The Engineer will direct the removal of rejected work and require construction to proceed under the original contract requirements without reimbursement for rejected work performed under the VEP, or for its removal. Where modifications to the VEP are approved to adjust to field or other conditions, reimbursement will be limited to the total amount payable for the work at the contract bid prices as if it were constructed under the original contract requirements. The rejection or limitation of reimbursement shall not constitute the basis of any claim against the Department for delay or for other costs

6. The proposed work shall not contain experimental features but shall contain features that have been used under similar or acceptable conditions on other projects or locations acceptable to the Department.

7. VEPs will not be considered if equivalent options are already provided in the contract.

8. The savings generated by the VEP must be sufficient to warrant a review and processing. A savings resulting solely from the elimination or reduction in quantity of a single bid item will not be considered as a VEP. A savings resulting from the elimination or reduction in quantity of a bid item specified as part of a VEP will be considered.

9. A VEP changing the type of the pavement structure or the type or basic design of a bridge structure will not be considered. Changes in the pavement structural section or in structure design details may be considered with prior approval by the Materials or State Bridge Engineer. Changes to contingency items such as traffic control and dust palliative will not be considered if they are part of pre-determined lump sum contract amounts. Contingency items such as traffic control and dust palliative may be considered when they are reduced as part of a VEP to change scope, method, or procedure, provided they are specified as individual contract bid items.

10. Additional information needed to evaluate VEPs shall be provided in a timely manner. Untimely submittals of additional information will result in rejection of the VEP. Where design changes are proposed, the additional information could include results of field investigations and surveys, design computations, and field change sheets.

11. The contractor may submit VEPs for an approved subcontractor. Reimbursement will be made to the contractor. Subcontractors may not submit a VEP except through the contractor.

12. The contractor shall ensure the VEP is sealed by a Registered Engineer.

D. Acceptance, Rejection and Payment:

Within 30 days of the contractor's formal submission of the VEP, the Department will accept or reject the VEP.

1. The contractor will be notified in writing by the Engineer as to whether the proposal has been accepted. The decision by the Department is final and shall not be subject to the provisions of Subsection 105.21 of the specifications.

2. If the VEP is rejected, the Department will share equally in the contractor's costs for developing and presenting the proposal, and the contractor will share equally in the cost to the Department for investigating and evaluating the proposal. A supplemental agreement will be executed to adjust the contract for the net increase or decrease in monies resulting from the contractor's development costs as listed above in Subsection 104.13(B)(8) of the specifications, and the Department's evaluation costs. The supplemental agreement will terminate the Department's review of the VEP.

3. If the VEP is accepted in whole or in part, the necessary contract modifications and contract price adjustments will be made by the execution of a supplemental agreement which will specifically state that it is executed pursuant to the provisions of this subsection. The Department will be the sole judge of the acceptability of a VEP and of the estimated net savings in construction costs from the adoption of all or any part of the VEP.

4. The contractor shall continue to perform the work in accordance with the requirements of the contract until a supplemental agreement incorporating the VEP has been executed, or until the contractor has been given written acceptance or rejection by the Engineer.

5. The executed supplemental agreement shall incorporate the changes in the plans, specifications, or other requirements of the contract which are necessary to permit the VEP, or such part of it which has been accepted, to be put into effect, and shall include any conditions upon which the Department's approval thereof is based. The executed supplemental agreement shall extend or decrease the contract time if required by the Department.

6. The executed supplemental agreement shall provide that the contractor be paid 50 percent of the net savings amount as reflected by the difference between the cost of the revised work and the cost of the related construction required by the original contract computed at contract bid prices. The net savings will take into account the contractor’s cost of developing the VEP and implementing the change, and reducing this amount by the Department’s cost for investigating and evaluating the VEP, including any ascertainable collateral costs to the Department. Such collateral costs may include increased costs for maintenance, operation, related work items, additional work items, or elements of related or additional work items.

7. The executed supplemental agreement shall also provide for the adjustment of contract prices. Contract prices shall be adjusted by subtracting the Department's share of the accrued net savings.

8. The amount specified to be paid to the contractor in the executed supplemental agreement shall constitute full compensation to the contractor for the VEP and the performance of the work thereof pursuant to the said supplemental agreement.

International Lessons Learned

Adopting Value Management in the organization: Challenges for VM Champions

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Introduction

In recent years, the interest in Value Management (VM) has risen substantially. Many organizations try to adopt the approach in their business nowadays, but this is not without problems. In particular, those who are responsible for managing the process of VM adoption – we call them Champions-- encounter several challenges and difficulties. In this paper, we explore which challenges and difficulties VM Champions face when they try to incorporate the methodology in their organizations. The purpose of this paper is to structure this growth path from a VM Champions point of view to help them speed up VM implementation processes and make VM more successful. Based on the results of a survey, we describe typical success indicators that Champions use, the issues they encounter and the actions they take to overcome these issues.

This paper is structured in several parts. First, we describe the background of this paper and explain the relevance of the topic. Then we will introduce three development stages, which we derived from ProRail's VM program evolution. Based on those three stages we present the experiences of various VM Champions from different industries on what they have learned about when a stage has been accomplished successfully, what the main focus should be and which issues they encounter, and finally how they have solved issues. We will end with a conclusion and a call for action.

Obstacles to adopting Value Management in organizations

We are fascinated by the fact that despite the benefits of VM, it appears to be rather difficult to get the methodology adopted firmly within organizations. Among other factors, it takes a long time to successfully implement Value Management (VM) in an organization. For example, the VM program of ProRail, Manager of the Dutch Railway Infrastructure and also the organization where one of the authors is working, was established 20 years ago and is still evolving. Today, VM within ProRail entails 55 inhouse Value Engineers and over 200 completed Value studies resulting in a total potential cost saving of around €800 million. Organizations in other industries appear to adopt VM in a similar time consuming fashion.

Nowadays, it is possible to find much information on VM programs on the internet and conference papers. Moreover, there is the European standard EN12973, which gives us a great description of what Value Management entails in an organization. Nevertheless, these do not describe how to get to a mature level of VM in an organization. For example, after some successful VE pilots at ProRail, the organization asked the VM Champion to further implement Value Management in the organization. But how? Although we have great personal growth paths worldwide, like SAVE and Value for Europe certification, their focus is on facilitating VM workshops.

There seems to be no VM Maturity model which defines maturity levels and the steps to reach those levels. Which is rather remarkable since the adoption of VM in an organization is an important prerequisite to apply the Value Methodology. It is mostly a trial and error venture for the Champion. The good thing is: It has already been done, hundreds of times.

Note that we use the term Value Management and not Value Methodology. Value Management is defined here as a management approach “with the aim of maximizing the overall performance of an organization” [CEN; 2008]. The Value Methodology is part of the Value Management approach.

Three stages of VM development in an organization

To define development stages to assess where an organization is in its development of VM we used ProRail’s development of VM as a blueprint. In figure 1, you see the timeline of ProRail’s VM program and its different phases it went through. Based on ProRail’s development three main stages were defined: Orientation, Adoption & Integration. These three stages signify the growth of Value Management in an organization.

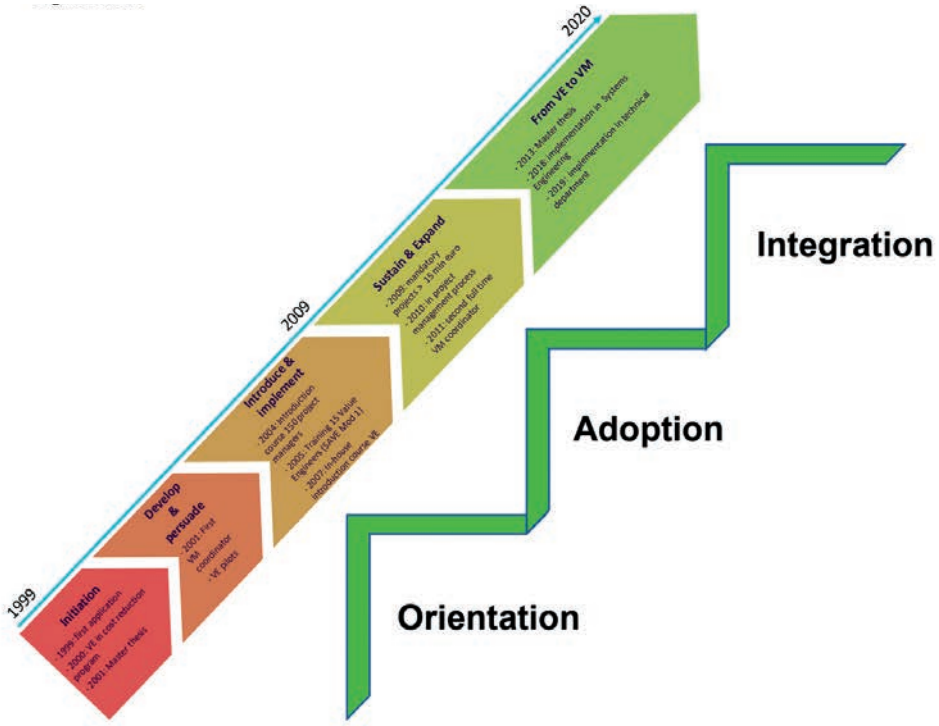

Figure 1: Prorail's VM development stages

When these stages are related to the work of Champions, the Orientation stage starts when the organization has appointed someone to explore VM (the Champion) and to probe if there is amino for the methodology within the organization. Alongside exploring VM, the Champion also needs to find out whether there is sufficient support among employees of the organization. The key focus of this stage is to determine whether VM is beneficial for the organization, whether there is sufficient support, and whether it is worth further investment.

The second stage of development, the Adoption stage, describes the situation when VM has taken root, but needs to grow further. This is the part where the Champion needs to generate additional support and tries to establish and embed the VM methodology further in the organization.

In the third stage, the Integration stage, the methodology has arrived at a point where it is more or less fully embedded in the organization, but in this stage, it needs to be monitored, updated and maintained. This is also the stage when VM may affect strategic plans of the organization.

VM championing survey

To study the challenges that Champions face when trying to get VM fully integrated in their organizations, we conducted a survey. The survey was handed out to about 49 people after a presentation on this subject at the VDI Wertanalyse conference on May 22nd 2019 in Mannheim, Germany (Hendriksen, 2019). Nine VM Champions responded. The Champions represented a wide variety of organizations, varying from public civil engineering organizations to private multinationals in different industries. The survey was structured in three parts. First, there were questions about the success criteria that the Champions strived after. Typical questions included how the Champions could know when they were successful and what indicators they used for that, implicitly or explicitly. Secondly, the survey consisted of questions about the actions that Champions took to reach the desired success goals. Finally, questions addressed which typical challenges the Champions faced when carrying out their championing roles.

Results

The results are presented in three tables in the appendix. The tables describe the VM success criteria that the Champions use explicitly or implicitly (Table 1), the VM actions (Table 2), and the VM issues that Champions face (Table 3). When considering the three tables, some general patterns can be identified. These are discussed here.

Development of success criteria

Based on the responses of the survey participants, we distinguished five categories of success:

1. the degree of VM management support;
2. the extent to which VM is embedded in the internal processes of the organizations;
3. the organizational awareness of VM;
4. VM knowledge and training;
5. the number of success cases.

The success indicators that the Champions use are tailored to specific stages of development. This means that in the Orientation stage, the success criteria are quite moderate and humble, but become more challenging in the Adoption and Integration stage that follows. Also apparent is that the success indicators gradually change in character, from ad hoc informal indictors, via structured organizational indicators, to VM maintenance indicators. By ‘informal’, we mean indicators or actions that are not embedded in organizational policies and procedures. For example, the number of people that know the VM Champion, corridor talk, and the number of training programs that are offered ad hoc. In the Adoption stage, the VM success indictors become more formal (meaning more linked to organizational procedures and policies), indicating the Return of Investments (ROI) of VM and stressing the efficiency and effectiveness of VM. Regarding the Integration stage, the nature of the indicators changes to VM maintenance, as it is indicated that, although VM is fully embedded, it can also erode.

Champion actions and issues

Regarding Champion actions, it became apparent that the responses could be categorized in five categories of actions:

1. personal level actions;
2. promotional activities;
3. knowledge and training facilitation;
4. building on success cases;
5. establishing a VM championing team.

For each of these categories, we can see changes in the nature of the actions, following the different development stages. These changes follow the development of the success criteria, meaning that Champions use different success criteria in different stages and adjust their actions to that. For example, in the Orientation stage, the Champions focus mainly on generating organizational VM awareness on an informal basis. Among others, this involves sharing what they know about VM, talking about VM (e.g. talks near coffee machines), and being enthusiastic. Also sharing some success cases belong to these more or less informal actions. The issues that Champions encounter in this stage are that there often are no metrics available to prove that VM works. Moreover, in this stage, it is quite unclear whether VM will stay or will be abandoned; so many employees adopt a wait and see attitude. As evidence is not available, the Champions clearly focus on generating evidence on the benefits of VM by focusing on success stories, generating projects with VM, or anything else that they can use as evidence to demonstrate that VM works.

In later stages, and in keeping with the changes in success criteria, the nature of the Champions' actions changes from VM promotion at individual and project level, to the organizational level. Issues such as embedding VM in HR policies, trying to convince others in the organization to promote VM, and linking VM metrics to organizational metrics is getting more attention. Typical issues that Champions encounter in this stage are resistance from program and project teams because VM adds to their long list of processes, which, they feel, is already too long. Consequently, in this stage there are not only proponents but also opponents, who do not see benefits of VM. Another challenge for Champions is that VM can become so large that one Champion cannot handle it. The Champion can be overloaded with work and needs to be supported by others. Problematic however in this stage is that formal VM systems are still under construction and not fully embedded yet, which means that the Champion becomes very dependent on volunteering people for support.

In the final stage of development, Integration, it appears that the Champions typically focus on maintenance of VM. In addition, they try making themselves obsolete, by appointing others to take over VM championing roles.

In sum, we see a clear development from ad hoc actions addressing individuals and projects (Orientation stage), via more structured actions targeting the organizational level and gathering metrics that VM works (Adoption stage), to trying to motivate others to take over and expand the Championing responsibilities (Integration stage).

Conclusion

In this paper, we explored which challenges and difficulties Value Management Champions face and how they can deal with different issues and bottlenecks when trying to incorporate Value Management in their organizations. We reached the following conclusions. First, the three stages we defined to incorporate VM in the organization (Orientation, Adoption and Integration) were recognized by the VM Champions from different industries and organizations. It appeared that it does not really matter if the organization is large or small, or in which industry it is active. Whether the organization is active in Civil Engineering, IT, or Manufacturing, the same stages of development seem to apply in all industries. In addition, the measures of success, the issues encountered and the actions taken by Champions also appeared to be similar across industries. Possibly, industries are less different than expected with regard to VM adoption. Finally, it appears that every stage has its own distinct measures of success, typical issues and requires different actions from Champions to progress to a next stage. This implies that Champions should carefully explore in which stage of VM adoption an organization is and tailor their actions to that

specific stage. As a final remark, we are of the opinion that VM Champions need to have quite some skills and perseverance to deal with all the challenges that come their way. It is neither a straightforward nor an easy job.

Call for action

Our paper provides some directions for VM Champions to improve and accelerate the adoption of VM in their organizations. However, more research is needed to further substantiate and structure the findings of our research so far. To our best knowledge, no research has been done on this specific topic. From an academic point of view a lot of research has been done on Champions and change processes, but none is related to VM.

Therefor our call for action is the following:

- Initiate more academic research on Champions and Change processes in relation to Value Management
- Share practical insights on experience based adoption of VM in organizations

References

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Appendix

Success category	Orientation	Adoption	Integration
VM Management support	Management (passively) accepts investments in VM training and projects.	Management actively sponsors VM top-down; management backs VM; Project managers are allowed to take the risk of applying VM.	Senior management is talking about VM, its benefits and is busy ensuring that the organization keeps applying it; Management uses VM dashboard/cockpit with metrics; Management increases VM expectations in terms of KPIs and ROIs; VM is integrated at the portfolio level; VM is incorporated in future strategic plans; VM specialist has a seat at the table of management and has become trusted advisor.
VM embedded in internal processes	VM not yet embedded, but applied ad-hoc.	VM included in metrics documents and/or dashboards (KPI, ROI, etc.); VM included in quality documents; VM included in stage gates; Some VM steps included in general management systems.	Stage gates have fully developed sign-off VM elements; Special rooms/locations for VM sessions; VM is mandatory for several types of projects; A professional is appointed to monitor and control VM metrics based on dashboards; VM is self- running and does not depend anymore on championing; Dedicated VM roles exists and are embedded formally; Value Analysis is now part of regular business too.
VM awareness in the organization	People are aware of existence VM Champion and know who he/she is; People talk about VM in the corridors; People request support from VM Champion from time to time.	More people actively ask for support of the VM Champion; Project managers ask the Champion to help apply VM; Explosion of attention for what Champion does; VM is mandatory for certain projects.	Everyone sees benefits of VM and applies it; Others (non-Champions) promote VM; Increased expectations of VM in terms of KPIs and ROIs; People use VM without mentioning it as it has become standard practice; VM embedded in DNA of the organization; There are VM ambassadors.
VM knowledge and training program	There is a training program; People attend/have attended VM trainings.	Number of people trained is rising; Increasing number of requests for training from people (intrinsic motivation, not sent by manager); More structure in training program.	Trainings are formally embedded and established as part of HR; There are specific VM expert pools; Benefits of VM training (soft + hard) are continuously shared;
Success cases	VM has been applied successfully in some pilot projects and benefits of VM for these projects are clear.	Number of VM projects is rising; There have been several successful quick win projects; Multiple project managers have experienced benefits of VM in their projects and are enthusiastic.	Almost all projects are carried out with VM; KPIs and ROIs of VM projects are in keeping with, or even exceeding expectations; VM projects clearly demonstrate benefits of VM; VM benefits are reinvested in further VM development.

Table 1: Success Indicators

Action category	Orientation	Adoption	Integration
Personal level development	Develop a vision for VM in the organization.	Develop a roadmap for this stage focusing on growth, but also on efficiency and effectiveness of VM; Do not take no for an answer; Persevere.	Develop a roadmap for this stage, focusing on maintaining and expanding VM; Delegate VM Champion roles; Maintain VM knowledge levels in the firm; Be mindful of VM complacency as VM can lose its charm; Be aware of competing methods and resistance/conflict they can cause.
VM promotion	Present benefits of VM during small talks; Do VM yourself, practice what you preach; Gather and present metrics and statistics, indicating that VM works; Present success cases/stories; Be enthusiastic.	Much networking; Keep management involved; Tailor VM messages to audience as you have to deal with different groups now;	Try to get VM included at the portfolio level at management; Keep on promoting VM.
Knowledge and training	Share your knowledge; Invite experts; Study success cases of others and share results; Arrange training program; Stress difference between VM and cost reduction.	Keep on training people, but select them carefully; Bring structure to training program; Link training to HR policies;	Keep investing in training people; Ensure that gaps in knowledge are plugged; Appoint roles to plug VM knowledge gaps; Keep training program stable, focus especially on knowledge that gets lost because people leave the organization.
Success cases	Carefully select projects. Select those that have low risk, guarantee success, and are not too complex. However, do not be afraid to use ad-hoc projects that present themselves. Get moving.	Promote, plan and schedule VM studies in advance in projects to ensure it is applied later on; Consider for which projects and in which stage VM is beneficial; Keep applying VM in quick-win or lighthouse projects; Bring project managers on board (willing horses); Build up a trusted advisory role with project managers; Show your ability to help improve business states of projects; Use project problems as leverage for VM; Keep in mind efficiency and effectiveness of VM projects;	Align VM projects with best practices provided by guidelines from VfE and IVM; Keep focusing on efficiency and effectiveness of VM in projects; Upscaling by delegating VM experts to other businesses and departments.
VM championing team	Select people to join you in your VM quest. Typical people are enthusiastic about VM, knowledgeable about VM and aware of the context of organization; If possible, involve someone from management, or key organizational figures.	The attention for VM can become much larger in this stage and too much to handle for one Champion; Try to establish a VM Champion team and establish tasks, roles and responsibilities for people in that team; Involve possible front-runners in your team.	Start delegating VM championing by asking others to run projects and Champion VM (make it self-running);

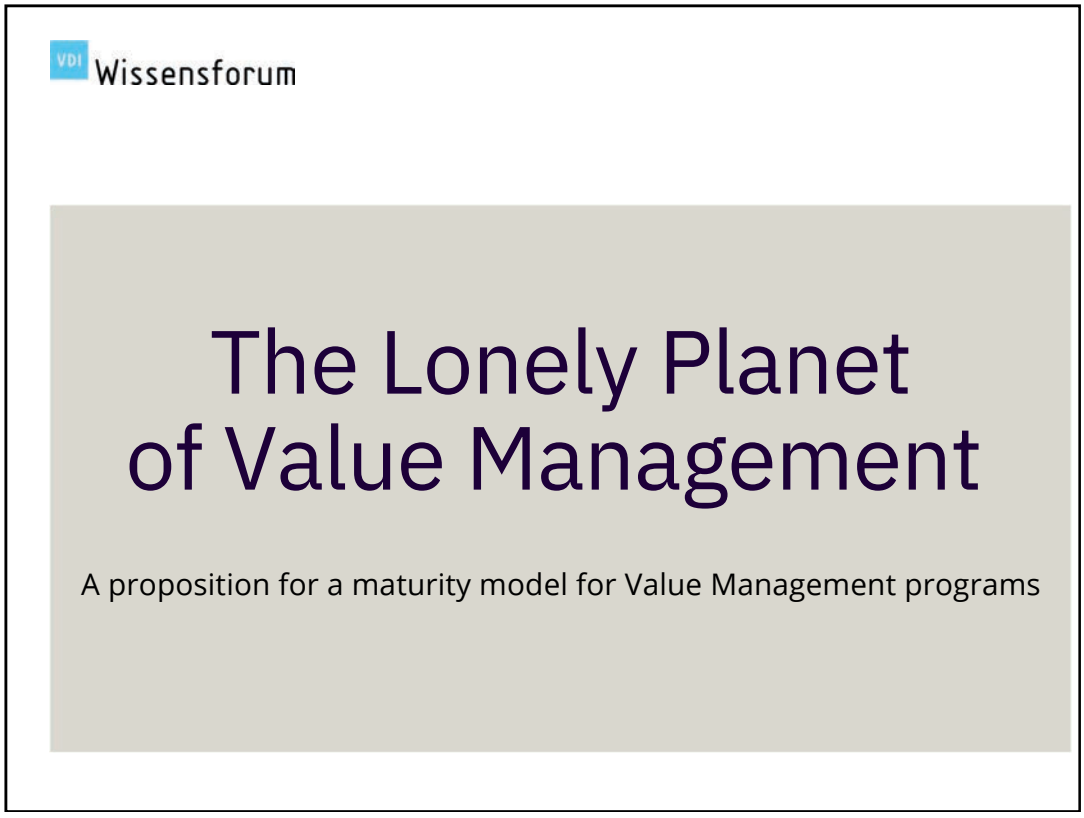
Table 2: Actions taken by Champions

Action category	Orientation	Adoption	Integration
Typical issues	There are no metrics to prove that VM is beneficial; there are no success cases to prove that VM is beneficial; there is always a chance that VM will not be supported or cancelled so people wonder why to invest in it; As VM is not embedded in the organization, it is difficult to reserve time and resources for it; in this stage there is little organizational support to build on, much depends on promoting VM training, raising awareness etc.	Some resistance from program and project teams can be expected because VM adds to their long list of processes, which is already too long; when VM is expanding, there will be proponents but also opponents, some don't see benefits of VM; VM can become so large that it cannot be handled by one team of Champions; Unclear if VM stays: need to fight for time VM is getting bigger than can be handled by one VM championing group; In this stage, you are still dependent on people as formal systems are still under construction and not fully embedded yet	When VM is expanding, there will be proponents but also opponents. Especially when VM becomes mandated, resistance can be expected; VM has to compete with other methods and hypes that are cheaper to apply. Competition between methods can be expected and needs to be handled; Communicate with representatives of other methods to divide the pie. Connect and link, do not compete; The success of VM can make people become too selfish, wanting to score with VM at cost of others; There is a risk of VM complacency (attention drains, people tend to shortcut VM, VM becomes tick-off exercise). Handle this through refresh courses/advanced courses, by making people VM ambassadors; Also monitor, and safeguard content/quality of VM actions/reports.

Table 3: Issues encountered by Champions

International Lessons Learned

The Lonely Planet of Value Management: A Proposition for a Maturity Model for Value Management Programs



VDI Wissensforum

WHAT'S THE DIFFERENCE?

FUßZEILE EINE VERANSTALTUNG DES VDI WISSENSFORUMS | DATUM

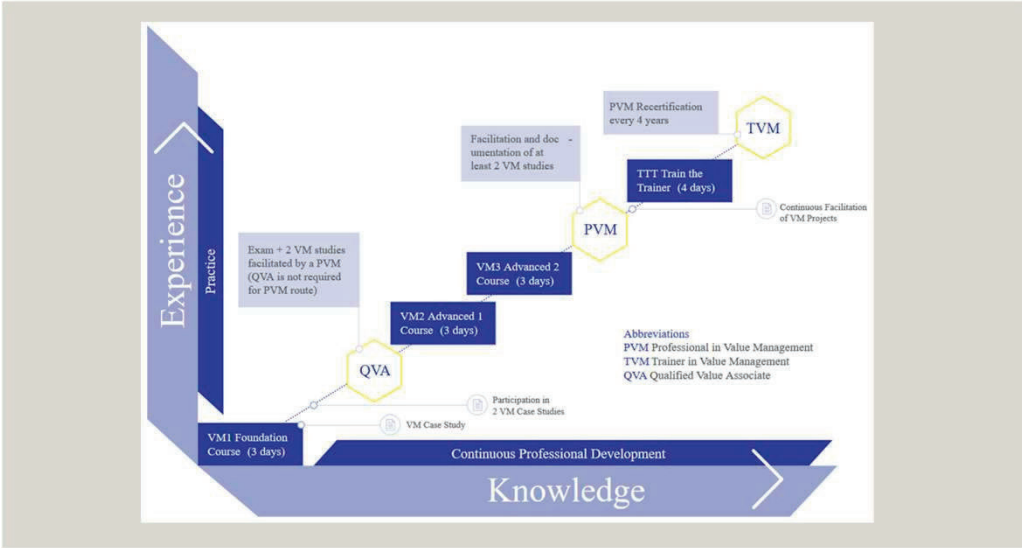
The difference is about 20 years of experience in running the ProRail, owner of Dutch Railways, VM program and also helping other organisations in various industries with the implementation of Value Management.
I want to give back my insights by identifying stages I went through, and challenges I encountered in these stages.
Why? Because I want you to go much faster than I did. I lacked the guidance I would like to give you.

In the next 20 minutes I want to raise awareness that we do not have guidelines how to get to the level described in VM standards
Then I will present to you the maturity model based on my experience
And finally I will propose to further develop the maturity model to support succesful growth of VM worldwide

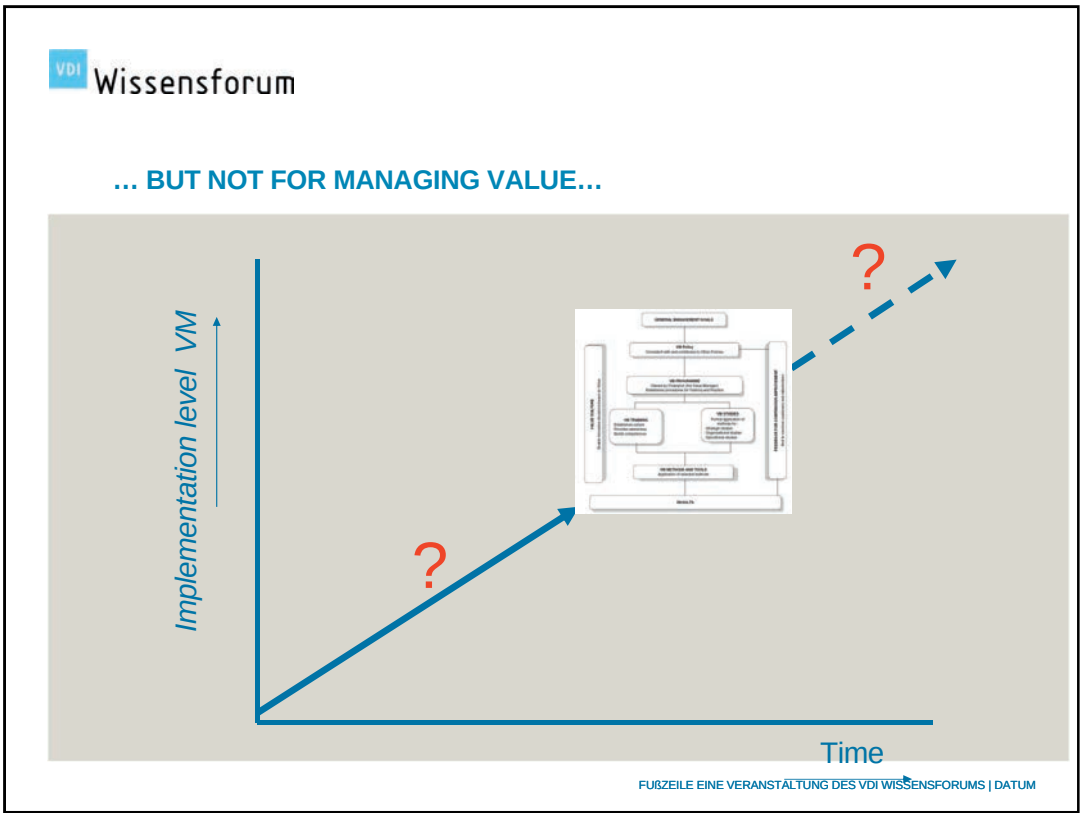
This guy on the left just finished his master thesis on Value Engineering at ProRail.
His first VE pilot (he co-lead) saved 75 %. We are talking millions here.
So they said: Well done, set up Value Management! But…… how?

VDI Wissensforum

WE HAVE GREAT FACILITATOR GROWTH PATHS!



I found that we have great growth paths for VM facilitators.
For example this is the certification route Value for Europe.
And there is SAVE of course.
Excellent ways to develop yourself in VE/VM
But what about VM implementation and other VM roles needed to manage value in organisations?



My biggest challenge was to develop the VM program.
The European standard EN12973 describes a great Value Management framework as you see in this slide
But getting there was a trail & error venture.
Wouldn't it be great if we had a roadmap for implementing value management in organisations?

VDI Wissensforum

WHAT IS MORE IMPORTANT?

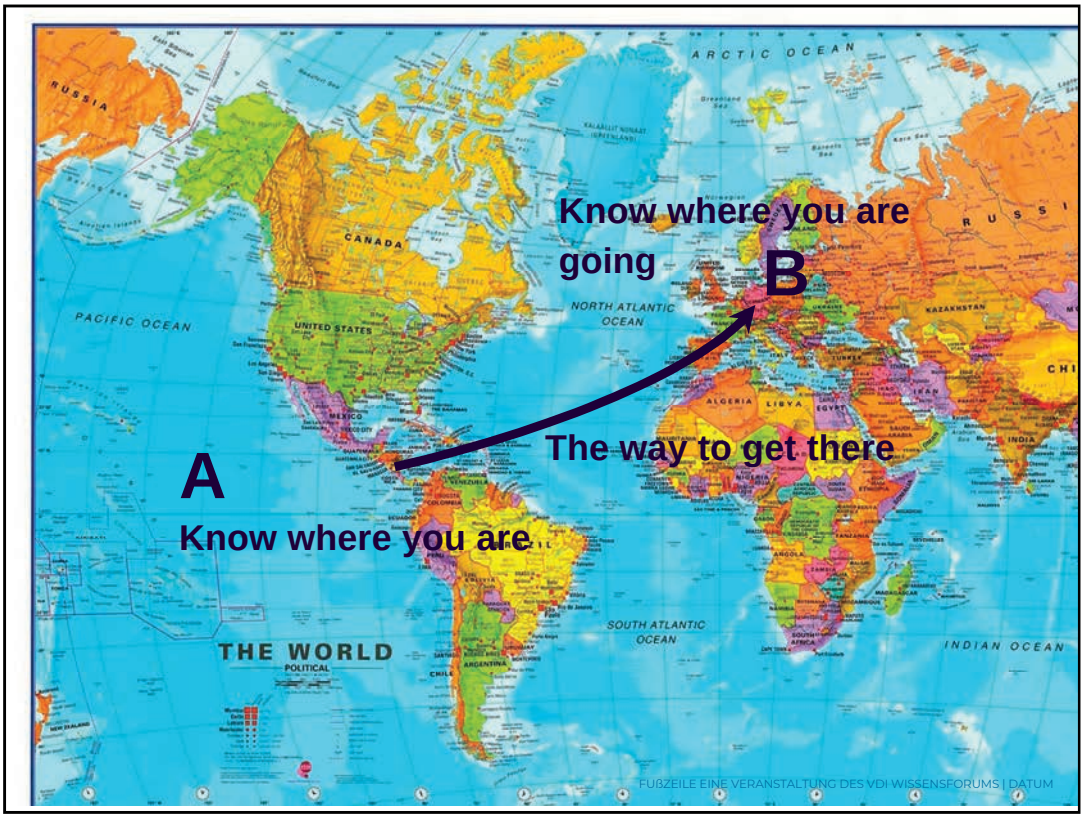
You need a car, before you can drive it!

How important is it to have a maturity model for VM? Lets do a little exercize:

What is more important?
To first have a car or to first have a drivers license (collect some thoughts of the audience)
You need a car, before you can drive it
Or in other words: the implementation of VM in an organisation is an important condition to conduct VE studies

In the Netherlands we have a saying: one swallow does not make it summer. Or in other words: One VE study does not make it Value Management

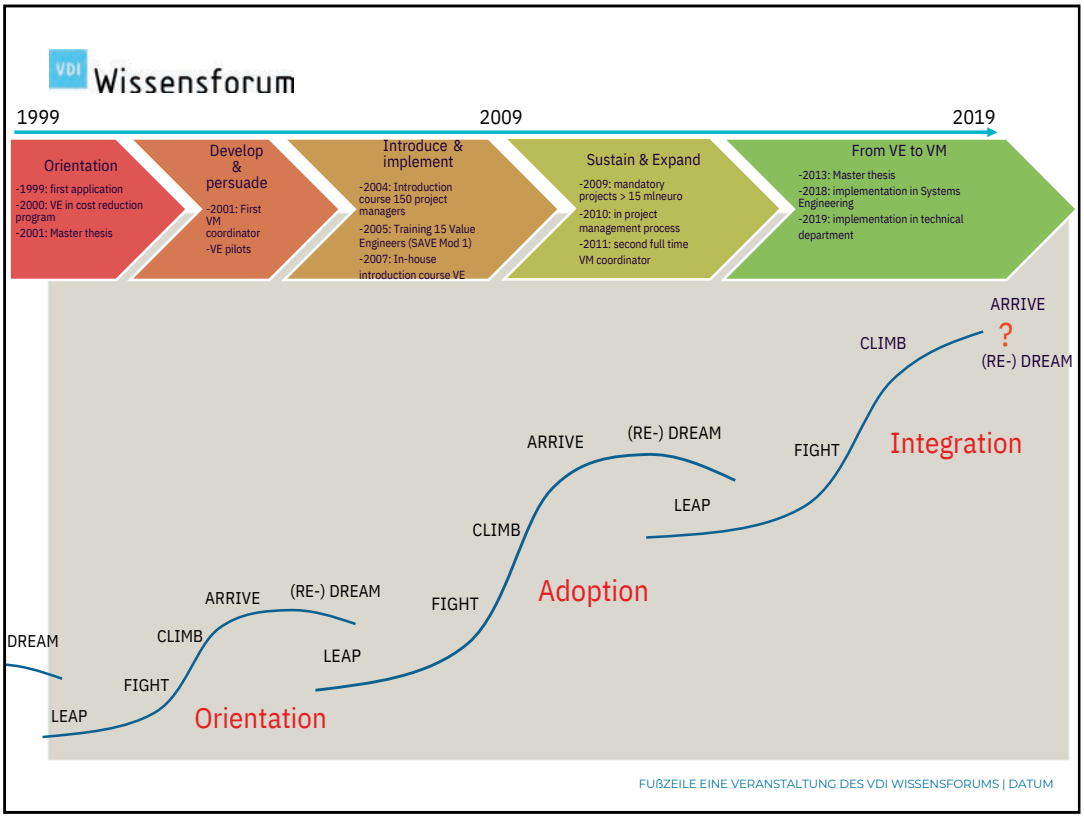
I really believe that focussing on the management of value in organisation will be key to make VM more succesful
But it is hard to get there
That's where a growth path would help



So what should this growth path look like?
You could compare it to a map.
So how do you use a map?
(determine starting point, determine destination, determine route)

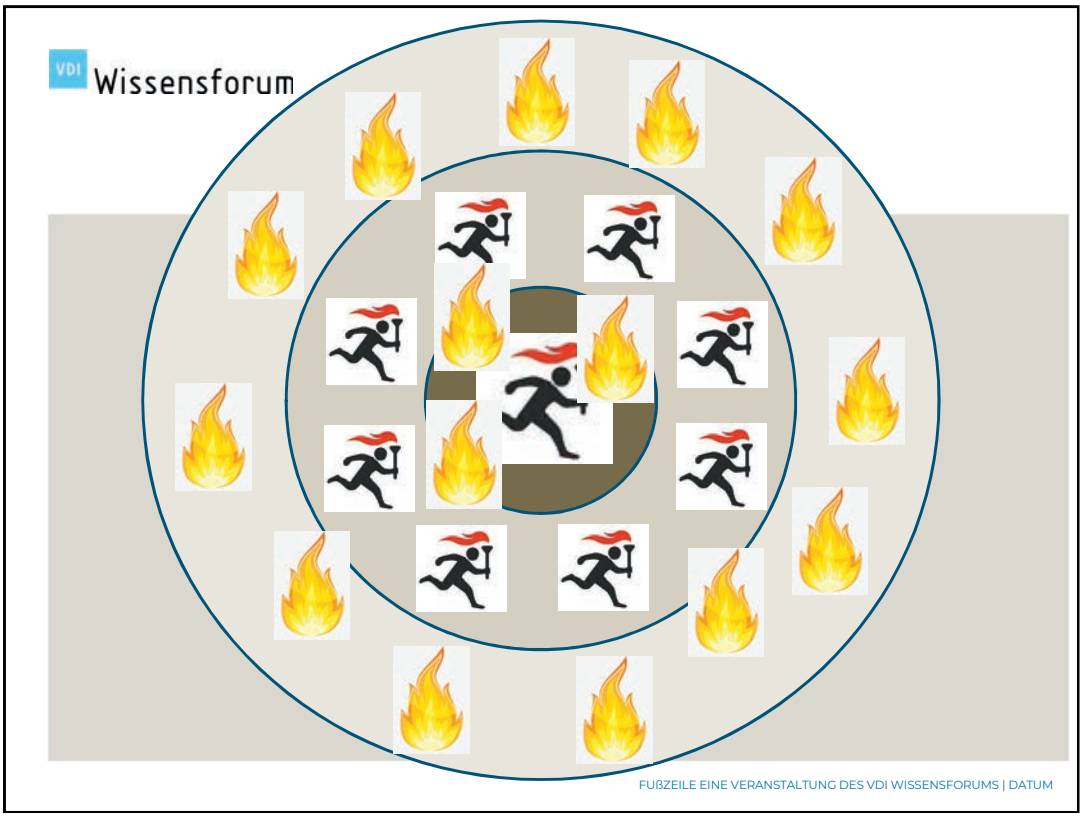
VDI Wissensforum

Everybody has a different context to start from, different goals and expectations on where to go and preferred routes to get there.
Therefor I cannot present THE way to do it.
But I can model rough stages and give some guidance based on my experience

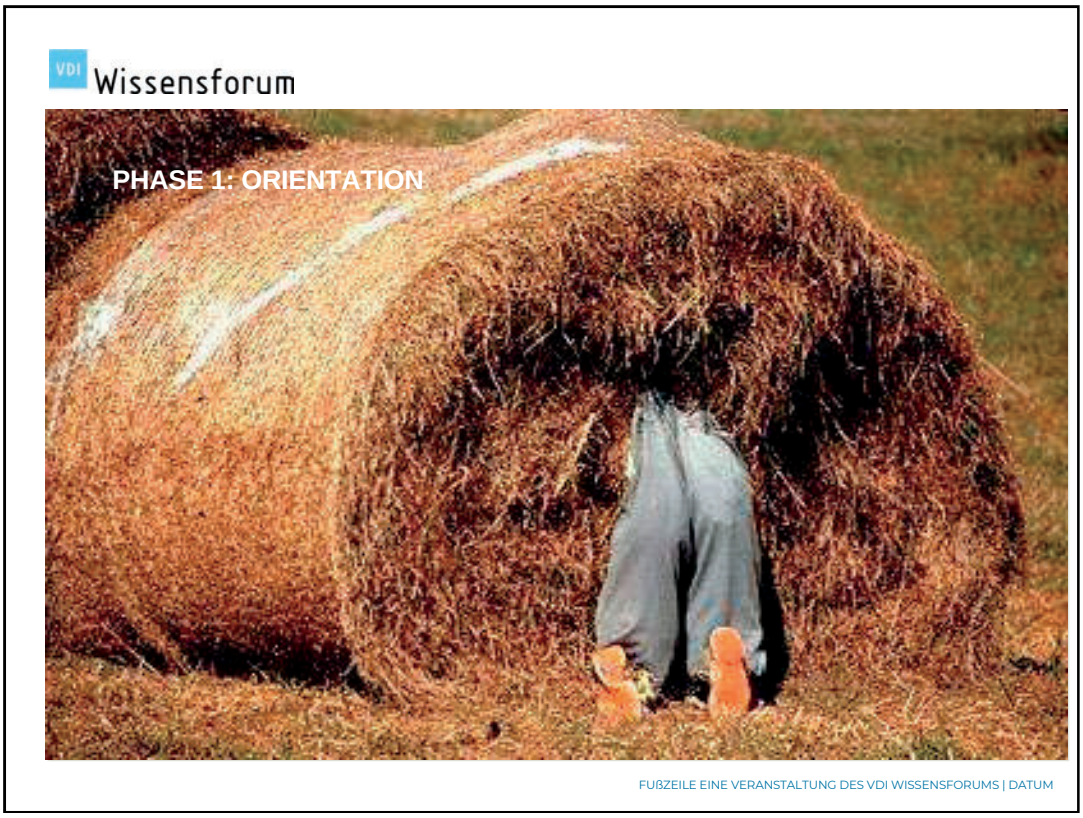


Now lets see what maturity model I derived from my ProRail journey
You see the timeline of ProRail's VM program and its different stages it went through.
I derived 3 phases: Orientation, Adoption & Integration
For those of you who start to grab their surfboards: these are not waves.
What do they look like to you?
These are multiple lifecycles in a venture. Each venture starts with a dream, whereafter you need take a leap in the great uncertain and come across challenges and difficulties before you arrive and re-dream. And leap again…
This model is derived from Nancy Duarte's transformation stages (book "Illuminate")

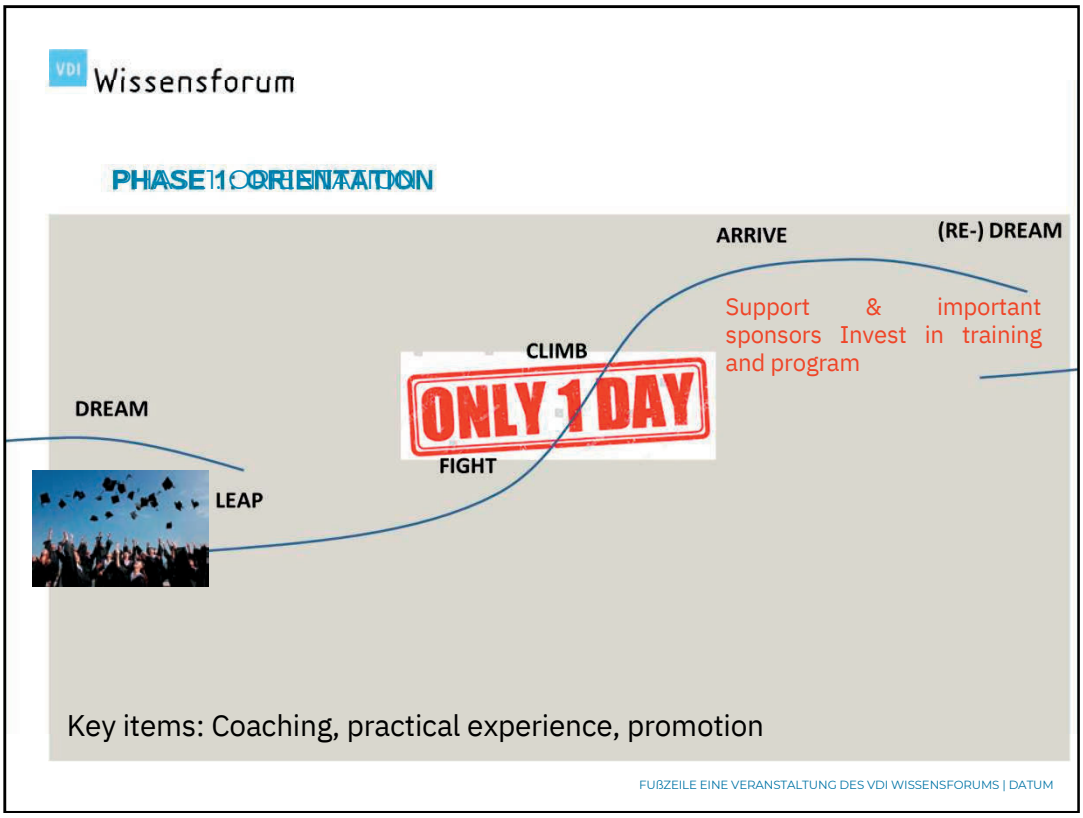
Every organisation has their own size and forms of 'waves'.
For instance the Dutch Highway department used ProRail's best practices and experience. So they went faster through the Orientation phase. But their Adoption phase was different, since they purchase their VE expertise, whereas ProRail has an internal pool of value engineers.



Basically these 3 phases signify the growth of Value Management in an organisation.
At first it is just you as a torchbearer who has a dream
Then there are more torchbearers with their own dreams
Until the whole organisation is on fire for value management



So let’s investigate the phases more in closely
Let start with the the first phase:, no clue what you are looking for



I just want to illustrate 2 things:

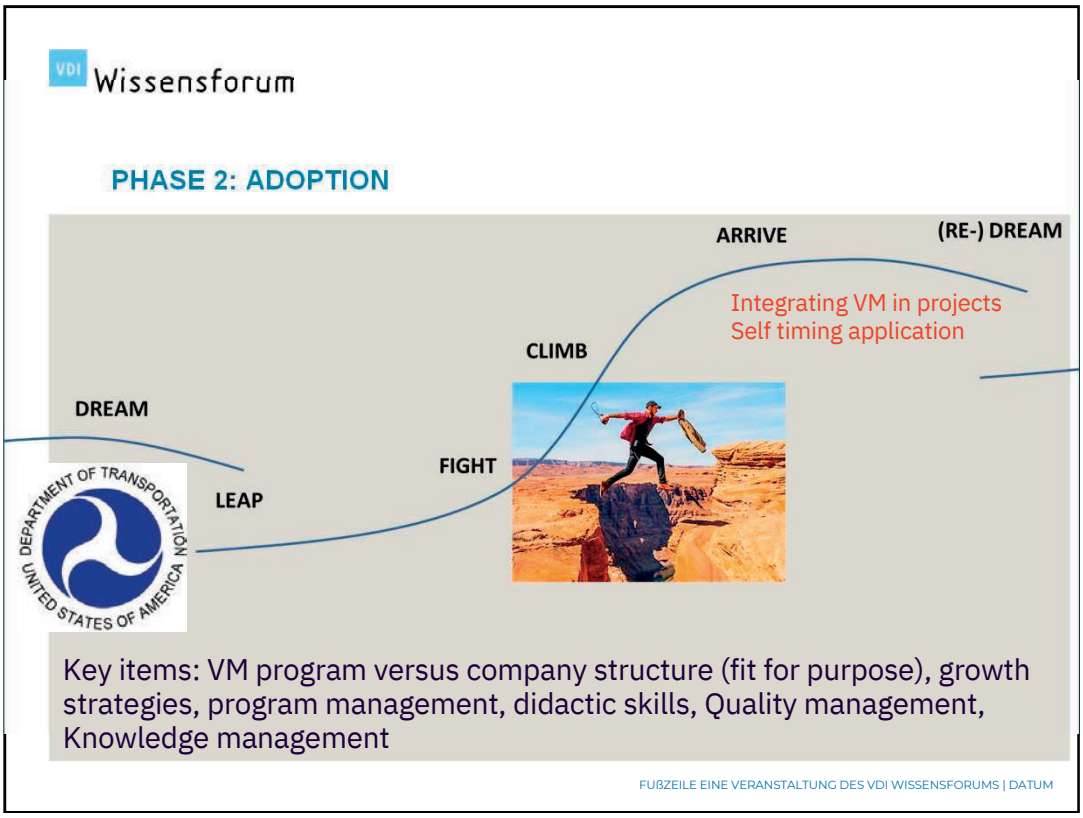
- When do you know that you have arrived?
- And what are challenges you could encounter (fight/climb)

In this phase I did not have a dream. it was my first job and I was enthusiastic about Value Engineering

One of the biggest challenges I encountered was that People don't know it, so they don't want to invest in it.
I started with SAVE certified training hammering 5 day workshops.
And then the project says: that's nice, but you only get one day!
How do you do that while still respecting the VM fundamentals and the need to achieve results (in order to promote it again)?

So when did I notice that I had "Arrived"?
Well, when I noticed that other stuff is starting to happen on another level.
In this case it was the project management department which decided to introduce VE to 150 project managers andtrain 15 Value Engineers

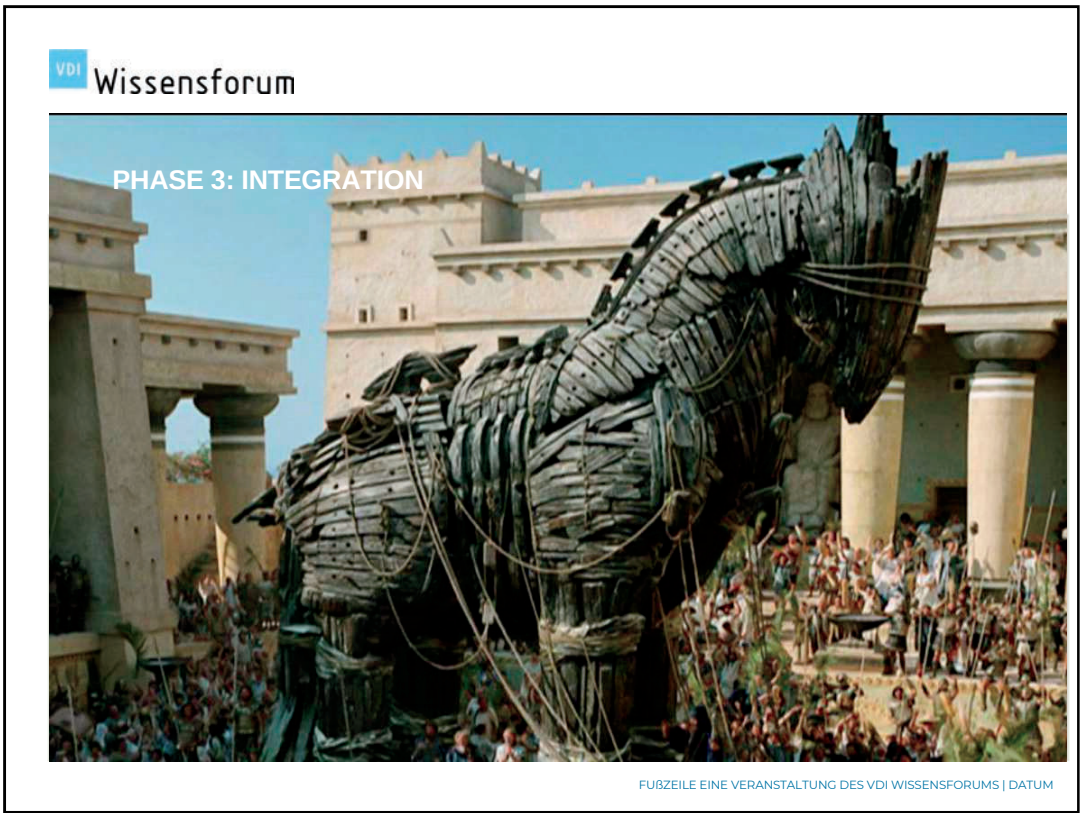
Phase 2: get more and more followers



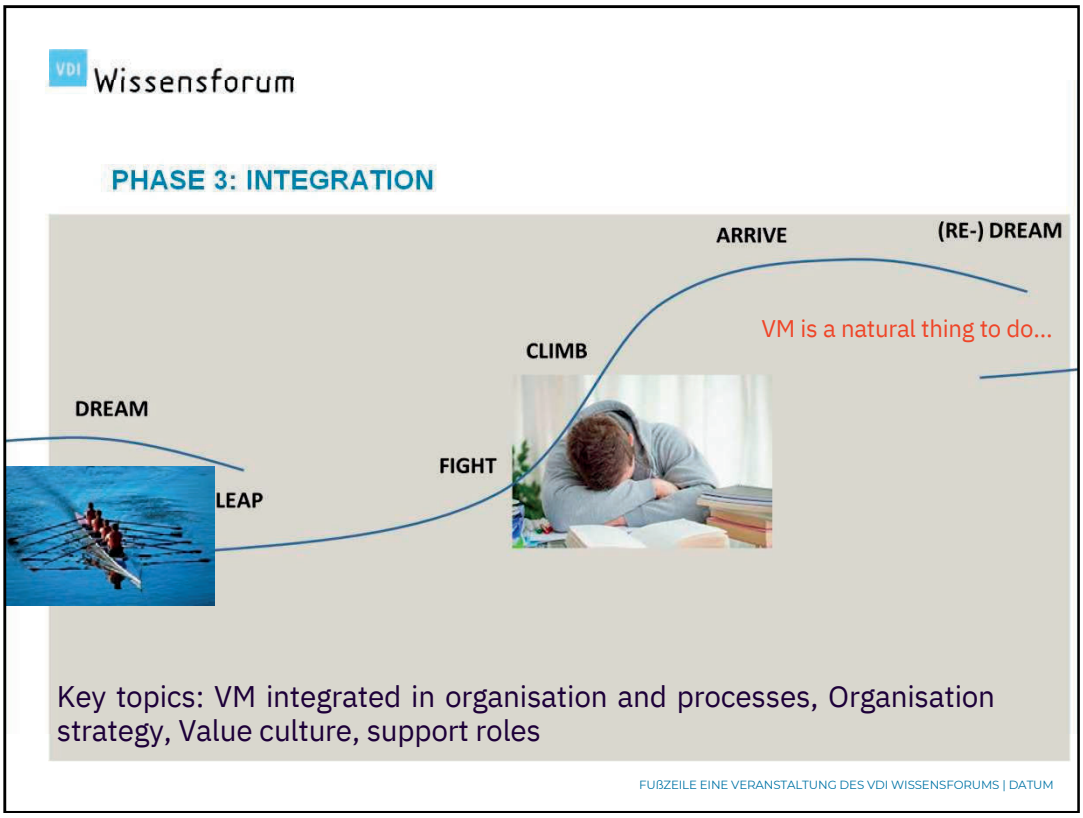
I was dreaming of a VE program US style. With a nice VM policy and a proper framework to support VE application.

Biggest challenge in this level was the gap between mandating VE and really doing it
Implementing VE in the organisation is a change process. VE is mandated for all ProRail projects > €15 mln.
But management is only mandating the instrument, it is not using the VE results to steer value in the organisation.
So the added value is mainly on project optimization and not business optimization.
For instance, If there is no project cost overrun, than projectmanagers are less motivated to use VE, because nothing is wrong, right?

I knew that I had arrived when projects started to initiate value studies themselves and integrate these in their development process.
Without me telling them anything.



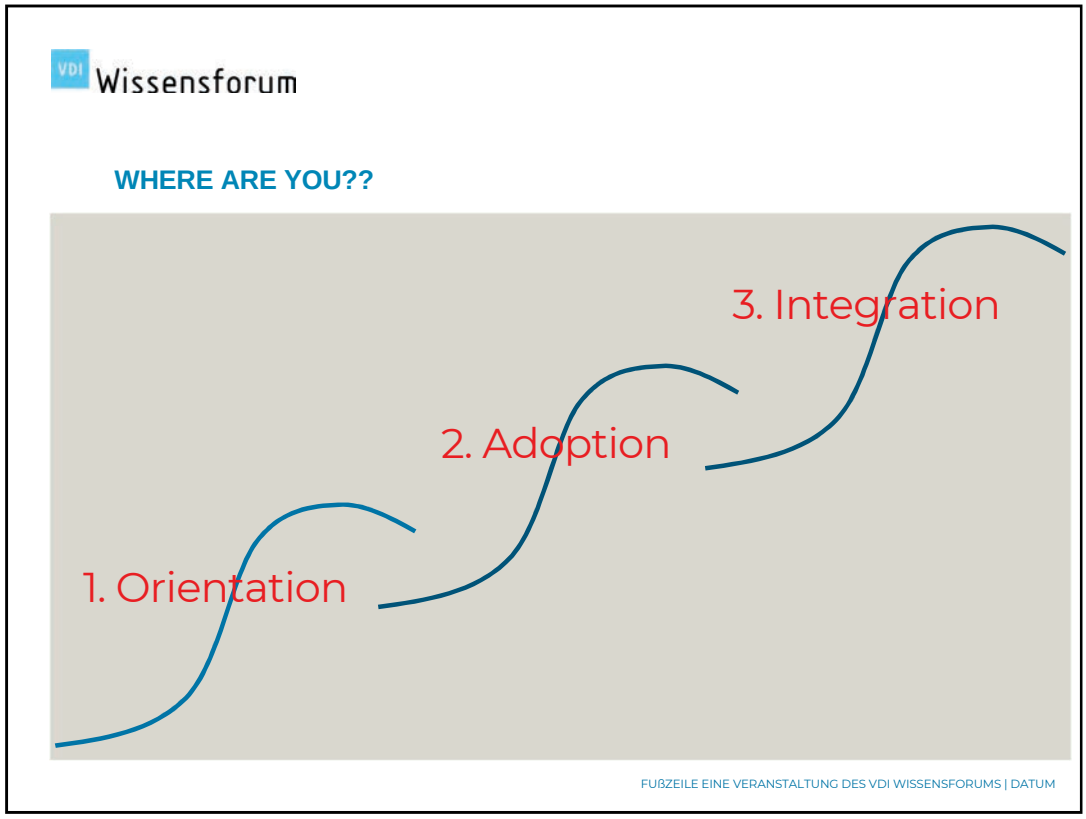
Phase 3: they have no idea what happened. But they have internalized VM



In phase 3 you start to realize that it is not about VE, but about managing value as an organisation. Instrumentation is not the main driver.
It's about value thinking and aligning Business and operational/technical layers.
This is more cultural and organisational. VM will be more integrated in development processes.

My main challenge was to get rid of the instrumental thinking. For example: "For this project VE application is not mandatory"

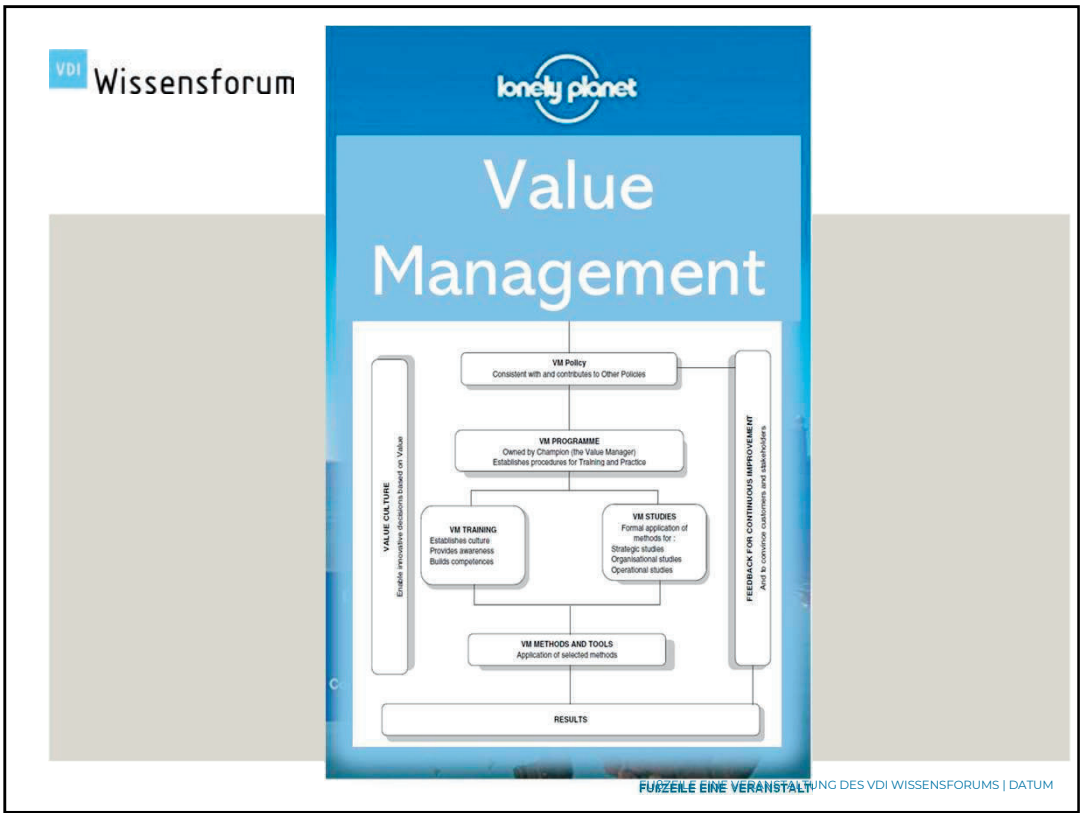
I am not sure where the arrival stage will be.
I guess it will be when everybody has a sense of their own contribution to value creation of the organisation and can organise processes on how to continuously improve value.
In that sense I would be interested in other experiences of what highest maturity level of Value Management looks like and if it matches our standards



So these are the three phase I derived from my journey

Are you aware of the maturity level of VM in your organisation,
what your fights and climbs are
and what you need to do to overcome these?

Do you recognize these phases in your organisation?
[if anybody does; where are they; what are their challenges? And how are the overcoming it?]



[Slotstuk: wat wil ik brengen/ wat moet daar gebeuren/ wat wil ik dat er in de zaal gebeurt?]

As a Value Community we defined the end destination in bodies of knowledge & standards, but there is little guidance in how to get there.
And in my opinion: it takes too long
Wouldn't it be great if we, as VM community, could guide our VM torchbearers to implement VM faster and more sustainable?
You now have a rough map, based on my journey, like a Lonely planet of Value Management.

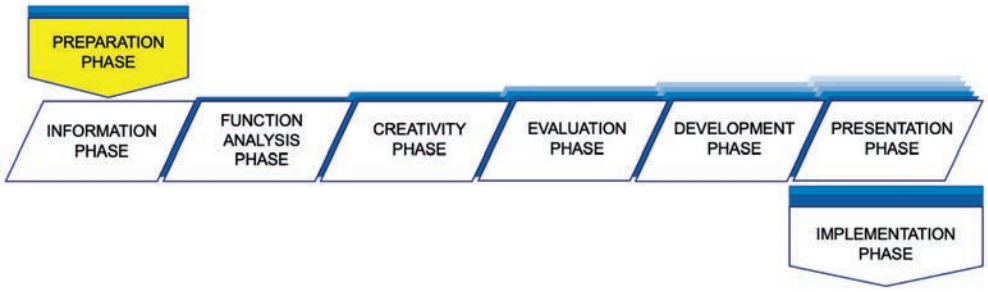
As you probably know, the lonely planet is based on experiences of fellow travelers.
I would like to invite you to share your experiences so I can bundle these in a whitepaper and share these with everyone.
I would really appreciate your help.
I have set up a survey to get feedback on the model and to collect your experiences
I could send it to you, in that case please leave your business card

Lets start making the journey more important than the destination!

APPENDIX

B

Preparation Phase Resources



The following resources are provided in this Appendix:

- **Preparation Phase Meeting Agenda (template)**
- **Preparation Phase Team Primer (template)**
- **Preparation Phase Key Issues Memo (template)**
- **Preparation Phase Team Composition and Data Collection for Infrastructure Projects**
- **Preparation Phase checklist**
- **Sample budgets for VM Studies**

Preparation Phase Meeting Agenda (template)

[PROJECT NAME]

[CLIENT NAME]

PRE-WORKSHOP MEETING MINUTES

Date: [Today's Date]

Attendees: [Name / Organization]

Agenda Items

1. VM Study Overview, Roles and Responsibility
2. Project Overview – Need and Purpose – Issues
3. Project Schedule Milestone Review
4. VM Process Overview
    - VM Study Agenda
    - Confirm Study Dates and Logistics
    - Meeting Location and Times
5. Verify Team Members and Other Participants
    - Team Members
    - Stakeholders to invite to In-brief and Out-brief presentations
    - Technical Reviewers and Resources
6. Review data collection information
7. In-brief Guidelines
8. Identify Decision Makers and discuss preliminary distribution of report and implementation form
9. Open Discussion of Other Topics

Action Items	Owner(s)	Deadline	Status

Preparation Phase Team Primer (template)

Team Primer

Date: **[TODAY'S DATE]**

To: **Value Study Team Members**

From: **[CVS FACILITATOR CONTACT INFO]**
[Name/Title]
[Email]
[Office Phone and Mobile Phone]

Reference: **[NAME OF PROJECT]**
[TYPE OF STUDY]

Thank you for your commitment to participate in the **[NAME OF PROJECT]**. This is an important project for **[NAME OF CLIENT]**, and we will all need to dig in and access our focus, commitment, creativity, flexibility, and potentially at times, patience to support the success of this workshop in this unique virtual environment. The team has varying familiarity with the virtual tools, and we will work with each person as needed to support their active participation.

Workshop Dates and Locations

The VM Workshop will be held **[DATES OF STUDY]**. We will all be in different locations, many in their own home, to achieve safe social distancing. The **Workshop Agenda** accompanies this Primer. We will be on-line for a total of **[BREAKDOWN OF STUDY HOURS, i.e., eight hours each day, Monday through Friday, to complete the originally planned 40-hour workshop]**. We've planned short breaks in the morning and afternoon, with longer breaks scheduled for mid-day. Your participation is required for the full time, and you are expected to be connected and focused on the workshop activities during those times. In-coming calls during those times should go to an answering device, and no texting or other messaging that is not directly workshop related should be happening. Let us know if some type of emergency is occurring that you need to address.

We recommend you review carefully and print-out for use in the workshop: the **Workshop Agenda**, **On-line Workshop Protocols**, and **Workshop Roster**, or have them on a second computer screen if you are conserving paper, so you have them readily available for reference during the workshop.

Preworkshop Preparation

[YOUR ORGANIZATION] desires to have a brief Technology Dry Run with all participants on [DATE] (see Agenda). We will make sure everyone can connect and provide some guidance on the use of the WebEx® meeting platform (free application) and go through the game-plan for document collaboration during the workshop. Since we can't all be talking at the same time, we will need to have protocols for speaking, raising questions, and explaining ideas (these accompany this document). These will include the use of the chat and screen sharing in WebEx® and a collaborative platform for accessing project information and document sharing.

Project documents have been provided to us and include the following:

- **[Document 1]**
- **[Document 2]**
- **[Document 3]**

Please review the documents and complete the pre-workshop **Key Issues Memo (KIM)** provided with this Primer. Please complete the **KIM and return to me no later than close-of-business [DATE]**. Please be thorough in your review and in the comments, issues, and ideas you include on the KIM as it will greatly assist with our work during the VM study. After the workshop kickoff in-brief on **[DATE]**, we will have time to brainstorm and include additional comments, issues, and ideas for consideration; but time will be limited, so be as thorough as possible during the pre-workshop review.

Workshop Equipment Requirements

You will need a computer with both Microsoft Excel® and Microsoft Word®; the computer should have the capacity to run WebEx®. You will need to have a video camera either on your computer or as a peripheral attachment. We do want to be able to see your face and hear you clearly. Earbuds or headphones, if compatible with your computer, will improve our ability to hear you, and buffer some outside noise. Please read the attached **Workshop Protocol Document** for additional details on the Rules and Engagement and Technical requirements of the workshop. Your Internet connection needs to be stable and to have adequate capacity to stream the on-line meeting and the transfer of documents back and forth. We recommend you have a computer screen that is at least 10"x14", but encourage you to have something larger if possible or two screens.

Workshop Dress Code

Business casual is still appropriate in a virtual workshop. Open collar shirts are fine, but please no T-shirts, caps, or distracting video backgrounds.

I look forward to working with you on this great project. I am eager to demonstrate that great collaboration is possible in a virtual environment. **If you have any questions or need to discuss anything with me about the workshop, please call [##-##-##-##].**

Thanks in advance for your focus, creativity, and great work on this effort.

Accompanying Documents

- Workshop Agenda
- Online Workshop Protocols
- Key Issues Memo template (KIM)
- Team Roster with Phone Numbers and E-Mail Addresses

Preparation Phase Key Issues Memo (template)

Value Engineering (VE) Key Issues Memo

Date: (to be completed and returned to **[NAME OF CVS FACILITATOR]** no later than close of business on **[THREE DAYS BEFORE WORKSHOP BEGINS]**)

To: **[CVS FACILITATOR CONTACT INFO]**
Name/Title
Email
Office Phone // Mobile Phone

From: Your Name
Your Email
Your Mobile Phone
Your Office Phone

Reference: **[NAME OF PROJECT]**
[TYPE OF STUDY]

After reviewing the project documents, detailed below are Issues/Observations, Preliminary VE Opportunities, Project Risks, Questions for the Owner/Designer, and additional Information Requests for the workshop starting **[DATE WORKSHOP IS TO BEGIN]**:

Issues/Observations

- Issue 1
- Issue 2

Preliminary VE Opportunities

- VEO 1
- VEO 2

Project Risks

- Risk 1
- Risk 2

Questions for the Owner/Designer

- Q 1
- Q 2

Information Requests

- Info 1
- Info 2

Team Composition and Data Collection for Infrastructure Projects

The following table includes considerations for the VM team composition, depending on the type of infrastructure project. In addition, the table includes types of information that could be part of the data collection and VM team review during the Preparation Phase of the VM study.

Team Composition (by type of infrastructure project)

Type of Infrastructure Project	Potential VM Team Composition
Airport	• Air Transport Specialist • Passenger Terminal Planner • Architect • Civil & Structural Engineer / Airfield Pavement Specialist • Electrical Engineer • Mechanical engineer • Airport Operations Expert • Safety/Security Specialist • Urban/Regional Development Specialist • Cost Estimator
Highway and Roadway Transportation	• Highway Engineer • Traffic Engineer • Geotechnical Engineer • Geometric Design/Geodetic Engineer • Right-of-way / Access Management Specialist • Hydrologist/Drainage Engineer • Civil & Structural Engineer • Architect (for projects with highway facilities, etc.) • Urban/Regional Development Specialist • Cost Estimator
Transit	• Transport Infrastructure Planning/Design Specialist • Transport Planner/Modeller • Alignment/Geodetic Engineer • Traffic Engineer • Civil & Structural Engineer • Architect • Geotechnical Engineer • Electrical/Mechanical Engineer • O&M Specialist • Urban/Regional Development Specialist • Cost Estimator

Type of Infrastructure Project	Potential VM Team Composition
Water	• Water Resources Planning Expert • Civil & Structural Engineer • Water Biologist • Hydrologic Engineer / Flood Management Specialist • Hydraulic Engineer or Dam/Irrigation Specialist • Electrical Engineer • Mechanical Engineer • O&M Specialist • Hydropower Specialist (for projects with hydropower component) • Urban/Regional Development Specialist • Cost Estimator
Wastewater	• Wastewater Treatment Process Engineer • Civil & Structural Engineer • Electrical Engineer • Mechanical Engineer • Hydraulic Engineer • Landscape Architect • Socio-Environmental Specialist • O&M Specialist • Urban/Regional Development Specialist • Cost Estimator
Flood Control	• Hydrologic Engineer / Flood Management Specialist • Hydraulic Engineer / Stormwater Management Specialist • Drainage Engineer • Civil & Structural Engineer • Landscape Architect • Environmental Specialist • Social Development/Relocation Specialist • Urban/Regional Development Specialist • Cost Estimator
Other Subject Matter Experts (SMEs) that may be added to a Study Team, depending on the stage, nature, complexity, or intricacies of the project	• Geographic Information System & Database Specialist • Construction Scheduler • Financial Specialist • Economic Specialist • Institutional Specialist • Environmental Specialist Gender and Development Specialistt

Data Collection (by type of infrastructure project)

In addition to the ideal team composition, it must be noted that the effectiveness of VM is limited by the quality, quantity, age and veracity of documents provided for the team to use.

The table below provides the list of documents that, whenever available, should be provided to the VM study Team prior to the VM Workshop.

Type of Infrastructure Project	Documents to be Provided for VM Team Review, if applicable and/or available
Airport	• Pavement design standards • Land-use requirements
Highway and Roadway Transportation	• Traffic models and forecasts • Right-of-way plans • Environmental documents • Hydrology and Hydraulic reports • Design concept reports
Transit	• Ridership data • Environmental documentation • Right-of-way plans • Land-use plans
Water	• Turbidity report • Hydraulic data • Hydrology data • Environmental documents • Permit requirements
Wastewater	• Process data • Permit data and requirements
Flood Control	• Hydraulic data • Hydrology data • Environmental documentation • Permit requirements • Land-use plans • Right-of-way plans
Additional considerations for all project disciplines	• Engineering, Design and Construction Standards • Local Codes & Regulations • Scope Statements • Project Management Plan • Drawings • Technical Reports • Stakeholder Information and/or agreements • Specifications and/or Requirements • Cost Estimates • Risk Registers

Preparation Phase Checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

Preparation Phase Checklist

✓	**Task / Activity, if applicable**	**Comment(s)**
	Identify the project, product or process to perform a VE Study on	
	Identify the Facilitator for the VE Study	

	Conduct VM study pre-meeting
	• Identify VM study goals and objectives
	• Identify Project Goals, Objectives, Study Constraints
	• Identify Subject Matter Expert (SME) needs for the study & any additional VM study participants
	• Clarify study needs (in person/virtual/hybrid, location and food/drink if in person)
	• Identify VM study schedule* and agenda
	• Identify VM study logistics
	  ◦ Will a site visit be conducted?
	  ◦ Identify site visit requirements	

	Identify and collect information • Identify primary and secondary sources of information	
	Distribute information	
	Review information	

✓	Task / Activity, if applicable	Comment(s)

	Create and distribute a team “Welcome Package”
	• Finalized Agenda with meeting dates, location or links (in person or virtual), and any other relevant data to the study days and location
	• Create a set of Team Protocols
	  ◦ Rules of engagement and etiquette
	• Create a Team Primer
	  ◦ Brief description of project, VM and study is conducted
	• Create invitations to virtual/in person meeting dates	

	Develop a workshop supply checklist (if in person), to suit the way you see your study being run, and to allow flexibility. As a brief example: • Printed copies of agenda, cost models, etc. for each study member • Tent cards for study participants • Flip charts, paper, folders • Markers, pens, pencils, sticky notes • Projector, microphone, speakers, cabling (power & connection) • Printer, scanner (with extra ink/toner) • Tape, scissors, scales and rulers • A “Crash Kit” in case your network connection is not available (all documents backed up to a USB thumb drive). This should include any and all templates to be used during the study.	

*When determining the duration of the VM study, the following factors should be considered:

- Size and complexity of the project
- VM study goals and objectives
- VM study scope
- Size and experience of the VM study team
- Resources available to conduct the study

SAVE International’s VM Guide provides guidance on “typical” five-day (40-hour workshop) and three-day (24-hour workshop) project VM studies, as follows:

VM Job Plan Phase	No. of Hours per Phase (5-day VM study model)	Number of Hours per Phase (3-day VM study model)
Preparation	8-24	24-32 *(Note: more pre-study time required by the VM facilitator to prepare for the abbreviated VM study)*
Information	4-6	4 *(Note: site visit eliminated)*

VM Job Plan Phase	No. of Hours per Phase (5-day VM study model)	Number of Hours per Phase (3-day VM study model)
Function Analysis	2-4	2-3 (*Note: less time for team interaction; increased VM facilitator influence; reduced time for cost/performance/function analysis)*
Creativity	3-6	2-3 *(Note: fewer ideas generated; potential loss of significant ideas)*
Evaluation	4-6	4 *(Note: reduced depth of team discussion and analysis of ideas)*
Development	16	8-10 *(Note: less detail; potentially less credibility related to VM proposals)*
Presentation (Oral Out-brief)	2-4	2 *(Note: fewer VM proposals to present)*
Presentation (Report)	40	64 *(Note: more time required in report writing to complete development of value proposals)*
Implementation	Times will vary and depend on VM study sponsor	

Sample budgets for VM Studies

AIRPORT AND HIGHWAY/ROADWAY PROJECTS

A. REMUNERATION	DURATION (Days)			BASE MONTHLY RATE	COST PER PROJECT TYPE	
	Pre (incl site visit)	Proper	Post		AIRPORT	HIGHWAY & ROADWAY
VM EXPERTS						
Certified Value Specialist (international)*	10	5	10	3,394,286.00	3,857,143.18	3,857,143.18
Certified Value Specialist (local)	10	5	10	1,508,572.00		
Value Methodology Associate (local)	10	5	20	754,286.00	1,200,000.45	1,200,000.45
VM STUDY TEAM						
Team Leader**	8	5	8	672,269.00	641,711.32	641,711.32
Airport Project						
Air Transport Specialist	5	5	5	420,169.00	286,478.86	
Passenger Terminal Planner	5	5	5	420,169.00	286,478.86	
Architect	5	5	5	420,169.00	286,478.86	
Civil & Structural Engineer / Airfield Pavement Specialist	5	5	5	420,169.00	286,478.86	
Electrical Engineer	5	5	5	420,169.00	286,478.86	
Mechanical engineer	5	5	5	420,169.00	286,478.86	
Airport Operations Expert	5	5	5	420,169.00	286,478.86	
Safety/Security Specialist	5	5	5	420,169.00	286,478.86	
Highway & Roadway Project						
Highway Engineer	5	5	5	420,169.00		286,478.86
Traffic Engineer	5	5	5	420,169.00		286,478.86
Geotechnical Engineer	5	5	5	420,169.00		286,478.86
Geometric Design/Geodetic Engineer	5	5	5	420,169.00		286,478.86
Right-of-way / Access Management Specialist	5	5	5	420,169.00		286,478.86
Hydrologist/Drainage Engineer	5	5	5	420,169.00		286,478.86
Civil & Structural Engineer	5	5	5	420,169.00		286,478.86
Architect (for projects with highway facilities, etc.)	5	5	5	420,169.00		286,478.86
Subject Matter Experts (SMEs) common to all infrastructure projects						
Urban/Regional Development Specialist	5	5	5	420,169.00	286,478.86	286,478.86
Cost Estimator	5	5	5	420,169.00	286,478.86	286,478.86
Other Subject Matter Experts (SMEs) that may be added to a Study Team, depending on the stage, nature, complexity, or intricacies of the project:						
Geographic Information System & Database Specialist	5	5	5	420,169.00		
Construction Scheduler	5	5	5	420,169.00		
Financial Specialist	5	5	5	420,169.00		
Economic Specialist	5	5	5	420,169.00		
Institutional Specialist	5	5	5	420,169.00		
Environmental Specialist	5	5	5	420,169.00		
Gender and Development Specialist	5	5	5	420,169.00		
SUPPORT STAFF						
Technical Support (for virtual workshops)	10	5	2	576,807.00	445,714.50	445,714.50
Researchers	15	5	2	84,034.00	84,034.00	84,034.00
Admin Support	15	5	2	84,034.00	84,034.00	84,034.00

B. REIMBURSABLE/MISCELLANEOUS EXPENSES	QTY	UNIT	UNIT PRICE	COST PER PROJECT TYPE	
				AIRPORT	HIGHWAY & ROADWAY
Travel expenses for international or domestic flights of personnel (airfare, etc.)		rountrip flights	at cost	------- *at cost, as needed* -------	
Per diem allowance of personnel (meal allowances, hotel, airport transfers, etc.)		days	at cost	------- *at cost, as needed* -------	
Venue rental and food arrangements	75	person-days	2,500.00	187,500.00	187,500.00
Supplies, drafting, printing and reproduction***	3	months	12,000.00	36,000.00	36,000.00
Local transportation, courier/messengerial services, etc. ***	3	months	10,000.00	30,000.00	30,000.00
Communication***	3	months	10,000.00	30,000.00	30,000.00
Site visit expenses (team transportation, accommodations, per diem, etc.)		persons or days	at cost	*cost, as needed, depending on locati*	
GIS software / mapping services		months	at cost	------- *at cost, as needed* -------	
Use/Lease of computer hardware & software		months	at cost	------- *at cost, as needed* -------	
Other necessary expenses		months	at cost	------- *at cost, as needed* -------	
SUB TOTAL				**9,460,926.09**	**9,460,926.09**
Add: 12% VAT				1,135,311.13	1,135,311.13
TOTAL				**10,596,237.22**	**10,596,237.22**

* *International CVS included in the budget due to current unavailability of a local CVS.*

** *For computation purposes, the Consultant did not assume that the Team Leader was also one of the subject matter experts. However, it is recommended that the Team Leader (TL) be selected from among the study team members (i.e., Highway Engineer may be the TL for a highway/road project). In this case, the rate and allocated person-months of the*

*** *Estimates only. Subject to increase, based on quantity of references and reports to be reproduced, type of communication to be provided, etc.*

TRANSIT AND WATER PROJECTS

A. REMUNERATION	DURATION (Days)			BASE MONTHLY RATE	COST PER PROJECT TYPE	
	Pre (incl site visit)	Proper	Post		TRANSIT	WATER
VM EXPERTS						
Certified Value Specialist (international)*	10	5	10	3,394,286.00	3,857,143.18	3,857,143.18
Certified Value Specialist (local)	10	5	10	1,508,572.00		
Value Methodology Associate (local)	10	5	20	754,286.00	1,200,000.45	1,200,000.45
VM STUDY TEAM						
Team Leader**	8	5	8	672,269.00	641,711.32	641,711.32
Transit Project						
Transport Infrastructure Planning/Design Specialist	5	5	5	420,169.00	286,478.86	
Transport Planner/Modeller	5	5	5	420,169.00	286,478.86	
Alignment/Geodetic Engineer	5	5	5	420,169.00	286,478.86	
Traffic Engineer	5	5	5	420,170.00	286,479.55	
Civil & Structural Engineer	5	5	5	420,169.00	286,478.86	
Architect	5	5	5	420,169.00	286,478.86	
Geotechnical Engineer	5	5	5	420,169.00	286,478.86	
Electrical/Mechanical Engineer	5	5	5	420,169.00	286,478.86	
O&M Specialist	5	5	5	420,169.00	286,478.86	
Water Project						
Water Resources Planning Expert	5	5	5	420,169.00		286,478.86
Civil & Structural Engineer	5	5	5	420,169.00		286,478.86
Water Biologist	5	5	5	420,169.00		286,478.86
Hydrologic Engineer / Flood Management Specialist	5	5	5	420,169.00		286,478.86
Hydraulic Engineer or Dam/Irrigation Specialist	5	5	5	420,169.00		286,478.86
Electrical Engineer	5	5	5	420,169.00		286,478.86
Mechanical Engineer	5	5	5	420,169.00		286,478.86
O&M Specialist	5	5	5	420,169.00		286,478.86
Hydropower Specialist (for projects with hydropower component)	5	5	5	420,169.00		286,478.86
Subject Matter Experts (SMEs) common to all infrastructure projects						
Urban/Regional Development Specialist	5	5	5	420,169.00	286,478.86	286,478.86
Cost Estimator	5	5	5	420,169.00	286,478.86	286,478.86
Other Subject Matter Experts (SMEs) that may be added to a Study Team, depending on the stage, nature, complexity, or intricacies of the project:						
Geographic Information System & Database Specialist	5	5	5	420,169.00		
Construction Scheduler	5	5	5	420,169.00		
Financial Specialist	5	5	5	420,169.00		
Economic Specialist	5	5	5	420,169.00		
Institutional Specialist	5	5	5	420,169.00		
Environmental Specialist	5	5	5	420,169.00		
Gender and Development Specialist	5	5	5	420,169.00		
SUPPORT STAFF						
Technical Support (for virtual workshops)	10	5	2	576,807.00	445,714.50	445,714.50
Researchers	15	5	2	84,034.00	84,034.00	84,034.00
Admin Support	15	5	2	84,034.00	84,034.00	84,034.00

B. REIMBURSABLE/MISCELLANEOUS EXPENSES	QTY	UNIT	UNIT PRICE	COST PER PROJECT TYPE	
				TRANSIT	WATER
Travel expenses for international or domestic flights of personnel (airfare, etc.)		rountrip flights	at cost		
Per diem allowance of personnel (meal allowances, hotel, airport transfers, etc.)		days	at cost		
Venue rental and food arrangements	75	person-days	2,500.00	187,500.00	187,500.00
Supplies, drafting, printing and reproduction***	3	months	12,000.00	36,000.00	36,000.00
Local transportation, courier/messengerial services, etc. ***	3	months	10,000.00	30,000.00	30,000.00
Communication***	3	months	10,000.00	30,000.00	30,000.00
Site visit expenses (team transportation, accommodations, per diem, etc.)		persons or days	at cost		
GIS software / mapping services		months	at cost		
Use/Lease of computer hardware & software		months	at cost		
Other necessary expenses		months	at cost		
SUB TOTAL				**9,747,405.64**	**9,747,404.95**
Add: 12% VAT				1,169,688.68	1,169,688.59
TOTAL				**10,917,094.31**	**10,917,093.55**

** International CVS included in the budget due to current unavailability of a local CVS.*

*** For computation purposes, the Consultant did not assume that the Team Leader was also one of the subject matter experts. However, it is recommended that the Team Leader (TL) be selected from among the study team members (i.e., Highway Engineer may be the TL for a highway/road project). In this case, the rate and allocated person-months of the*

**** Estimates only. Subject to increase, based on quantity of references and reports to be reproduced, type of communication to be provided, etc.*

WASTEWATER AND FLOOD CONTROL PROJECTS

A. REMUNERATION	DURATION (Days)			BASE MONTHLY RATE	COST PER PROJECT TYPE	
	Pre (incl site visit)	Proper	Post		WASTEWATER	FLOOD CONTROL
VM EXPERTS						
Certified Value Specialist (international)*	10	5	10	3,394,286.00	3,857,143.18	3,857,143.18
Certified Value Specialist (local)	10	5	10	1,508,572.00		
Value Methodology Associate (local)	10	5	20	754,286.00	1,200,000.45	1,200,000.45
VM STUDY TEAM						
Team Leader**	8	5	8	672,269.00	641,711.32	641,711.32
Wastewater Project						
Wastewater Treatment Process Engineer	5	5	5	420,169.00	286,478.86	
Civil & Structural Engineer	5	5	5	420,169.00	286,478.86	
Electrical Engineer	5	5	5	420,169.00	286,478.86	
Mechanical Engineer	5	5	5	420,169.00	286,478.86	
Hydraulic Engineer	5	5	5	420,169.00	286,478.86	
Landscape Architect	5	5	5	420,169.00	286,478.86	
Socio-Environmental Specialist	5	5	5	420,169.00	286,478.86	
O&M Specialist	5	5	5	420,169.00	286,478.86	
Flood Control Project						
Hydrologic Engineer / Flood Management Specialist	5	5	5	420,169.00		286,478.86
Hydraulic Engineer / Stormwater Management Specialist	5	5	5	420,169.00		286,478.86
Drainage Engineer	5	5	5	420,169.00		286,478.86
Civil & Structural Engineer	5	5	5	420,169.00		286,478.86
Landscape Architect	5	5	5	420,169.00		286,478.86
Environmental Specialist	5	5	5	420,169.00		286,478.86
Social Development/Relocation Specialist	5	5	5	420,169.00		286,478.86
Subject Matter Experts (SMEs) common to all infrastructure projects						
Urban/Regional Development Specialist	5	5	5	420,169.00	286,478.86	286,478.86
Cost Estimator	5	5	5	420,169.00	286,478.86	286,478.86
Other Subject Matter Experts (SMEs) that may be added to a Study Team, depending on the stage, nature, complexity, or intricacies of the project:						
Geographic Information System & Database Specialist	5	5	5	420,169.00		
Construction Scheduler	5	5	5	420,169.00		
Financial Specialist	5	5	5	420,169.00		
Economic Specialist	5	5	5	420,169.00		
Institutional Specialist	5	5	5	420,169.00		
Environmental Specialist	5	5	5	420,169.00		
Gender and Development Specialist	5	5	5	420,169.00		
SUPPORT STAFF						
Technical Support (for virtual workshops)	10	5	2	576,807.00	445,714.50	445,714.50
Researchers	15	5	2	84,034.00	84,034.00	84,034.00
Admin Support	15	5	2	84,034.00	84,034.00	84,034.00

B. REIMBURSABLE/MISCELLANEOUS EXPENSES	QTY	UNIT	UNIT PRICE	COST PER PROJECT TYPE	
				WASTEWATER	FLOOD CONTROL
Travel expenses for international or domestic flights of personnel (airfare, etc.)		rountrip flights	at cost		
Per diem allowance of personnel (meal allowances, hotel, airport transfers, etc.)		days	at cost		
Venue rental and food arrangements	75	person-days	2,500.00	187,500.00	187,500.00
Supplies, drafting, printing and reproduction***	3	months	12,000.00	36,000.00	36,000.00
Local transportation, courier/messengerial services, etc. ***	3	months	10,000.00	30,000.00	30,000.00
Communication***	3	months	10,000.00	30,000.00	30,000.00
Site visit expenses (team transportation, accommodations, per diem, etc.)		persons or days	at cost		
GIS software / mapping services		months	at cost		
Use/Lease of computer hardware & software		months	at cost		
Other necessary expenses		months	at cost		
SUB TOTAL				**9,460,926.09**	**9,174,447.23**
Add: 12% VAT				1,135,311.13	1,100,933.67
TOTAL				**10,596,237.22**	**10,275,380.89**

* *International CVS included in the budget due to current unavailability of a local CVS.*

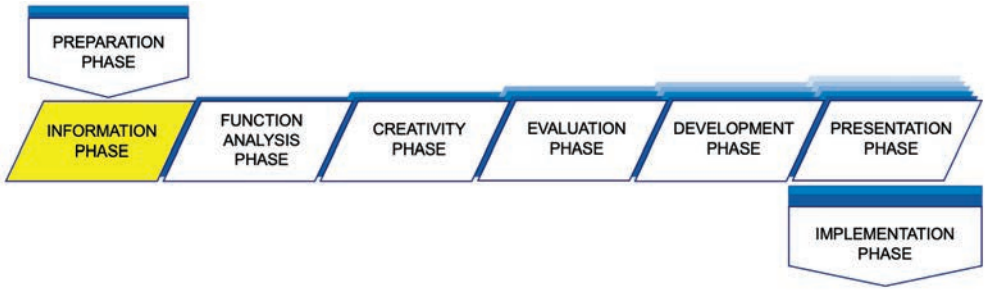
** *For computation purposes, the Consultant did not assume that the Team Leader was also one of the subject matter experts. However, it is recommended that the Team Leader (TL) be selected from among the study team members (i.e., Highway Engineer may be the TL for a highway/road project). In this case, the rate and allocated person-months of the*

*** *Estimates only. Subject to increase, based on quantity of references and reports to be reproduced, type of communication to be provided, etc.*

APPENDIX

C

Information Phase Resources



The following resources are provided in this Appendix:

- **Value Study (40-hour) agenda (sample)**
- **Cost model (sample)**
- **Risk register (template)**
- **Performance criteria / paired comparisons (sample)**
- **Information Phase checklist**
- **Information Phase commonly asked questions**

Value Study (40-hour) agenda (sample)

Value Engineering / Value Analysis (VE/VA) Workshop
[PROJECT NAME]
(All times are PHST and MST; times are approximate)

Agenda

Time (PHST)	Time (MST)	Activity
Day 0	***Monday, 12 October 2020 (Sunday, 11 October 2020)***	
1:00 pm	10:00 pm	Welcome & Introductions Technology Dry-run ▪ Protocols ▪ Subject Matter Expert (SME) Accounts and Passwords ▪ Meeting Platform (WebEx) ▪ Document Collaboration (Google Drive, Virtual Workroom) ▪ Q&A
2:00 pm	11:00 pm	Adjourn Day 0
Day 1	***Thursday, 15 October 2020 (Wednesday, 14 October 2020)***	
08:30 am	5:30 pm	Welcome & Introductions
08:45	5:45	Brief Overview of the VE/VA Process & Agenda Review (CVS Facilitator)
		INFORMATION PHASE
09:00	6:00	Virtual Site Tour (Project Representatives) Stakeholder Issues & Concerns
10:00	7:00	*Short Break*
10:10	7:10	Identify/Review: ▪ Project Goals ▪ VE Study Objectives (Focus of VE/VA Study) ▪ VE/VA Study Constraints ▪ Identify Performance Attributes
11:30	8:30	*Meal Break*
12:30pm	9:30	Review Cost Model, Schedule, Project Risks Team Observations
2:30	11:30	Adjourn Day 1
Day 2	***Friday, 16 October 2020 (Thursday, 15 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 1
		FUNCTION ANALYSIS PHASE
08:50	5:50	Introduce Function Analysis Phase / Function Identification of Project Elements ▪ Identify/Classify Functions ▪ Apply Risks/Resources to Functions
10:00	7:00	*Short Break*
10:10	7:10	▪ Model Functions (FAST) ▪ Select Specific Functions for Study
11:30	8:30	*Meal Break*
		CREATIVE PHASE
12:30 pm	9:30	Introduce Creative Phase Begin Brainstorm Ideas / Alternatives
2:30	11:30	Adjourn Day 2
Day 3	***Monday, 19 October 2020 (Sunday, 18 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 2

Value Engineering / Value Analysis (VE/VA) Workshop
[PROJECT NAME]
(All times are PHST and MST; times are approximate)

Time (PHST)	Time (MST)	Activity
CREATIVE PHASE (continued)		
08:50	5:50	Brainstorm Ideas / Alternatives
10:00	7:00	*Short Break*
10:10	7:10	Brainstorm Ideas / Alternatives
11:30	8:30	*Meal Break*
12:30 pm	9:30	Continue Brainstorm Ideas / Alternatives
2:30	11:30	Adjourn Day 3
Day 4	***Tuesday, 20 October 2020 (Monday, 19 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 3
CREATIVE PHASE (continued)		
08:50	5:50	Brainstorm Ideas / Alternatives - Finalize
10:00	7:00	*Short Break*
EVALUATION PHASE		
10:10	7:10	Introduce Evaluation Phase Two-step Evaluation Process (Shortlist Ideas for Development)
11:30	8:30	*Meal Break*
12:30	9:30	Complete Evaluation Process Team Assignments for Development Review Workbook Template & Process Flow
2:30	11:30	Adjourn Day 4
Day 5	***Wednesday, 21 October 2020 (Tuesday, 20 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 4
09:00	6:00	Midpoint Review
DEVELOPMENT PHASE		
10:00	7:00	*Short Break*
10:10	7:10	Develop / Cost Alternatives
11:30	8:30	*Meal Break*
12:00 pm	9:00	Develop / Cost Alternatives
2:30	11:30	***Adjourn Day 5***
Day 6	***Thursday, 22 October 2020 (Wednesday, 21 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 5
DEVELOPMENT PHASE (continued)		
08:50	5:50	Develop / Cost Alternatives
10:00	7:00	*Short Break*
10:10	7:10	Develop / Cost Alternatives
11:30	8:30	*Meal Break*
12:30 pm	9:30	Develop / Cost Alternatives
2:30	11:30	***Adjourn Day 6***
Day 7	***Friday, 23 October 2020 (Thursday, 22 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 6
DEVELOPMENT PHASE (continued)		
08:50	5:50	Develop / Cost Alternatives
10:00	7:00	*Short Break*

Value Engineering / Value Analysis (VE/VA) Workshop
[PROJECT NAME]
(All times are PHST and MST; times are approximate)

Time (PHST)	Time (MST)	Activity
10:10	7:10	Develop / Cost Alternatives
11:30	8:30	*Meal Break*
12:30 pm	09:30	Develop / Cost Alternatives – Complete Begin Team Review of Developed Alternatives
2:30	11:30	***Adjourn Day 7***
Day 8	***Monday, 26 October 2020 (Sunday, 25 October 2020)***	
08:30 am	5:30 pm	Check-in, Questions from Day 7
08:50	5:50	Team Review of Developed Alternatives Prepare Presentation
10:00	7:00	*Short Break*
10:10	7:10	Team Review of Developed Alternatives Prepare Presentation
12:00	9:00	*Meal Break*
PRESENTATION PHASE		
1:00 pm	10:00	Presentation of VE/VA Key Findings to Management Team
2:00	11:00	Workshop Close-out / Lessons Learned
2:30	11:30	***Adjourn Day 8***

Cost model (sample)

M'lang Airport Development Project

Data Source: Feasibility & Master Plan Study, and Environmental Impact Assessment (December 2018)

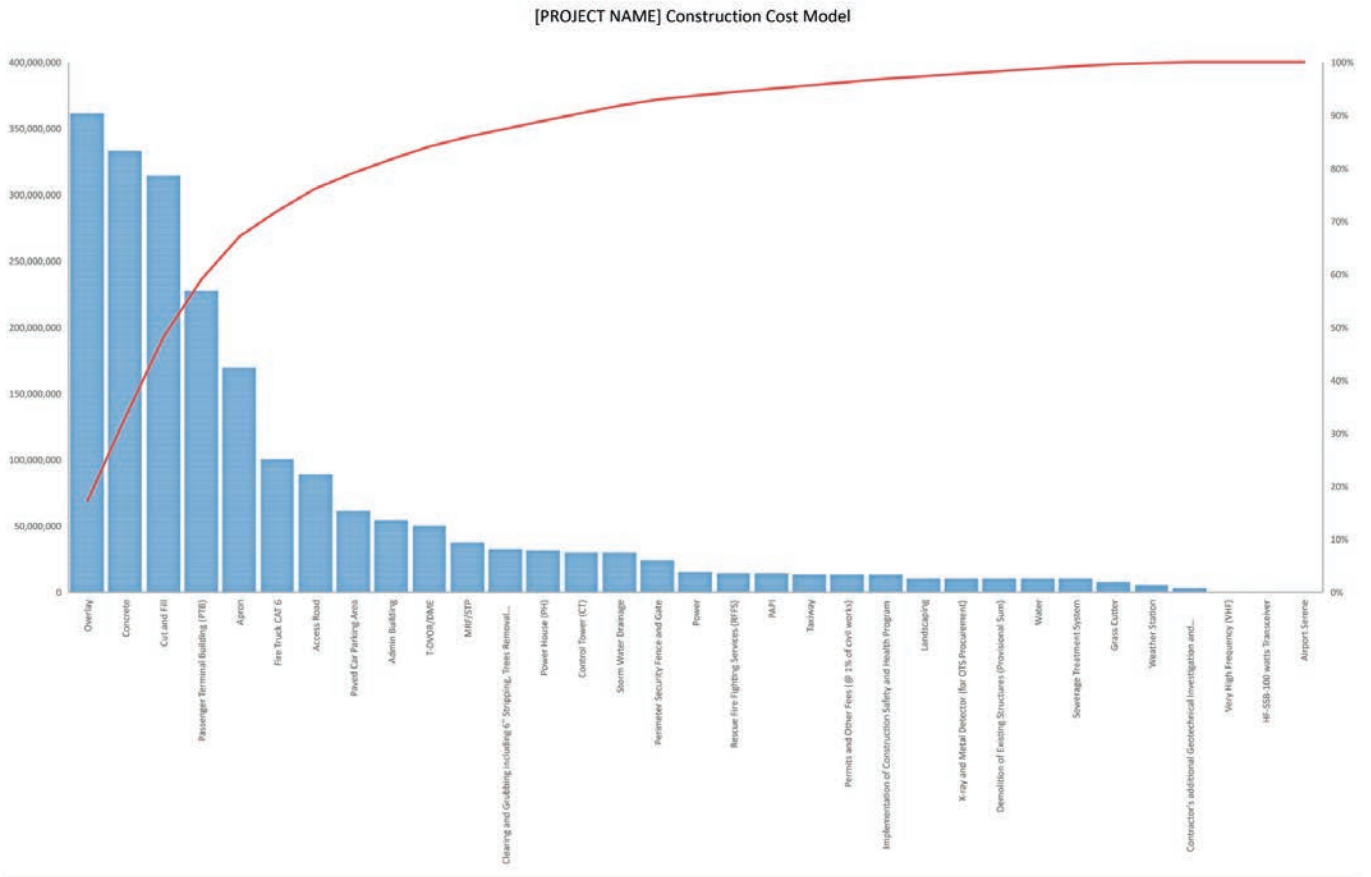
P53.00 = 1 US Dollar (As of October, 2018)
P48.60 = 1 US Dollar (As of October, 2020)

Table 8-2: Cost Estimate for Short and Medium-Long Term Development

Item No.	Item Description	Unit	Unit Cost	Quantity	Total Cost (October 2018)	Total Cost USD (October 2018)	% Total
I	CONSTRUCTION PHASE						
1.0	General Requirements						
1.1	Permits and Other Fees (@ 1% of civil works)	LS		1	12,866,000.00	242,754.72	0.61%
1.2	Contractor's additional Geotechnical Investigation and geotechnical interpretation	LS		1	3,000,000.00	56,603.77	0.14%
1.3	Implementation of Construction Safety and Health Program	LS		1	12,865,207.64	242,739.77	0.61%
	Sub-Total for General Requirements				**28,731,207.64**	**542,098.26**	
						0.00	0.00%
2.0	Horizontal Structures					0.00	0.00%
2.1	Earthworks					0.00	0.00%
2.1.1	Clearing and Grubbing including 6" Stripping, Trees Removal including Grubbing of Roots and Disposal	has.	273,938.00	118	32,324,684.00	609,899.70	1.54%
2.1.2	Cut and Fill	sq.m.	1,200.00	261,725	314,070,000.00	5,925,849.06	15.01%
2.2	Pavement					0.00	0.00%
2.2.1	Runway					0.00	0.00%
	Concrete	sq.m.	3,600.00	92,462	332,863,200.00	6,280,437.74	15.91%
	Overlay	sq.m.	2,500.00	144,501	361,252,500.00	6,816,084.91	17.26%
2.2.3	Taxiway	sq.m.	3,600.00	3,614	13,010,400.00	245,479.25	0.62%
2.2.4	Apron	sq.m.	3,330.00	50,906	169,516,980.00	3,198,433.58	8.10%
2.2.5	Paved Car Parking Area	sq.m.	2,780.00	22,100	61,438,000.00	1,159,207.55	2.94%
2.2.6	Access Road	sq.m.	2,500.00	35,500	88,750,000.00	1,674,528.30	4.24%
2.3	Storm Water Drainage	L.S.	30,000,000.00	1	30,000,000.00	566,037.74	1.43%
2.4	Perimeter Security Fence and Gate	l.m.	3,500.00	6,862	24,017,000.00	453,150.94	1.15%
2.5	Landscaping	L.S.	10,000,000.00	1	10,000,000.00	188,679.25	0.48%
	Sub-Total for Horizontal Structures				**1,437,242,764.00**	**27,117,788.00**	
						0.00	0.00%
3.0	Vertical Structures					0.00	0.00%
3.1	Passenger Terminal Building (PTB)	sq.m.	65,000.00	3,500	227,500,000.00	4,292,452.83	10.87%
3.2	Cargo Terminal Building (CTB) *(Private Concessionaire)*	sq.m.	-	3,750	-	0.00	0.00%
3.3	General Aviation (GA) *(Private Concessionaire)*	sq.m.	-	2,500	-	0.00	0.00%
3.4	Rescue Fire Fighting Services (RFFS)	sq.m.	35,000.00	400	14,000,000.00	264,150.94	0.67%
3.5	Control Tower (CT)	sq.m.	75,000.00	400	30,000,000.00	566,037.74	1.43%
3.7	Admin Building	sq.m.	20,000.00	2,706	54,120,000.00	1,021,132.08	2.59%

Item No.	Item Description	Unit	Unit Cost	Quantity	Total Cost (October 2018)	Total Cost USD (October 2018)	% Total
3.8	MRF/STP	sq.m.	15,000.00	2,500	37,500,000.00	707,547.17	1.79%
3.9	Safety & Security Area *(Provision Only)*	sq.m.	-	7,000	-	0.00	0.00%
3.11	Power House (PH)	sq.m.	35,000.00	900	31,500,000.00	594,339.62	1.51%
3.12	PAGASA Area *(Provision Only)*	sq.m.	-	1,500	-	0.00	0.00%
3.13	Tanker / Fuel Farm Area *(Provision Only)*	sq.m.	-	7,500	-	0.00	0.00%
3.14	Elevation WT. Area *(Provision Only)*	sq.m.	-	400	-	0.00	0.00%
3.15	Demolition of Existing Structures (Provisional Sum)	L.S.	10,000,000.00	1	10,000,000.00	188,679.25	0.48%
	Sub-Total for Horizontal Structures				**404,620,000.00**	**7,634,339.62**	
						0.00	0.00%
4.0	**Air Navigation & Support Facilities**					0.00	0.00%
4.1	Air Navigation System					0.00	0.00%
4.1.1	PAPI	L.S.	14,000,000.00	1	14,000,000.00	264,150.94	0.67%
4.1.2	T-DVOR/DME	L.S.	50,000,000.00	1	50,000,000.00	943,396.23	2.39%
4.1.3	Runway End Identification Light (REIL)	L.S.	4,000,000.00	-	-	0.00	0.00%
4.1.4	Rotating Beacon (ABN)	L.S.	1,500,000.00	-	-	0.00	0.00%
4.1.5	Lighted Windcore	L.S.	3,000,000.00	-	-	0.00	0.00%
4.1.6	Weather Station	L.S.	5,000,000.00	1	5,000,000.00	94,339.62	0.24%
4.1.7	Very High Frequency (VHF)	L.S.	200,000.00	1	200,000.00	3,773.58	0.01%
4.1.8	HF-SSB-100 watts Transceiver	L.S.	100,000.00	1	100,000.00	1,886.79	0.00%
4.1.9	Airport Serene	L.S.	50,000.00	1	50,000.00	943.40	0.00%
	Sub-Total for Air Navigation & Support Facilities				**69,350,000.00**	**1,308,490.57**	
						0.00	0.00%
5.0	**Special Equipment / Instruments**					0.00	0.00%
5.1	X-ray and Metal Detector *(for OTS Procurement)*	L.S.	10,000,000.00	1	10,000,000.00	188,679.25	0.48%
	Sub-Total for Special Equipment / Instrumentation				**10,000,000.00**	**188,679.25**	
						0.00	0.00%
6.0	**Fire Fighting Vehicle & Other Maintenance Equipment**					0.00	0.00%
6.1	Grass Cutter	unit	7,500,000.00	1	7,500,000.00	141,509.43	0.36%
6.2	Fire Truck CAT 4	unit	-	1	-	0.00	0.00%
6.3	Fire Truck CAT 6	unit	50,000,000.00	2	100,000,000.00	1,886,792.45	4.78%
	Sub-Total for Fire Fighting Vehicle & Other				**107,500,000.00**	**2,028,301.89**	
						0.00	0.00%
7.0	**Utilities**					0.00	0.00%
7.1	Power	L.S.	15,000,000.00	1	15,000,000.00	283,018.87	0.72%
7.2	Water	L.S.	10,000,000.00	1	10,000,000.00	188,679.25	0.48%
7.3	Sewerage Treatment System	L.S.	10,000,000.00	1	10,000,000.00	188,679.25	0.48%

Item No.	Item Description	Unit	Unit Cost	Quantity	Total Cost (October 2018)	Total Cost USD (October 2018)	% Total
	Sub-Total for Utilities				35,000,000.00	660,377.36	
	Total Cost for CONSTRUCTION PHASE (Item I)				2,092,443,971.64	39,480,074.94	100.00%
						0.00	
II	Physical Contingency, (10% of Item I)				209,245,000.00	3,948,018.87	
III	Detailed Engineering Design (DED), (2% of Item I)				41,849,000.00	789,603.77	
IV	Construction Supervision, (6% of Item I)				125,547,000.00	2,368,811.32	
						0.00	
V	TOTAL COST CIVIL WORKS (Item I + II + III + IV)				2,469,084,971.64	46,586,508.90	
						0.00	
VI	LAND ACQUISITION AND EASEMENTS	has.	2,500,000.00	54	135,000,000.00	2,547,169.81	
						0.00	
	GRAND TOTAL COST (Item V + VI)				2,604,084,971.64	49,133,678.71	



Risk register (template)

Probability of Occurrence	Highly Likely	Likely	Possible	Unlikely	Very Unlikely	MATRIX KEY
	> 70%	51 - 70%	21 - 50%	5 - 20%	<5%	
Severity of Impact	Not Able to Meet Key Milestone/ Project Objective (10% or more)	Major Slip in Milestone/ Project Objective at Risk (7-9%)	Minor Slip/ Project Objective Slightly Impacted (4-6%)	Added Resources / Meets Project Objective (2-3%)	Minimal Impact/ Project Objective Not Impacted (1% or less)	
	100	50	20	5	1	
Risk Rating	Extremely High		High	Moderate		Low
	Red (50 - 500)		Orange (15 - 49)	Yellow (3 - 14)		Green (0 - 2.9)

Identify the Risk		Assign the Risk	Classify the Risk			Quantify	Quantify	Risk Response	
Risk ID	Description of Risk	Who does the risk affect?	Probability of occurrence (%)	Severity of Impact (Numeric)	Risk Rating	Cost Impact	Schedule Impact	Avoid? Mitigate? Accept? Transfer?	Comments
1					0				
2					0				
3					0				
4					0				
5					0				
6					0				
7					0				
8					0				
9					0				
10					0				
11					0				
12					0				
13					0				
14					0				
15					0				
16					0				

Performance Criteria / Paired Comparison (sample)

M'lang Airport Development Project

Weighted Evaluation
Paired Comparisons

Project:	**Value Engineering/Value Analysis Workshop**
Location:	**[LOCATION]**
Study Element:	**[PROJECT NAME]**
Date:	**October 15-26, 2020**

LIST OF CRITERIA	#	Criteria:	Description (Optional):
	A	Environmental Management	Meet the plan and the BMPs to be compliant during the development and operation of the project
	B	Schedule	Least impact to schedule and availability of funds to develop
	C	Operability	Meet 3C requirements for a commercial aerodrome; turbo-prop; eliminates threats to operations
	D	Sustainability of Operations	Does the traffic meet the demands to maintain continuous operations or to meet future expansion; revenue generation (tickets, cargo, etc.)
	E	Economic Viability	The airport's contribution to the local economy; job opportunities, taxes, land values, able to move the people that are conducting economic activities in the area
	F	Constructability	Availability of materials and labor; equipment availability;

Date: October 15-26, 2020
Project: Value Engineering/Value Analysis Workshop
Study Element: [PROJECT NAME]
Location: [LOCATION]

Criteria Scoring Matrix

	Weight	Preference		Preference		Preference		Preference		Preference	
A Environmental Management Meet the plan and the BMPs to be compliant during the development and operation of the project	8.16%	A	B	A	C	A	D	A	E	A	F
			3		4		4		4	4	
B Schedule Least impact to schedule and availability of funds to develop	8.16%	B	C	B	D	B	E	B	F	B	G
			3		3		3	1	1		
C Operability Meet 3C requirements for a commercial aerodrome; turbo-prop; eliminates threats to operations	36.73%	C	D	C	E	C	F	C	G		
		3		4		4					
D Sustainability of Operations Does the traffic meet the demands to maintain continuous operations or to meet future expansion; revenue generation (tickets, cargo, etc.)	24.49%	D	E	D	F	D	G				
		4		1	1						
E Economic Viability The airport's contribution to the local economy; job opportunities, taxes, land values, able to move the people that are conducting economic activities in the area	14.29%	E	F	E	G						
			2								
F Constructability Availability of materials and labor; equipment availability	8.16%	F	G								

How Important:
- 4 = Major Preference
- 3 = Medium Preference
- 2 = Minor Preference
- 1 = No Preference (each)

Analysis Matrix

Criteria	A	B	C	D	E	F
Raw score	4	4	18	12	7	4
Weight	8.16%	8.16%	36.73%	24.49%	14.29%	8.16%

Information Phase checklist

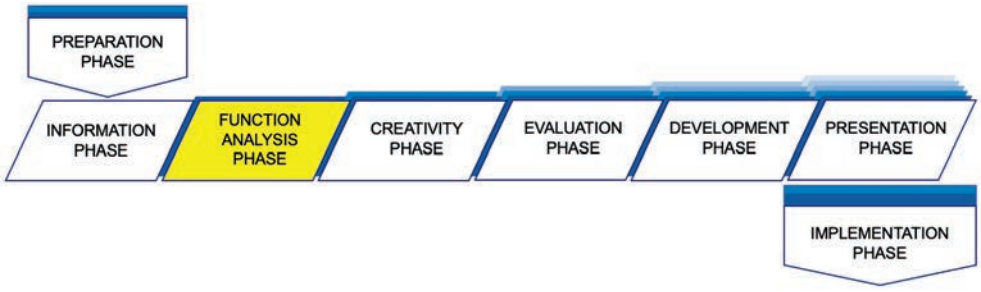
The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

✓	**Task / Activity, if applicable**	**Comment(s)**
	Review / transform subject scope information (i.e., process flowchart)	
	Review / transform subject performance and quality information (i.e., performance attributes and paired comparison)	
	Review / transform subject time information (i.e., Gantt chart)	
	Review / transform subject risk information (i.e., risk management planning, risk identification, risk analysis, risk response planning, risk monitoring and control)	
	VM study kick-off meeting • Identify and address the “voice of the customer” (sometimes a product or device, instead of a person) • Continue to identify Project Goals and Objectives • Continue to identify Study Objectives and Constraints • Gather and address team observations	
	Site visit • This should be done, whether in person or virtually by someone with a deep understanding of the site to assist in helping familiarize the team • Encourage photos (when allowable), notes, sketches and questions to be asked	

APPENDIX

D

Function Analysis Phase Resources



The following resources are provided in this Appendix:

- **Verb-Noun function list**
- **Function Analysis worksheet (sample)**
- **How to read a FAST diagram**
- **FAST diagram (sample)**
- **Resources to Functions matrix (sample)**
- **Function Analysis Phase checklist**

Verb-Noun function list

VERB LIST

This is only a partial list of verbs that may be used in describing the functions of a ***product, project or process***. Searching for the most descriptive combination can be difficult and time consuming.

Absorb	Decrease	Improve	Record
Actuate	Deliver	Increase	Reduce
Allocate	Develop	Induce	Reflect
Allow**	Direct	Insulate	Refresh
Alter	Distribute	Interrupt	Regulate
Amplify	Emit	Isolate	Release
Analyze	Enclose	Join	Remove
Apply	Enhance	Limit	Repair
Assure	Enjoy	Load	Repel
Attract	Enter	Locate	Resist
Audit	Establish	Maintain	Rotate
Authorize	Evaluate	Make	Seal
Certify	Exclude	Measure	Sense
Change	Extend	Meet	Separate
Circulate	Extract	Modulate	Set
Collect	Facilitate**	Monitor	Specify
Compile	Fasten	Multiply	Store
Conduct	Fill	Obtain	Supply
Confirm	Filter	Organize	Support
Connect	Find	Pivot	Test
Contain	Finish	Position	Transmit
Control	Forecast	Prevent	Transport
Convert	Generate	Procure	Verify
Convey	Guide	Protect	_____
Cool	Identify	Provide**	_____
Copy	Illuminate	Receive	_____
Create	Impede	Reconcile	_____

Verbs marked with the "**" need to be avoided. Also avoid using verbs that end with "-ize".

Verb-Noun function list

NOUN LIST

This is only a partial list of nouns that may be used in describing the functions of a ***product, project or process***. Searching for the most descriptive combination can be difficult and time consuming.

Access	Flow	Parts	Tension
Alignment	Fluid	Passenger	Time
Angle	Force	Path	Torque
Appearance	Friction	Performance	Traffic
Assembly	Gap / Separation	Picture	Transparency
Balance	Glare	Pivot	Travel
Circuit	Grip	Power	User
Climate	Heat	Precision	Vacuum
Color	Height	Pressure	Variation
Comfort	Image	Prestige (or Style)	Vibrance
Component	Impact	Rate	Vibration
Compression	Information	Reflection	Voltage
Condition	Insulation	Regulation	Volume
Contamination	Leaks	Rotation	Weight
Contents	Length	Shape	_____
Corrosion	Light	Sheer	_____
Current	Limit	Signal	_____
Data	Load	Sound	_____
Décor	Location	Space	_____
Deflection	Mass	Stability	_____
Delay	Material	State	_____
Dimension	Moisture	Status	_____
Direction	Motion	Structure	_____
Energy	Noise	Substance	_____
Environment	Occupant	Surface	_____
Feeling	Odor / Smell	Taste	_____
Flavor	Oxidation	Temperature	_____

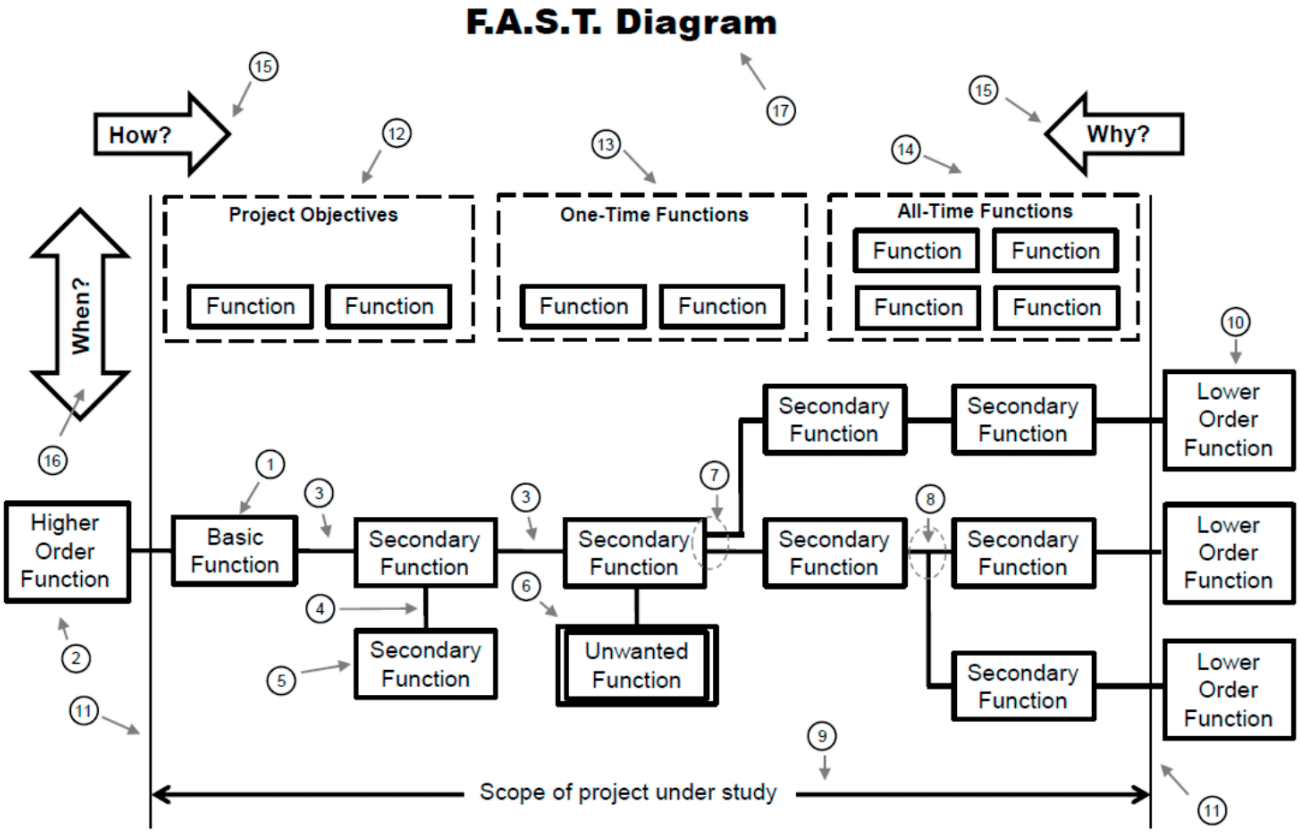
Function Analysis worksheet (sample)

[PROJECT NAME] FUNCTION ANALYSIS WORKSHEET						
	IDENTIFY FUNCTIONS		CLASSIFY FUNCTIONS	PRIORITIZE FUNCTION		
Item Name	Active Verb	Measurable Noun	Higher Order Basic Secondary	COST	RISK	SELECT FOR CREATIVE PHASE
Expansion of Apron (horizontal / vertical)	Resist	Loads	Secondary	High		YES
Expansion of Apron (vertical)	Withstand	Elements	Secondary			(incl with Resist Loads)
Expansion of Apron	Accommodate	Aircraft	Secondary	High		YES
Expansion of Apron	Ensure	Safety	Secondary			
Expansion of Apron	Enable	Separation	Secondary			
Expansion of Apron	Enable	Refueling	Secondary			
Expansion of Apron	Secure	Aircraft	Secondary			
Expansion of Apron	Enable	Maintenance	Secondary			
Expansion of Apron	Limit	Congestion	Secondary			
Expansion of Apron	Load	Traffic	Secondary			
Expansion of Apron	Unload	Traffic	Secondary			
Perimeter Fence	Delimit	Property	Secondary			
Perimeter Fence	Limit	Access	Secondary		High	YES
Perimeter Fence	Ensure	Security	Secondary			
Security Fence and Gate	Control	Access	Secondary			
Security Fence and Gate	Secure	Area	Secondary			
Security Fence and Gate	Protect	People	Secondary			
Security Fence and Gate	Prevent	Crimes	Secondary			
Expansion of existing PTB	Process	Passengers	Secondary			
Expansion of existing PTB	Enable	Faith Sensitivity	Secondary			
Expansion of existing PTB	Process	Baggage	Secondary			
Expansion of existing PTB	Limit	Congestion	Secondary			
Expansion of existing PTB	Distribute	Water	Secondary			
Expansion of existing PTB	Enable	Comfort	Secondary			
Expansion of existing PTB	Ensure	Safety	Secondary			
Expansion of existing PTB	Enable	Welcoming	Secondary			
Expansion of existing PTB	Ease	Access	Secondary			
Expansion of existing PTB	Control	Access	Secondary			
Expansion of existing PTB	Enhance	Travel Experience	Secondary	High		YES
Expansion of existing PTB	House	Concessionaires	Basic			
Expansion of existing PTB	Display	Information	Secondary			
Expansion of existing PTB	Generate	Revenue	Higher Order			
Expansion of existing PTB	Protect	Passengers	Secondary		High	YES
Expansion of existing PTB	Remove	Waste	Secondary			
Expansion of existing PTB	House	Passengers	Secondary		High	YES
Expansion of existing PTB	Illuminate	Spaces	Secondary			
Expansion of existing PTB	House	Operations	Secondary		High	YES
Expansion of existing PTB	Enable	Gender Sensitivity	Secondary		High	YES
Vehicular Parking	Accommodate	Vehicles	Secondary	High		YES
Vehicular Parking	Protect	Vehicles	Secondary			
Vehicular Parking	Generate	Revenue	Higher Order			
Vehicular Parking	Receive	Vehicles	Secondary			
Vehicular Parking	Control	Access	Secondary		High	YES
Vehicular Parking	Ease	Access	Secondary			
Vehicular Parking	Limit	Congestion	Secondary			
Vehicular Parking	Control	Flow	Secondary			

[PROJECT NAME] FUNCTION ANALYSIS WORKSHEET						
	IDENTIFY FUNCTIONS		CLASSIFY FUNCTIONS	PRIORITIZE FUNCTION		
Item Name	Active Verb	Measurable Noun	Higher Order Basic Secondary	COST	RISK	SELECT FOR CREATIVE PHASE
Vehicular Parking	Illuminate	Spaces	Secondary			
Vehicular Parking	Create	Meeting Points	Secondary			
Vehicular Parking	Display	Information	Secondary			
Vehicular Parking	Enable	Waiting	Secondary			
Vehicular Parking	House	Concessionaires	Basic			
Control Tower	Minimize	Accidents	Secondary			
Control Tower	Enable	Communication	Secondary		High	YES
Control Tower	Control	Traffic	Secondary			
Control Tower	Monitor	Environment	Secondary			
Control Tower	Control	Aircraft Movement	Secondary			
Control Tower	Control	Apron Usage	Secondary			
Control Tower	House	Equipment	Secondary	High		YES
Control Tower	Enable	Emergency-response	Secondary			
Control Tower	Create	Height	Secondary	High		YES
Control Tower	Deliver	Power	Secondary	High		YES
Control Tower	Enable	Backup	Secondary			
Control Tower	Display	Information	Secondary			
Control Tower	Enable	Resting	Secondary			
Drainage System	Collect	Runoff	Secondary		High	YES
Drainage System	Prevent	Flooding	Secondary			
Drainage System	Enhance	Environmental Safety	Secondary			
Drainage System	Control	Flow	Secondary		High	YES
Drainage System	Store	Fluid	Secondary		High	YES
Drainage System	Withstand	Elements	Secondary			
Drainage System	Prevent	Skidding	Secondary			
Drainage System	Minimize	Erosion	Secondary			
Power House	Deliver	Power	Secondary			
Power House	House	Equipment	Secondary			
Power House	Regulate	Power	Secondary			
Power House	Enable	Backup	Secondary		High	YES
Power House	Limit	Access	Secondary			
Power House	Withstand	Elements	Secondary			
Power House	Receive	Power	Secondary			
Power House	Support	Operations	Secondary			
Power House	Distribute	Power	Secondary			
Air Navigational Facilities and Eq.	Enable	Communication	Secondary			
Air Navigational Facilities and Eq.	Control	Traffic	Secondary			
Air Navigational Facilities and Eq.	Ensure	Safety	Secondary			
Air Navigational Facilities and Eq.	Transmit	Signals	Secondary			
Air Navigational Facilities and Eq.	Receive	Power	Secondary			
Air Navigational Facilities and Eq.	Enable	Navigation	Secondary	High		YES
Air Navigational Facilities and Eq.	Direct	Landing	Secondary			
Lot Acquisition	Secure	Ownership	Secondary		High	YES
Lot Acquisition	Secure	Rights	Secondary		High	YES
Lot Acquisition	Increase	Area	Secondary	High		YES
Lot Acquisition	Support	Growth	Secondary			
Lot Acquisition	Enable	Development	Secondary			

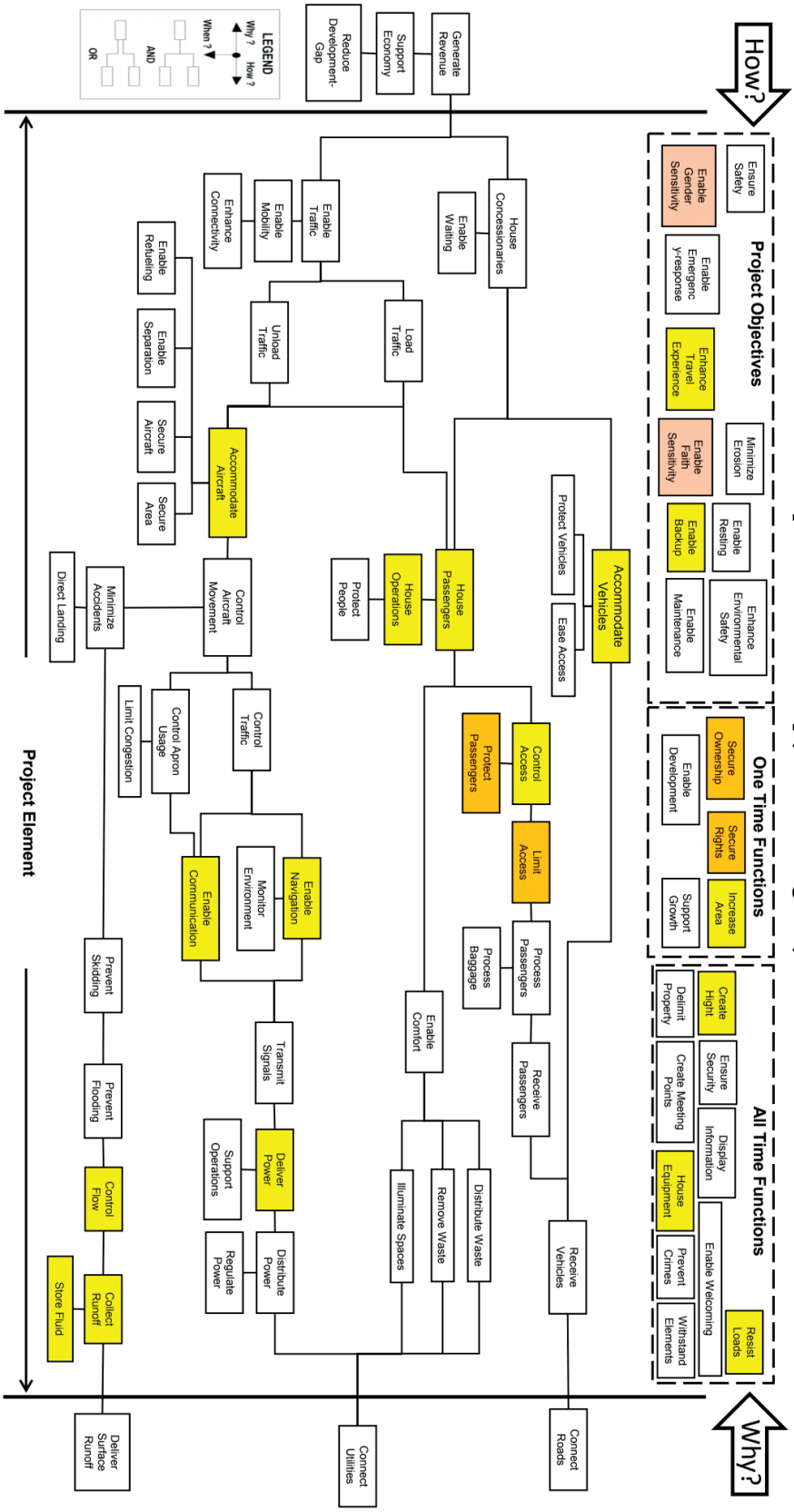
[PROJECT NAME] FUNCTION ANALYSIS WORKSHEET						
	IDENTIFY FUNCTIONS		CLASSIFY FUNCTIONS	PRIORITIZE FUNCTION		
Item Name	Active Verb	Measurable Noun	Higher Order Basic Secondary	COST	RISK	SELECT FOR CREATIVE PHASE
M'lang Airport Development Project	Enable	Mobility	Secondary			
M'lang Airport Development Project	Enhance	Connectivity	Secondary			
M'lang Airport Development Project	Enable	Air Traffic	Basic			
M'lang Airport Development Project	Generate	Revenue	Higher Order			
M'lang Airport Development Project	Support	Economy	Higher Order			
M'lang Airport Development Project	Reduce	Development-Gap	Higher Order			
M'lang Airport Development Project	Deliver	Surface Runoff	Lower Order			
M'lang Airport Development Project	Connect	Utilities	Lower Order			
M'lang Airport Development Project	Connect	Roads	Lower Order			

How to read a FAST diagram



1. Basic Function.
2. High Order Function.
3. The Critical Path (All connections on the “How?” and “Why?” Directions, linked to the Basic Function).
4. “When” Direction.
5. A Secondary function that “caused by” or “happens at the same time” as the one above.
6. An “Unwanted” secondary function.
7. “OR” Logic Gate.
8. “AND” Logic Gate.
9. Description of the scope under study..
10. “Lower Order Functions”, formerly known as “Input Functions” or “Assumed functions”.
11. Scope Lines.
12. Secondary Required Functions that are requested by the client, design or standard (and is not connected to the critical path).
13. Secondary Required Functions that happen only once in the life of the studied object.
14. Secondary Required Functions that are permanent, even if the basic function is not happening.
15. Visual aides, remainders of how to read the “How-Why” direction.
16. Visual aides, remainders of how to read the “When” direction.
17. A title describing what the FAST Diagram is about (The project).

FAST diagram (sample)



Resources to Functions matrix (sample)

Subject / Project: Warehouse
Resource Type (cost, time, weight, etc.): Space - Gross Square Feet (GSF)

% OF RESOURCE ALLOC.	COMPONENT	QTY	U/M	UNIT	TOTAL	FUNCTION (active verb + measurable noun)														
						Ship Material	Retrieve Material	Store Material	Manage Inventory	Report Inventory	Transport Material	Receive Material	Classify Material	Receive Visitors	Maintain Hygiene	Manage Facility	Maintain Comfort	Energize Warehouse	Maintain Safety	Enclose Space	Ensure Efficiency
100%	Entry/Reception Area	600	GSF		600.00									95%						5%	
100%	Office Area	2000	GSF		2,000.00				20%	20%						35%			10%	5%	10%
100%	Toilets	400	GSF		400.00										95%					5%	
100%	Mechanical/Elect. Eq. Area	1000	GSF		1,000.00												75%	20%		5%	
100%	Truck Dock Area	4000	GSF		4,000.00	45%						50%								5%	
100%	Material Storage Area	52000	GSF		52,000.00		5%	61%			30%		1%						1%	2%	
RESOURCE TOTALS:					60,000.00	1,800.00	2,600.00	31,720.00	400.00	400.00	15,600.00	2,000.00	520.00	570.00	380.00	700.00	750.00	200.00	720.00	1,440.00	200.00
FUNCTION - PERCENTAGE:					100.00%	3.00%	4.33%	52.87%	0.67%	0.67%	26.00%	3.33%	0.87%	0.95%	0.63%	1.17%	1.25%	0.33%	1.20%	2.40%	0.33%

Subject / Project: Warehouse
Resource Type (cost, time, weight, etc.): Space - Gross Square Feet (GSF)

Basic Function: Ship Material
Higher Order Function: Distribute Material

Component	Resource (space GSF)	Function		Function Type	Resource Allocation
		Verb	Noun		
Entry / Reception Area	600	Receive	Visitors	Secondary	95%
Entry / Reception Area		Enclose	Space	Secondary	5%
Office Area	2,000	Manage	Inventory	Secondary	20%
Office Area		Report	Inventory	Secondary	20%
Office Area		Manage	Facility	Secondary	35%
Office Area		Maintain	Safety	Secondary	10%
Office Area		Enclose	Space	Secondary	5%
Office Area		Ensure	Efficiency	Secondary	10%
Toilet Area	400	Maintain	Hygiene	Secondary	95%
Toilet Area		Enclose	Space	Secondary	5%
Mechanical/Elect. Eq. Area	1,000	Maintain	Comfort	Secondary	75%
Mechanical/Elect. Eq. Area		Energize	Warehouse	Secondary	20%
Mechanical/Elect. Eq. Area		Enclose	Space	Secondary	5%
Truck Dock Area	4,000	Ship	Material	Secondary	45%
Truck Dock Area		Receive	Material	Secondary	50%
Truck Dock Area		Enclose	Space	Secondary	5%
Material Storage Area	52,000	Retrieve	Material	Secondary	5%
Material Storage Area		Store	Material	Secondary	61%
Material Storage Area		Transport	Material	Secondary	30%
Material Storage Area		Classify	Material	Secondary	1%
Material Storage Area		Maintain	Safety	Secondary	1%
Material Storage Area		Enclose	Space	Secondary	2%
TOTAL	60,000				

Function Analysis Phase Checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

Function Analysis Phase Checklist

✓	**Task / Activity, if applicable**	**Comment(s)**

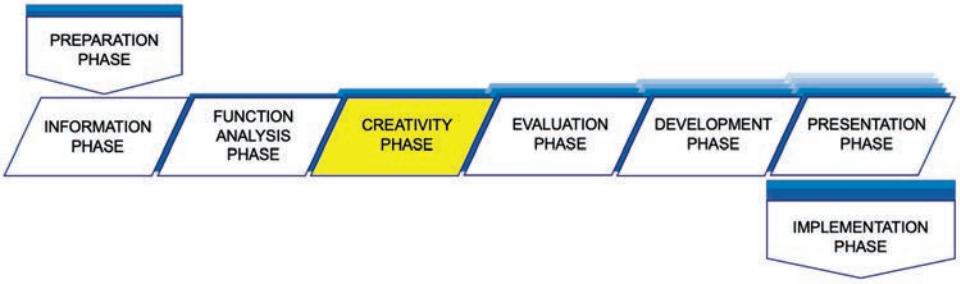
	Define functions
	• Identify functions
	  ◦ Establishes a common language to communicate between the SMEs and Facilitator, using a two-word active-verb / measurable-noun statement
	• Classify functions
	  ◦ Classify each function as Basic, Secondary, Higher or Lower Order
	• Organize functions
	  ◦ FAST Diagram, meaningful groupings, etc.	

	Allocate resources to each identified function	
	Prioritize functions	
	Identify best opportunities for value improvement	

APPENDIX

E

Creativity Phase Resources



The following resources are provided in this Appendix:

- **Creativity list (template)**
- **Creativity list (sample)**
- **Creativity Phase checklist**

Creativity list (template)

[CLIENT NAME]
[PROJECT NAME]
VE/VA

Creative Idea List

Idea No.	Idea Title	Score
XX	Function	
XX-01		
XX-02		
XX-03		
XX-04		
XX-05		
XX-06		
XX-07		
XX-08		
XX-09		
XX-10		
XX-11		
XX-12		
XX-13		
XX-14		
XX-15		
XX-16		
XX-17		
XX-18		

Creativity list (sample)

[CLIENT NAME]
[PROJECT NAME]
VE/VA

Creative Idea List

Idea No.	Idea Title
AV	**Accommodate Vehicles**
AV-01	Allow for bicycle parking
AV-02	Designate parking for PWD (wheelchair, signage, striping designation) to comply with standards and locate near entrance
AV-03	Designate areas for public transport vehicles
AV-04	Separate parking for private vehicles and official/airport personnel
AV-05	Designate drop-off areas for public transport vehicles
AV-06	Accommodate comfortable waiting areas
AV-07	Traffic management within the parking
AV-08	Provision of communal toilets
AV-09	Provision for overnight/long-term parking
AV-10	Space for food stalls/concessionaires
AV-11	Designate space for "barkers" (ride share vans)
AV-12	Provide public information (signages)
AV-13	Vehicle control (ticketing, payment, security...); requires electronic payment system
AV-14	Verify number of vehicles to be accommodated
AV-15	Verify parking pavement type (unpaved and paved)
AV-16	Provide electric vehicle charging station
AV-17	Phase parking over time
AV-18	Construct temporary lot (rough grade and gravel) in lieu of building parking lot
ET	**Enhance Travel Experience**
ET-01	Provision of wifi, charging station, work station in the airport
ET-02	Pre-departure comfortable seating (cushioned)
ET-03	Comfortable and well-maintained toilets
ET-04	Clean facilities and surroundings
ET-05	Smiling & courteous staff
ET-06	User-friendly sign boards and information display
ET-07	Adequate check-in facilities (service desks, kiosks)
ET-08	Provision of breast feeding station (requirement)
ET-09	Smooth process flow of PTB functions and layout (entry, check-in, etc.)
ET-10	Provision of air-conditioning
ET-11	Provision of prayer room
ET-12	Provision of trolleys for heavy baggage
ET-13	Provision of ramps, handrails (requirement)
ET-14	Feeding room for babies
ET-15	Clean and decent lounge for waiting
ET-16	Clinic for emergencies - verify if this is a requirement
ET-17	Unique local delicacies
ET-18	Entertainment system (audio, video or both)

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Creative Idea List

Idea No.	Idea Title
ET-19	Baggage conveyor (airport can operate without conveyor; potentially phase later)
ET-20	Extended seating (to be able to stretch legs)- Lazy Boy seats/loungers (with possible charge for use; coin-operated) - possible revenue generation opportunity and/or concessionaire could provide
ET-21	Comfortable seats (cushioned)
ET-22	Cultural performances at certain times
ET-23	Presence of local artists - designated area within the PTB; supports local economy
ET-24	Concessionaires (fast food chains, coffeeshops, etc.)
ET-25	One-stop shop - designated area (kiosk) for local delicacies
ET-26	Water fountains
ET-27	Free city tour for tourists
ET-28	X-ray machine for hand-carried baggage so no need to open bags for inspection
ET-29	Provide free unique delicacy and drinks (teaser size) and welcome package
ET-30	Shower facilities
EB	**Enable Backup**
EB-01	Use of solar power system
EB-02	Heavy-duty fossil-fuel generator (back-up generator)
EB-03	Diesel-engine generator set (DEGS) (back-up generator)
EB-04	Provide uninterrupted power supply (UPS) for control tower equipment
EB-05	Provide an Automatic Transfer Switch (ATS) is an electrical switch that switches a load between two sources; it is often installed where a backup generator is located, so that the generator may provide temporary electrical power if the utility source fails.
EB-06	Battery packs
EB-07	Firewall, fire retardant devices (i.e., fire extinguishers/fire suppressant, water
EB-08	Constant current and voltage regulator for stable electricity
EB-09	Candles and lamps
EB-10	Remote generator hookup
EB-11	Emergency lamps - requirement
EB-12	Hybrid solar and fossil fuel power system
EB-13	Provide uninterrupted power supply (UPS) for select services (long-term use)
IA	**Increase Area**
IA-01	Land donation
IA-02	Land conversion/reclassification
IA-03	Site acquisition and resettlement
IA-04	Mixed use - having multiple uses for the area (revenue generation) During the Development Phase, this idea was downgraded from a "DS" to a "2" (Poor Opportunity). After review of the layout of the proposed airport, it was found that the proposed airport area even with the additional land to be acquired is not sufficient to accomodate additional land uses.
IA-05	Land banking (buy now for later use, purchase land for 4C)

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Creative Idea List

Idea No.	Idea Title
IA-06	Review the CLUP of M'Lang
IA-07	Identify any special permits that will be required for land acquisition
IA-08	Regulate construction of structures within the aerodrome
IA-09	Verify existing landholding titles in the area (Provincial government to purchase and donate to DOTr)
IA-10	Update the airport layout plan
IA-11	Identify phasing plan for appropriate expansion to meet 3C requirements
IA-12	Fence off areas acquired for 4C
IA-13	Land purchase by the government
IA-14	Verify existing landholding titles in the area
CH	**Create Height**
CH-01	Build control tower as wooden structure
CH-02	Construct 7-storey to 9-storey for unobstructed view
CH-03	Emergency escape/evacuation plan; security plan
CH-04	Make bamboo tower
CH-05	Place control tower function on top of PTB During the Development Phase, this idea was downgraded from a "4" to a "2" due to the obstacle limitation surface requirement Control Tower sight lines to the Runway).
CH-06	Operate with Flight Service Station (FSS) in lieu of control tower for 3C only
CH-07	Investigate alternative elevator design/configuration (hydraulic piston - "lift")
CH-08	Integrate control tower structure with admin building
HE	**House Equipment**
HE-01	Segregate location of equipment by function
HE-02	Weather proof/climate control equipment storage rooms (i.e., control tower)
HE-03	Air-conditioned areas (i.e., navigational equipment, CCTV control equipement) - requirement
HE-04	Provide security (e.g., CCTV cameras) for equipment
HE-05	Place equipment on roller carts for ease of use (electronic equipment actually designed to be on racks and modular but requires wiring)
HE-06	Maintenance equipment should be mobile
HE-07	Place equipment for ease of operations and maintenance
HE-08	Efficiency of design of horizontal and vertical storage
HE-09	Very clear signages for safety and security of personnel
HE-10	Occupational safety
HE-11	Proper ventilation and adequate lighting
HE-12	Protect public from radiation coming from equipment - verify
HE-13	Size electrical, mechanical and communication rooms appropriately
HE-14	Locate electrical, mechanical and communication rooms to optimize utility runs
HE-15	Add lightning rods/lightning arrestor to protect equipment

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Creative Idea List

Idea No.	Idea Title
HE-16	Air-conditioned areas (i.e., staff)
RL	**Resist Load**
RL-01	Identify usage (load, unload, etc.) - type and number of airplanes to use apron; will impact size and thickness of pavement
RL-02	Proper design of the cross-section elements
RL-03	Use pervious pavement in lieu of concrete
RL-04	Use chopped scrap tires as base material
RL-05	Disaster resilient design
RL-06	Efficient and effective design
RL-07	Use of alternative materials that are eco-friendly and can resist load
HP	**House Passengers**
HP-01	Design using local building materials (locally fabricated and locally sourced) to support local economy
HP-02	Good lighting, high ceiling, good ventilation
HP-03	Add skylights if building design can accommodate a skylight
HP-04	Design architectural theme/facade to suit local culture
HP-05	Consider health-proof measures (HEPA filters for HVAC system, social distancing for queuing and seating); may to review area alotment
HP-06	Consider green airport concept in the building
HP-07	Appropriate Level of Service in terms of space and service processing time
HP-08	Arrangement of concessionaires/tenants areas - do not impede flow of passengers
HP-09	Wind flow oriented design to minimize aircon use but still comfortable (part of Green design); may have opportunity to save energy and cost and balance with security
HP-10	Provide space for greeters and those seeing off the passengers
HP-11	Efficient floor layout
HP-12	Provide comfort, enhance travel experience (e.g., departure area)
HP-13	Build two-story PTB to reduce overall footprint (possible new PTB; future phase)
HP-14	Safety and security (personnel and equipment)
HP-15	Provision of signages (wayfinding)
HP-16	Large glass windows to see runway/planes
HP-17	Disaster-resilient design
HP-18	Protection of passengers from food preparation areas
HP-19	Build one-story PTB with a mechanical mezzanine
HP-20	Provision of temporary accommodation (e.g., rooms to rent)
HP-21	Evacuation plan for passengers
HP-22	Use gym-quality, recycled rubberized flooring material throughout circulation areas
HO	**House Operations**
HO-01	Facility for ground-handling personnel (staff house)
HO-02	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

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Creative Idea List

Idea No.	Idea Title
HO-03	House airline offices
HO-04	Strategic information stations that is easy to find with enough space
HO-05	Energy-efficient facility
HO-06	Separate and secured area (not mixed with public)
HO-07	Green design (lighting, ventilation, disaster-resiliency, temperature, etc.)
HO-08	Baggage handling
HO-09	Airline ticketing booths
HO-10	Identify area of refuge in the building for occupants
HO-11	Operations may be in separate building or in the same building but with limited access
HO-12	Occupy back rooms for operations personnel
HO-13	Safety and security personnel and protocols, CCTV room, etc.
AA	**Accommodate Aircraft**
AA-01	Verify that runway size and location is adequate to meet 3C requirements
AA-02	Clear communication between pilot and control tower
AA-03	Verify conditions of the runway and apron in compliance to the safety of operations
AA-04	Runway, taxiway and apron markings
AA-05	Validate strip requirement if compliant with 3C
AA-06	Runway grade correction
AA-07	Enable refueling
AA-08	Lighting for night-time landing and take-off (for 3C, only day operations)
AA-09	Design to minimize skidding
AA-10	Include hangar in the design
AA-11	Safe parking and pathway for fuel tankers
AA-12	Clear runway of stray animals and birds (to include mitigating measures)
AA-13	Provision of runway turn-pad
AA-14	Define aircraft loads and frequency to inform pavement design section
AA-15	Avoid use of runway for other purposes such as driving lesson area
AA-16	Safety of maintenance and ground personnel during landing and take-off (prohibit maintenance activities)
AA-17	Verify turning radii at apron for planned aircraft (3C and future expansion)
AA-18	Monitor the runway for possible foreign object debris (FOD) before and after aircraft arrival
EN	**Enable Navigation**
EN-01	Well-trained navigation staff
EN-02	Install navigational equipment
EN-03	Provide emergency backup power for air navigation facilities and equipment
EN-04	Verify appropriate navigational aids of the airport
EN-05	Provide uninterrupted power supply
EN-06	Radio contact with control tower for aircraft and/or ground vehicle
EN-07	Verify that all equipment is working properly

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Idea No.	Idea Title
EN-08	Develop flight plan/flight procedures
EN-09	Stable and reliable communication signals (related to power)
EN-10	Identify emergency bay area (an extended parallel taxiway)
EC	**Enable Communication**
EC-01	Install radio/communication equipment
EC-02	Runway and apron markers and markings
EC-03	Old fashioned signalling to guide aircraft parking
EC-04	Well-trained ground personnel
EC-05	Installed equipment by contractor to include a training component as part of their contract
EC-06	Properly equipped ground personnel
EC-07	Well maintained equipment
DP	**Deliver Power**
DP-01	Review ground fault protection
DP-02	Have multiple sources of power (e.g., commercial, backup generator)
DP-03	Adequate power distribution system
DP-04	Construct power house
DP-05	Ensure clean power (constant current, constant voltage, etc.)
DP-06	Install enough PV and coordinate controls and energy to make this a net zero energy facility
DP-07	Use renewable sources of energy (solar, etc.)
DP-08	Install utilities outside of the footprint of the future expansion
DP-09	Install hybrid and electric vehicle charging stations
CF	**Control Flow**
CF-01	Collect stormwater from roof drain system for reuse
CF-02	Introduce bio-drainage
CF-03	Use permeable pavement to manage stormwater runoff at non-runway areas
CF-04	Clear waterways of debris
CF-05	Construct cistern tank
CF-06	Adequate drainage collection (grated drainage capable of airport loads)
CF-07	Drainage from NE will drain through SW; complete NE drainage in Phase 1
CF-08	Design system where water will naturally flow to drainage system
CF-09	Provide bioswale for drainage improvement
CF-10	Efficient drainage (covered) system layout
CF-11	Grade runway strip
CF-12	Revisit study to validate the natural elevation of the area
CF-13	Use a vegetated roof
CR	**Collect Runoff**
CR-01	Construct small impounding areas
CR-02	Install flood warning system (simple solution - post with markings) - outside the airport

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Creative Idea List

Idea No.	Idea Title
CR-03	Calculate discharge (should be included in drainage report/analysis)
CR-04	Utilize collected water for reuse in the airport
CR-05	Install cross drainage (should be included in drainage report/analysis)
CA	**Control Access**
CA-01	24/7 Security
CA-02	Security gates
CA-03	Add a CCTV system
CA-04	Bollards in front of building (near passenger drop-off)
CA-05	Sufficient lighting at strategic points
CA-06	Well trained staff to check ID and travel documents
CA-07	Provide clear access protocols and guidelines
CA-08	Gate barrier (to control access to parking, etc.)
CA-09	Provide clear access protocols and guidelines
CA-10	Secured gate going to airside
CA-11	Guard house and guard posts
CA-12	Key card access doors to secured areas
CA-13	Issuance of Identification cards - locals and tourists
CA-14	Issue Airport Access Passes
CA-15	Issue uniforms for personnel
CA-16	Usage of QRcode in tickets for passenger entry to PTB
CA-17	Security fence
CA-18	Install electric fence
CA-19	Roving patrol checks
MR	**Manage Risks**
MR-01	Verify that the land acquisition is adequately supported by the right documents to avoid project challenges, delays or discontinuance
MR-02	Government subsidy may be explored (review financial analysis)
MR-03	Propose PPP for budget and development
MR-04	Establish cause of liquefaction
MR-05	Implementing agency may invoke the three-year rolling budget during budget preparation
MR-06	Verify sewer capacity for projected passenger traffic
MR-07	Procurement of reputable contractors
MR-08	Create performance incentives to reward good quality service
MR-09	In contractor selection, make schedule an important factor (not just price)
MR-10	Strict implementation of liquidated damages for contractors
MR-11	QBS = Qualifications Based Selection
MR-12	Review qualification criteria for the selection of contractors
MR-13	Identify items that may be scaled down in the design...use of low demand forecast scenario given current situation (pandemic effect) to air Travel... (scenario analysis)

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Creative Idea List

Idea No.	Idea Title
MS	**Miscellaneous**
MS-01	Identify scope for Phase 1 to comply with Aerodrome Reference Code 3C and budget
MS-02	Identify scope for Phase 2 to comply with Aerodrome Reference Code 4C and budget
MS-03	Identify scope and budget required for commercial operation by 2022
MS-04	Validate existing development thru status report, etc.
MS-05	Identify scope for Phase 1, including standards
MS-06	Bring Phase 1 work completion to a level that will minimize any major rework when upgrading to Phase 2
MS-07	Secure area required for 4C (strip requirement)
MS-08	Acquire land now that is required for future phase/expansion
MS-09	Phase airport development as traffic volume increases (airport, passenger, other)
MS-10	Investigate alternative funding sources (e.g., PPP)
MS-11	Locate Phase 1 PTB within footprint of Phase 2 PTB (minimizes demolition and building costs)
MS-12	Verify ownership of lands within the developed areas (are there documentations available?)
MS-13	Conduct additional social and environmental impact assessment, and EGGAR
MS-14	Conduct environmental risk assessment
MS-15	Check/validate separation distances
MS-16	Conduct additional geotechnical investigation
MS-17	The Feasibility Study appears to have made a mistake in the wind analysis, the wind in M'lang is almost perpendicular to the FS's report, which used weather station data from another location. So there's an additional risk of crosswind for the M'lang airport. On the other hand, Manila airport has a runway that is perpendicular to prevailing winds, so it may not be much of a problem.

Creativity Phase Checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

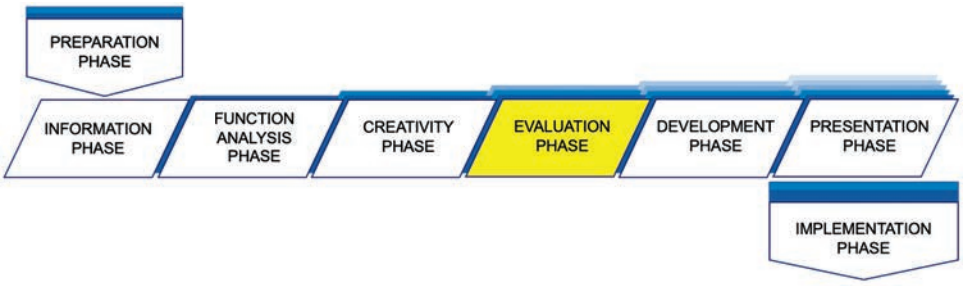
Creativity Phase Checklist

✓	**Task / Activity, if applicable**	**Comment(s)**
	Generate Ideas • Generate large quantities of ideas • Do not be concerned with quality, this phase of study is about quantity	
	Record Ideas • Record all ideas generated during this phase • Do not stop an idea at this point, as other ideas may fall out of it	

APPENDIX

F

Evaluation Phase Resources



The following resources are provided in this Appendix:

- **Evaluation Phase Weighted Evaluation (sample)**
- **Evaluation Phase "value key" (sample)**
- **"Scored" ideas from Creativity Phase (sample)**
- **Evaluation Phase checklist**

Weighted Evaluation (sample)

Project Criteria and Definitions

Criteria		Definition
A	Environmental Management	Meet the plan and the best management practices (BMPs) to be compliant during the development and operation of the project
B	Schedule	Least impact to schedule and availability of funds to develop
C	Operability	Meet Category 3C requirements for operation of a commercial aerodrome; turbo-prop; eliminates threats to operations
D	Financial Profitability	Does the traffic demand merit continuous operations or future expansion? Revenue generation (tickets, cargo, etc.)
E	Economic Viability	The airport's contribution to the local economy; job opportunities, taxes, land values, able to move the people that are conducting economic activities in the area
F	Constructability	Availability of materials and labor; equipment availability

Scale of preference used in scoring the paired criteria:

- 4 – Major preference
- 3 – Medium preference
- 2 – Minor preference
- 1 (each) – No preference

Project Criteria Weights

Criteria		Preference		Preference		Preference		Preference		Preference		Raw Score	Weight
A	Environmental Management	A	B	A	C	A	D	A	E	A	F	4	8.16%
			3		4		4		4	4			
B	Schedule	B	C	B	D	B	E	B	F			4	8.16%
			3		3		3	1	1				
C	Operability	C	D	C	E	C	F					18	36.73%
		3		4		4							
D	Financial Profitability	D	E	D	F							12	24.49%
		4		1	1								
E	Economic Viability	E	F									7	14.29%
			2										
F	Constructability											4	8.16%

Value Key (sample)

Value Relationship Key	Value = Function / Resources					
5 **Great Value**	F	F+	F++	F++	F++	F++
	R--	R--	R	R-	R--	R+
4 **Good Value**	F-	F	F+	F+	F+	
	R--	R-	R	R-	R+	
3 **Moderate Value**	F--	F-	F+(*)	F++(*)		
	R--	R-	R++	R++		
2 **Poor Value**	F--	F-	F	F		
	R	R--	R+	R++		
1 **Fatal Flaw**	Unacceptable Impacts, violates a code or standard					

*Is the Function improved to the point that it overcomes the resources needed?

Value Cue Key – Magnitude of Change	
F++ = Large increase in function	R-- = Large decrease in resources used
F+ = Small increase in function	R- = Small decrease in resources used
F = No impact in function	R = No impact in resources used
F- = Small negative impact in function	R+ = Small increase in resources used
F-- = Large negative impact in function	R++ = Large increase in resources used

Score	Description
5	Great Value (Workbook prepared)
4	Good (Workbook prepared)
3	Moderate Value (No workbook prepared)
2	Poor Value (No workbook prepared)
DS	Design Suggestion, more than a DC, requires further explanation
DC	Design Comment, Stand-alone comment that needs no further explanation; a list of these will be given to the design team
ABC	Already Being Considered/Done Included in the baseline concept
OS	Out of Scope, Not a part of this project

“Scored” ideas from Creativity Phase (sample)

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Creative Idea List

Idea No.	Idea Title	Score
AV	**Accommodate Vehicles**	
AV-01	Allow for bicycle parking	4
AV-02	Designate parking for PWD (wheelchair, signage, striping designation) to comply with standards and locate near entrance	DC
AV-03	Designate areas for public transport vehicles	4
AV-04	Separate parking for private vehicles and official/airport personnel	3
AV-05	Designate drop-off areas for public transport vehicles	w/AV-03
AV-06	Accommodate comfortable waiting areas	w/AV-03
AV-07	Traffic management within the parking	DC
AV-08	Provision of communal toilets	5
AV-09	Provision for overnight/long-term parking	DS
AV-10	Space for food stalls/concessionaires	DC
AV-11	Designate space for "barkers" (ride share vans)	DC
AV-12	Provide public information (signages)	DC
AV-13	Vehicle control (ticketing, payment, security...); requires electronic payment system	DC
AV-14	Verify number of vehicles to be accommodated	DC
AV-15	Verify parking pavement type (unpaved and paved)	DC
AV-16	Provide electric vehicle charging station	3
AV-17	Phase parking over time	w/MS-
AV-18	Construct temporary lot (rough grade and gravel) in lieu of building parking lot	w/MS-
ET	**Enhance Travel Experience**	
ET-01	Provision of wifi, charging station, work station in the airport	DS
ET-02	Pre-departure comfortable seating (cushioned)	DC
ET-03	Comfortable and well-maintained toilets	DC
ET-04	Clean facilities and surroundings	DC
ET-05	Smiling & courteous staff	OS
ET-06	User-friendly sign boards and information display	DC
ET-07	Adequate check-in facilities (service desks, kiosks)	DC
ET-08	Provision of breast feeding station (requirement)	DC
ET-09	Smooth process flow of PTB functions and layout (entry, check-in, etc.)	DC
ET-10	Provision of air-conditioning	ABC
ET-11	Provision of prayer room	DS
ET-12	Provision of trolleys for heavy baggage	ABC
ET-13	Provision of ramps, handrails (requirement)	DC
ET-14	Feeding room for babies	OS
ET-15	Clean and decent lounge for waiting	DC
ET-16	Clinic for emergencies - verify if this is a requirement	DC
ET-17	Unique local delicacies	OS
ET-18	Entertainment system (audio, video or both)	OS
ET-19	Baggage conveyor (airport can operate without conveyor; potentially phase later)	ABC

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Creative Idea List

Idea No.	Idea Title	Score
ET-20	Extended seating (to be able to stretch legs)- Lazy Boy seats/loungers (with possible charge for use; coin-operated) - possible revenue generation opportunity and/or concessionaire could provide	3
ET-21	Comfortable seats (cushioned)	DC
ET-22	Cultural performances at certain times	OS
ET-23	Presence of local artists - designated area within the PTB; supports local economy	DC
ET-24	Concessionaires (fast food chains, coffeeshops, etc.)	ABC
ET-25	One-stop shop - designated area (kiosk) for local delicacies	w/ET-24
ET-26	Water fountains	DC
ET-27	Free city tour for tourists	OS
ET-28	X-ray machine for hand-carried baggage so no need to open bags for inspection	ABC
ET-29	Provide free unique delicacy and drinks (teaser size) and welcome package	OS
ET-30	Shower facilities	3
EB	**Enable Backup**	
EB-01	Use of solar power system	DS
EB-02	Heavy-duty fossil-fuel generator (back-up generator)	ABC
EB-03	Diesel-engine generator set (DEGS) (back-up generator)	w/EB-02
EB-04	Provide uninterrupted power supply (UPS) for control tower equipment	DC
EB-05	Provide an Automatic Transfer Switch (ATS) is an electrical switch that switches a load between two sources; it is often installed where a backup generator is located, so that the generator may provide temporary electrical power if the utility source fails.	DC
EB-06	Battery packs	w/EB-01,
EB-07	Firewall, fire retardant devices (i.e., fire extinguishers/fire suppressant, water	ABC
EB-08	Constant current and voltage regulator for stable electricity	DC
EB-09	Candles and lamps	NR
EB-10	Remote generator hookup	OS
EB-11	Emergency lamps - requirement	ABC
EB-12	Hybrid solar and fossil fuel power system	4
EB-13	Provide uninterrupted power supply (UPS) for select services (long-term use)	DC
IA	**Increase Area**	
IA-01	Land donation	ABC
IA-02	Land conversion/reclassification	ABC
IA-03	Site acquisition and resettlement	ABC
IA-04	Mixed use - having multiple uses for the area (revenue generation) During the Development Phase, this idea was downgraded from a "DS" to a "2" (Poor Opportunity). After review of the layout of the proposed airport, it was found that the proposed airport area even with the additional land to be acquired is not sufficient to accomodate additional land uses.	2
IA-05	Land banking (buy now for later use, purchase land for 4C)	ABC
IA-06	Review the CLUP of M'Lang	OS
IA-07	Identify any special permits that will be required for land acquisition	DC

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Creative Idea List

Idea No.	Idea Title	Score
IA-08	Regulate construction of structures within the aerodrome	OS
IA-09	Verify existing landholding titles in the area (Provincial government to purchase and donate to DOTr)	OS
IA-10	Update the airport layout plan	ABC
IA-11	Identify phasing plan for appropriate expansion to meet 3C requirements	ABC
IA-12	Fence off areas acquired for 4C	ABC
IA-13	Land purchase by the government	ABC
IA-14	Verify existing landholding titles in the area	ABC
CH	**Create Height**	
CH-01	Build control tower as wooden structure	FF
CH-02	Construct 7-storey to 9-storey for unobstructed view	2
CH-03	Emergency escape/evacuation plan; security plan	DC
CH-04	Make bamboo tower	FF
CH-05	Place control tower function on top of PTB During the Development Phase, this idea was downgraded from a "4" to a "2" due to the obstacle limitation surface requirement Control Tower sight lines to the Runway).	2
CH-06	Operate with Flight Service Station (FSS) in lieu of control tower for 3C only	4
CH-07	Investigate alternative elevator design/configuration (hydraulic piston - "lift")	DS
CH-08	Integrate control tower structure with admin building	5
HE	**House Equipment**	
HE-01	Segregate location of equipment by function	ABC
HE-02	Weather proof/climate control equipment storage rooms (i.e., control tower)	DC
HE-03	Air-conditioned areas (i.e., navigational equipment, CCTV control equipement) - requirement	ABC
HE-04	Provide security (e.g., CCTV cameras) for equipment	DC
HE-05	Place equipment on roller carts for ease of use (electronic equipment actually designed to be on racks and modular but requires wiring)	OS
HE-06	Maintenance equipment should be mobile	DC
HE-07	Place equipment for ease of operations and maintenance	DC
HE-08	Efficiency of design of horizontal and vertical storage	w/HE-07
HE-09	Very clear signages for safety and security of personnel	DC
HE-10	Occupational safety	DC
HE-11	Proper ventilation and adequate lighting	DC
HE-12	Protect public from radiation coming from equipment - verify	DC
HE-13	Size electrical, mechanical and communication rooms appropriately	ABC
HE-14	Locate electrical, mechanical and communication rooms to optimize utility runs	DC
HE-15	Add lightning rods/lightning arrestor to protect equipment	ABC
HE-16	Air-conditioned areas (i.e., staff)	ABC
RL	**Resist Load**	
RL-01	Identify usage (load, unload, etc.) - type and number of airplanes to use apron; will impact size and thickness of pavement	ABC

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Creative Idea List

Idea No.	Idea Title	Score
RL-02	Proper design of the cross-section elements	DC
RL-03	Use pervious pavement in lieu of concrete	2
RL-04	Use chopped scrap tires as base material	4
RL-05	Disaster resilient design	ABC
RL-06	Efficient and effective design	ABC
RL-07	Use of alternative materials that are eco-friendly and can resist load	w/RL-04
HP	**House Passengers**	
HP-01	Design using local building materials (locally fabricated and locally sourced) to support local economy	DS
HP-02	Good lighting, high ceiling, good ventilation	ABC
HP-03	Add skylights if building design can accommodate a skylight	3
HP-04	Design architectural theme/facade to suit local culture	DS
HP-05	Consider health-proof measures (HEPA filters for HVAC system, social distancing for queuing and seating); may to review area alotment	DC
HP-06	Consider green airport concept in the building	ABC
HP-07	Appropriate Level of Service in terms of space and service processing time	DC
HP-08	Arrangement of concessionaires/tenants areas - do not impede flow of passengers	DC
HP-09	Wind flow oriented design to minimize aircon use but still comfortable (part of Green design); may have opportunity to save energy and cost and balance with security	ABC
HP-10	Provide space for greeters and those seeing off the passengers	DC
HP-11	Efficient floor layout	w/HP-08
HP-12	Provide comfort, enhance travel experience (e.g., departure area)	3
HP-13	Build two-story PTB to reduce overall footprint (possible new PTB; future phase)	ABC
HP-14	Safety and security (personnel and equipment)	DC
HP-15	Provision of signages (wayfinding)	DC
HP-16	Large glass windows to see runway/planes	ABC
HP-17	Disaster-resilient design	w/RL-05
HP-18	Protection of passengers from food preparation areas	w/HP-08
HP-19	Build one-story PTB with a mechanical mezzanine	2
HP-20	Provision of temporary accommodation (e.g., rooms to rent)	3
HP-21	Evacuation plan for passengers	DC
HP-22	Use gym-quality, recycled rubberized flooring material throughout circulation areas	2
HO	**House Operations**	
HO-01	Facility for ground-handling personnel (staff house)	ABC
HO-02	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction	4
HO-03	House airline offices	ABC
HO-04	Strategic information stations that is easy to find with enough space	3
HO-05	Energy-efficient facility	ABC
HO-06	Separate and secured area (not mixed with public)	ABC
HO-07	Green design (lighting, ventilation, disaster-resiliency, temperature, etc.)	ABC

[CLIENT NAME]
[PROJECT NAME]
VE/VA

Creative Idea List

Idea No.	Idea Title	Score
HO-08	Baggage handling	ABC
HO-09	Airline ticketing booths	ABC
HO-10	Identify area of refuge in the building for occupants	DC
HO-11	Operations may be in separate building or in the same building but with limited access	ABC
HO-12	Occupy back rooms for operations personnel	ABC
HO-13	Safety and security personnel and protocols, CCTV room, etc.	ABC
AA	**Accommodate Aircraft**	
AA-01	Verify that runway size and location is adequate to meet 3C requirements	ABC
AA-02	Clear communication between pilot and control tower	DC
AA-03	Verify conditions of the runway and apron in compliance to the safety of operations	ABC
AA-04	Runway, taxiway and apron markings	ABC
AA-05	Validate strip requirement if compliant with 3C	ABC
AA-06	Runway grade correction	ABC
AA-07	Enable refueling	ABC
AA-08	Lighting for night-time landing and take-off (for 3C, only day operations)	2
AA-09	Design to minimize skidding	ABC
AA-10	Include hangar in the design	OS
AA-11	Safe parking and pathway for fuel tankers	DC
AA-12	Clear runway of stray animals and birds (to include mitigating measures)	DS
AA-13	Provision of runway turn-pad	ABC
AA-14	Define aircraft loads and frequency to inform pavement design section	ABC
AA-15	Avoid use of runway for other purposes such as driving lesson area	DC
AA-16	Safety of maintenance and ground personnel during landing and take-off (prohibit maintenance activities)	DC
AA-17	Verify turning radii at apron for planned aircraft (3C and future expansion)	ABC
AA-18	Monitor the runway for possible foreign object debris (FOD) before and after aircraft arrival	DC
EN	**Enable Navigation**	
EN-01	Well-trained navigation staff	OS
EN-02	Install navigational equipment	ABC
EN-03	Provide emergency backup power for air navigation facilities and equipment	w/
EN-04	Verify appropriate navigational aids of the airport	DC
EN-05	Provide uninterrupted power supply	w/
EN-06	Radio contact with control tower for aircraft and/or ground vehicle	ABC
EN-07	Verify that all equipment is working properly	OS
EN-08	Develop flight plan/flight procedures	OS
EN-09	Stable and reliable communication signals (related to power)	w/
EN-10	Identify emergency bay area (an extended parallel taxiway)	4
EC	**Enable Communication**	
EC-01	Install radio/communication equipment	ABC
EC-02	Runway and apron markers and markings	ABC

[CLIENT NAME]
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VE/VA

Creative Idea List

Idea No.	Idea Title	Score
EC-03	Old fashioned signalling to guide aircraft parking	OS
EC-04	Well-trained ground personnel	OS
EC-05	Installed equipment by contractor to include a training component as part of their contract	DC
EC-06	Properly equipped ground personnel	OS
EC-07	Well maintained equipment	OS
DP	**Deliver Power**	
DP-01	Review ground fault protection	DC
DP-02	Have multiple sources of power (e.g., commercial, backup generator)	ABC
DP-03	Adequate power distribution system	DC
DP-04	Construct power house	ABC
DP-05	Ensure clean power (constant current, constant voltage, etc.)	DC
DP-06	Install enough PV and coordinate controls and energy to make this a net zero energy facility	DC
DP-07	Use renewable sources of energy (solar, etc.)	DC
DP-08	Install utilities outside of the footprint of the future expansion	DC
DP-09	Install hybrid and electric vehicle charging stations	2
CF	**Control Flow**	
CF-01	Collect stormwater from roof drain system for reuse	2
CF-02	Introduce bio-drainage	DS
CF-03	Use permeable pavement to manage stormwater runoff at non-runway areas	4
CF-04	Clear waterways of debris	OS
CF-05	Construct cistern tank	2
CF-06	Adequate drainage collection (grated drainage capable of airport loads)	ABC
CF-07	Drainage from NE will drain through SW; complete NE drainage in Phase 1	DC
CF-08	Design system where water will naturally flow to drainage system	ABC
CF-09	Provide bioswale for drainage improvement	3
CF-10	Efficient drainage (covered) system layout	ABC
CF-11	Grade runway strip	ABC
CF-12	Revisit study to validate the natural elevation of the area	DC
CF-13	Use a vegetated roof	2
CR	**Collect Runoff**	
CR-01	Construct small impounding areas	ABC
CR-02	Install flood warning system (simple solution - post with markings) - outside the airport	OS
CR-03	Calculate discharge (should be included in drainage report/analysis)	ABC
CR-04	Utilize collected water for reuse in the airport	2
CR-05	Install cross drainage (should be included in drainage report/analysis)	ABC
CA	**Control Access**	
CA-01	24/7 Security	OS
CA-02	Security gates	ABC
CA-03	Add a CCTV system	ABC

[CLIENT NAME]
[PROJECT NAME]
VE/VA

Creative Idea List

Idea No.	Idea Title	Score
CA-04	Bollards in front of building (near passenger drop-off)	DC
CA-05	Sufficient lighting at strategic points	DC
CA-06	Well trained staff to check ID and travel documents	OS
CA-07	Provide clear access protocols and guidelines	OS
CA-08	Gate barrier (to control access to parking, etc.)	DC
CA-09	Provide clear access protocols and guidelines	OS
CA-10	Secured gate going to airside	ABC
CA-11	Guard house and guard posts	ABC
CA-12	Key card access doors to secured areas	4
CA-13	Issuance of Identification cards - locals and tourists	OS
CA-14	Issue Airport Access Passes	OS
CA-15	Issue uniforms for personnel	OS
CA-16	Usage of QRcode in tickets for passenger entry to PTB	DS
CA-17	Security fence	ABC
CA-18	Install electric fence	2
CA-19	Roving patrol checks	OS
MR	**Manage Risks**	
MR-01	Verify that the land acquisition is adequately supported by the right documents to avoid project challenges, delays or discontinuance	DC
MR-02	Government subsidy may be explored (review financial analysis)	DS
MR-03	Propose PPP for budget and development	2
MR-04	Establish cause of liquefaction	DC
MR-05	Implementing agency may invoke the three-year rolling budget during budget preparation	DC
MR-06	Verify sewer capacity for projected passenger traffic	DC
MR-07	Procurement of reputable contractors	DC
MR-08	Create performance incentives to reward good quality service	OS
MR-09	In contractor selection, make schedule an important factor (not just price)	ABC
MR-10	Strict implementation of liquidated damages for contractors	DC
MR-11	QBS = Qualifications Based Selection	ABC
MR-12	Review qualification criteria for the selection of contractors	DC
MR-13	Identify items that may be scaled down in the design...use of low demand forecast scenario given current situation (pandemic effect) to air Travel... (scenario analysis)	DC
MS	**Miscellaneous**	
MS-01	Identify scope for Phase 1 to comply with Aerodrome Reference Code 3C and budget	4
MS-02	Identify scope for Phase 2 to comply with Aerodrome Reference Code 4C and budget	4
MS-03	Identify scope and budget required for commercial operation by 2022	w/MS-01
MS-04	Validate existing development thru status report, etc.	DC
MS-05	Identify scope for Phase 1, including standards	w/MS-01
MS-06	Bring Phase 1 work completion to a level that will minimize any major rework when upgrading to Phase 2	w/MS-01

[CLIENT NAME]
[PROJECT NAME]
VE/VA

Creative Idea List

Idea No.	Idea Title	Score
MS-07	Secure area required for 4C (strip requirement)	w/
MS-08	Acquire land now that is required for future phase/expansion	w/
MS-09	Phase airport development as traffic volume increases (airport, passenger, other)	ABC
MS-10	Investigate alternative funding sources (e.g., PPP)	ABC
MS-11	Locate Phase 1 PTB within footprint of Phase 2 PTB (minimizes demolition and building costs)	w/MS-01, MS-02
MS-12	Verify ownership of lands within the developed areas (are there documentations available?)	DC
MS-13	Conduct additional social and environmental impact assessment, and EGGAR	DC
MS-14	Conduct environmental risk assessment	DC
MS-15	Check/validate separation distances	DC
MS-16	Conduct additional geotechnical investigation	4
MS-17	The Feasibility Study appears to have made a mistake in the wind analysis, the wind in M'lang is almost perpendicular to the FS's report, which used weather station data from another location. So there's an additional risk of crosswind for the M'lang airport. On the other hand, Manila airport has a runway that is perpendicular to prevailing winds, so it may not be much of a problem.	DC

Evaluation Phase Checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

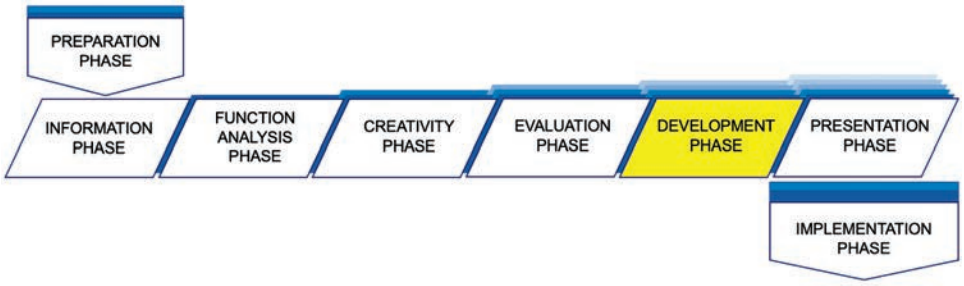
Evaluation Phase Checklist

✓	**Task / Activity, if applicable**	**Comment(s)**
	Establish evaluation framework	
	Establish evaluation criteria	
	Evaluate ideas	
	Select ideas	

APPENDIX

G

Development Phase Resources



The following resources are provided in this Appendix:

- **Development Phase workbook (template)**
- **Development Phase workbook (sample)**
- **Development Phase checklist**

Development Phase workbook (template)

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]
FUNCTION	**[FUNCTION]**

BASELINE ASSUMPTION:

Briefly describe the baseline concept that would be changed by the value proposal. (1-2 sentences)

PROPOSED ALTERNATIVE:

A brief (1 to 2 sentence) statement summarizing the proposal's value proposition. It should address questions such as: "Why is it a good idea?" " What is the value team's perspective?" and "Why is this proposal better than the baseline concept (risks, performance, safety, etc.)?" This is the 15 second elevator sales pitch; it should be succinct and impactful. It is NOT intended to replace the fuller explanation in the discussion on page 2.

BENEFITS	**RISKS/CHALLENGES**
• Short phrases (not full sentences), no periods	• Short phrases (not full sentences), no periods
•	•
•	•
•	•
•	•
•	•
•	•

Performance Score	**0**

COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	₱0	₱0	₱0
PROPOSED ALTERNATIVE:	₱0	₱0	₱0
TOTAL (Baseline less Proposed)	₱0	₱0	₱0
			NO CHANGE

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]

DISCUSSION/JUSTIFICATION:

"The intent of this section is to provide an in-depth analysis of the value proposal. This analysis dives deeper into how the value proposal can be implemented in the design, as well as providing detailed justification for why it is a better idea than the baseline concept design. Sufficient detail should be included to allow the reader to see this is a viable proposal that will improve the value of the project. The following items are examples of what should be included in this section when applicable:

• Technical Considerations

• Performance Impacts (Durability/Longevity, Sustainability, Historic Compatability, Biddability, Awardability, Maintainability, Constructability)

• Cost Considerations

• Schedule Impacts

• Risk Considerations

• Project Management Considerations

• Stakeholder Acceptance

• Implementation Considerations

USE ALT+ENTER FOR A HARD ENTER/CARRIAGE RETURN WITHIN THE CELL"

SPECIAL IMPLEMENTATION CONSIDERATIONS:

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Attribute #1	Defined			0
Justification for Impact Score				
Attribute #2	Defined			0
Justification for Impact Score				
Attribute #3	Defined			0
Justification for Impact Score				
Attribute #4	Defined			0
Justification for Impact Score				
Attribute #5	Defined			0
Justification for Impact Score				
Attribute #6	Defined			0
Justification for Impact Score				
	OVERALL PERFORMANCE SCORE	**0.00%**		**0**

SCALE

10 Large positive impact to performance
5 Small positive Impact to performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost (₱)	TOTAL (₱)	Qty	Unit Cost (₱)	TOTAL (₱)
Cost Element 1							
Cost Element 2							
Cost Element 3							
Cost Element 4							
TOTAL				₱0			₱0
						(BASELINE LESS PROPOSED)	0
							SAVINGS

Note: Total costs are rounded to the nearest thousand dollars.

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]

SKETCH OF BASELINE ASSUMPTION

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING/VALUE ANALYSIS (VE/VA) PROPOSAL
[IDEA NUMBER]
[PROJECT NAME]

TITLE	[IDEA TITLE]

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Development Phase workbook (sample)

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction
FUNCTION	**House Operations**

BASELINE ASSUMPTION:

The existing Passenger Terminal Building Team (PTB) needs a major renovation to provide adequate facilities in compliance with current standards. The Feasibility Study indicates the new PTB will be constructed on-site and composed as a simple structural-framed facility that may utilize a combination of steel and reinforced concrete columns and beams that support a steel roof-framing system.

PROPOSED ALTERNATIVE:

The proposed alternative suggests constructing the Passenger Terminal Building (PTB) using a pre-engineered building (PEB).

BENEFITS	**RISKS/CHALLENGES**
● Faster building construction	● None apparent
● Enables flexibility for future expansion - made in several sizes to adapt to needs	●
● Arrival and placement minimizes disruption of current operations	●
●	●
●	●
●	●
●	●

		Performance Score	**2.9485**
COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	₱227,500,000	₱0	₱227,500,000
PROPOSED ALTERNATIVE:	₱136,500,000	₱0	₱136,500,000
TOTAL (Baseline less Proposed)	₱91,000,000	₱0	₱91,000,000
			SAVINGS

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

DISCUSSION/JUSTIFICATION:

The Feasibility Study indicates that the proposed new Passenger Terminal Building (PTB) will be a simple structural-framed facility that may utilize a combination of steel and reinforced concrete columns and beams that support a steel roof-framing system. The structure will be sheathed with Concrete Hollow Block (CHB) walls at the perimeter with fixed and operable glass windows/doors. The interior walls shall be made up of dry walls for flexibility. The general roof design shall be a combination of either lean-to or curvilinear form of metal roofing materials. Skylights may be utilized to increase daylighting where necessary. On the side elevations, clerestory windows of metal frames and operable/fixed glass panels will be provided to maximize natural light and ventilation. The horizontal metal louvers will be provided on the outer side of the windows to reduce glare and heat gain on the interior side the PTB. These basic design features will help reduce the use of costly artificial lighting and cooling systems and may operate comfortably, possibly even without emergency power during power outage. The floor area of the PTB was calculated by tabulating the space or area allocated for individual facilities incorporated in the PTB. A proposed 3,000 m^2 total area PTB for phase 1 was considered to accommodate five (5) to ten (10) years planning period for Category 3C aerodrome, which will later develop to Category 4C considering a full jet operation that will transfer and relocate the previous landside facilities.

Airports in the midst of expansion projects must remain open and functional. Closing the entire operation or any part of it causes too much disruption. This can result in passengers looking for alternate ways to get to their destinations and revenues will suffer. Sometimes this can have a long-term effect because ticket buyers will remember the inconvenience. Modular buildings are pre-engineered in the factory for fast delivery and set up. Lead time from placing an order to actual use can be relatively short. In the past without pre-engineered buildings, airport terminals were closed anywhere from months to years. Eliminating this problem keeps the airport running efficiently and lowers construction costs.

A unique feature of prefabricated buildings is their flexibility of design. This is ideal when working around runways and existing buildings. They are delivered on trucks and easily positioned in place. Units become accessible without disrupting daily flight operations. Buildings can be craned into place around existing structures.

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

DISCUSSION/JUSTIFICATION:

Airport expansions are dynamic and can take place over a period of months or even years. Temporary as well as permanent buildings may be needed. Modular structures are ideal for this type of facility. Temporary units can be set up for cargo, baggage, staff, and even passengers. Because prefabricated buildings are expandable, they can be converted or expanded to create more usable space for additional services. Conventional buildings do not allow this approach.

Small airports can enjoy the savings and convenience of buildings for passengers and staff. Administrators of small city governments have limited budgets to meet their needs. Modular construction for their newly funded airports can mean the difference between having one or doing without. Traditional buildings for airport usage are just too slow and expensive to construct. Modern buildings go up fast and can be ready for those planes and passengers in a relatively short time frame.

Many leading companies manufacture prefabricated structures that are durable and affordable. Here are some benefits of prefabricated buildings for new small airports:

- No assembly or disassembly
- They are ready to plug in
- The units are relocatable and expandable
- They save money and time
- Their arrival and placement minimizes disruption
- Forklift and crane pockets make them easier to move
- Only the final electrical tie-in is needed
- Come in standard and customized units
- Made in several sizes to adapt to needs
- Energy efficient throughout
- Insurance costs are lower than traditional buildings
- Provide greater protection during wind storms

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

DISCUSSION/JUSTIFICATION:

A number of smaller or regional airports are experiencing growth around the country. Getting all of the permits for creating an additional office or passenger space and hiring contractors can be a lengthy process. Portable offices eliminate most of this hassle since the modular units are created in a factory and not on the work site. The workflow does not slow down, employees are not pulled off the job to help, and the general mess with traditional buildings is eliminated.

NOTE: While this VE/VA proposal focuses on the PTB, other buildings could also be constructed as PEB.

References:
https://rapidsetbuildings.com/metal-buildings/aviation/terminal-buildings/
https://alaskastructures.com/news/future-airport-construction-engineered-fabric-buildings/
https://honkae.en.made-in-china.com/product/pjTJdqiKArkB/China-Prefab-Steel-Building-for-Airport-Terminal.html
https://www.specoengineering.com/airport-terminal-buildings-structure/
http://www.velocityairportsolutions.com/modular-terminal-buildings.html

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Environmental Management	Meet the plan and the BMPs to be compliant during the development and operation of the project	8.16%	0	0
Justification for Impact Score	No perceived impact to performance.			
Schedule	Least impact to schedule and availability of funds to develop	8.16%	10	0.816
Justification for Impact Score	PEB reduces construction duration.			
Operability	Meet 3C requirements for a commercial aerodrome; turbo-prop; eliminates threats to operations	36.73%	0	0
Justification for Impact Score	No perceived impact to performance.			
Financial Profitability	Does the traffic demand merit continuous operations or future expansion? Revenue generation (tickets, cargo, etc.)	24.49%	5	1.2245
Justification for Impact Score	PEB allows for future expansion as demand increases.			
Economic Viability	The airport's contribution to the local economy; job opportunities, taxes, land values, able to move the people that are conducting economic activities in the area	14.29%	0	0
Justification for Impact Score	No perceived impact to performance.			
Constructability	Availability of materials and labor; equipment availability	18.16%	5	0.908
Justification for Impact Score	Several manufacturers available to provide PEB for Passenger Terminal Building.			
	OVERALL PERFORMANCE SCORE	**100.00%**		**2.9485**

SCALE

10 Large positive impact to performance
5 Small positive Impact to performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost (₱)	TOTAL (₱)	Qty	Unit Cost (₱)	TOTAL (₱)
Passenger Terminal Building (Feasibility Study - Table 8.2)	SM	3,500	₱65,000.00	₱227,500,000.00			
Passenger Terminal Building (PEMB) - NOTE 1	SM				3,500	₱39,000.00	₱136,500,000.00
NOTE 1: Prefab units cost anywhere from 50%-60% of the price of conventionally made buildings of wood and concrete.							
TOTAL				₱227,500,000			₱136,500,000
						(BASELINE LESS PROPOSED)	₱91,000,000
Note: Total costs are rounded to the nearest thousand dollars.							**SAVINGS**

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

SKETCH OF BASELINE ASSUMPTION

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING/VALUE ANALYSIS PROPOSAL
HO-02
M'LANG AIRPORT DEVELOPMENT PROJECT

TITLE	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

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Pat

Jegs

lorna

name 4

name 5

name 6

name 7

name 8

name 9

name 10

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name 12

Development Phase Checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

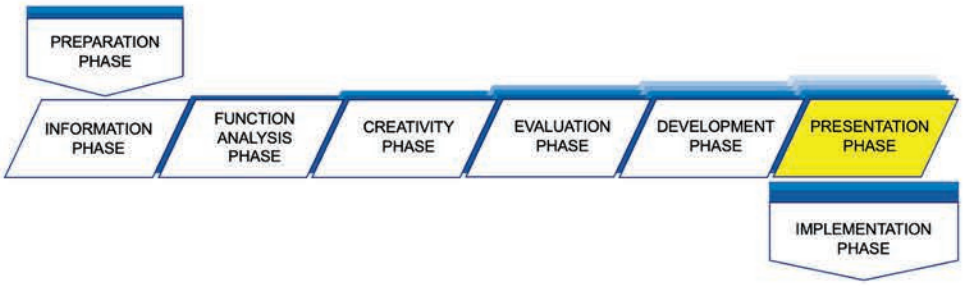
Development Phase Checklist

✓	**Task / Activity, if applicable**	**Comment(s)**
	Assign ideas to the VM team • Evenly distribute workload to the team	
	Develop VM ideas • A separate workbook should be prepared for each proposal, and include (but not limited to): ◦ Sketches of the baseline concept and proposed alternative ◦ A T-Chart of the advantages and disadvantages for this proposal ◦ An action plan (what needs to happen or be done to implement this recommendation) ◦ Cost detail and annual savings	
	Review / Revise VM proposals • Peer reviews done by CVS and SMEs	

APPENDIX

H

Presentation Phase Resources



The following resources are provided in this Appendix:

- **Presentation Phase out-brief presentation (sample)**
- **Presentation Phase out-brief handout (sample)**
- **Value Study Report Outline and Guide**
- **Presentation Phase checklist**

Out-brief Presentation (sample)

2

VE/VA Study Team

Samuel CUSTODIO	Air Transport Planner & Deputy Team Leader
Victoria CORPUZ	Urban & Regional Development
Lorna LLIDO	Structural / Civil Works
Gerry BAGTASA	Weather and Meteorology
Reynaldo CRUZ Jr.	Geotechnical
Ma. Flora May CERNA	Institutional and Social
Ma. Jeanette LIBRERO	Environmental
Porvenir PORCIUNCULA	Economic/Financial
Christine Laumond, VMA	Co-Facilitator
Rhiza Castillo, VMA	Co-Facilitator
Javier Masini, CVS	Co-Facilitator
Renee Hoekstra, CVS	Co-Facilitator
Patrice Miller, CVS	Facilitator
Colin Miller	Technical Assistant

A special thank you to our Government Counterparts: Rodrigo De Vera, Christopher Floyd Querijero, Alfred Sheldon M. Sevallos and Christopher Bryan Dizon for their valuable input during the study.

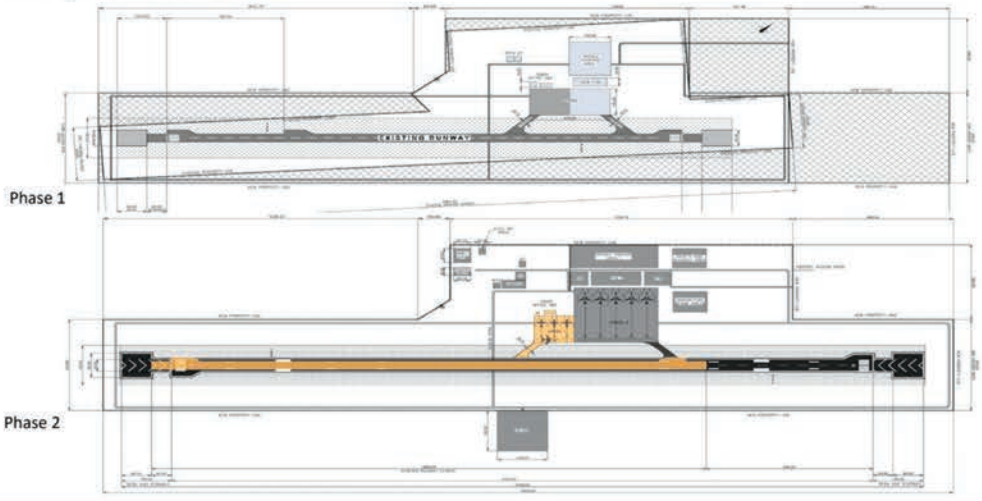
3

Project Overview

- The M'lang (Central Mindanao) Airport is located at Brgy. Tawan-Tawan, M'Lang, North Cotabato. The airstrip is geographically situated almost at the center of the 3 major airports in Mindanao (Cotabato Airport, Davao & GenSan Int'l. Airport).The airport is proposed to be an alternate airport to Cotabato Airport of which has a limited area for improvement to accommodate bigger aircraft.
- On April 2003, a MOA was signed between the Provincial Government of Cotabato (PGC), and Air Transportation Office (ATO, now CAAP). Realizing the socio-economic significance and importance of an air transport services in the Province of Cotabato has led the development initiative in the implementation of Secondary Airport at Tawan-Tawan, M'lang, Cotabato.
- From 2004 to 2012 a total of Php 416 Million has been allocated for the development and construction of M'lang Airport. The following facilities that were completed are:
  - 2100m x 300m Runway Strip
  - 1660m x 30m Runway - concrete
  - One taxiway - concrete (115m x 18m)
  - 1200 sq.m. Apron - concrete
  - Passenger Terminal Building (660 sq.m.)
  - Fire Station building - 2 bays
  - Land Acquisition (92 has.)
- On March 2017, a Feasibility, Master Plan (FS/MP) and Environmental Impact Assessment (EIA) Study was conducted to determine optimum development and master planning of the M'lang Airport. The study was completed on December 2018.

4

Project Overview

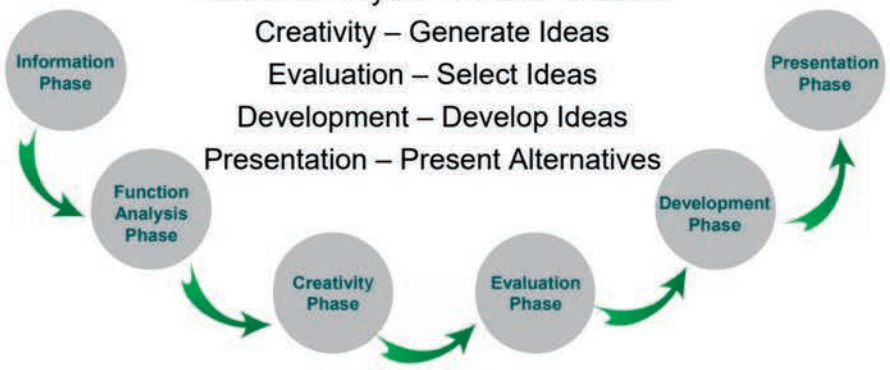


5

Value Methodology Job Plan

Adding Value. Enhancing Ideas.

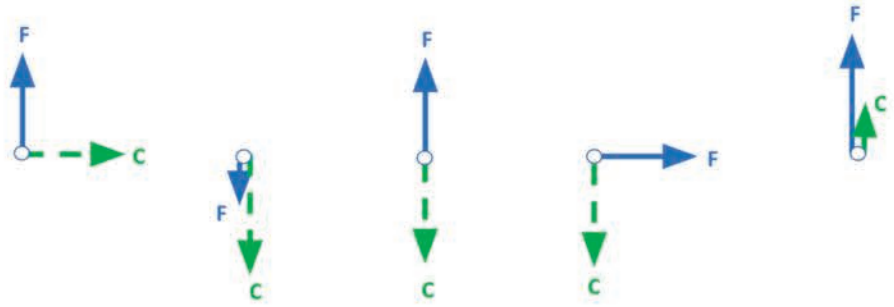
Information – Analyze Information
Function Analysis – Define Functions
Creativity – Generate Ideas
Evaluation – Select Ideas
Development – Develop Ideas
Presentation – Present Alternatives



6

Value Defined

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$



7

Project Goals and VE/VA Workshop Objectives

Project Goals

- Commercial entry-level turbo-prop operations by 2022 meeting the 3C requirements
- Meet the ₱505M budget

VE/VA Workshop Objectives

- Identify value improvements to support the goal of completing the Phase I M'lang airport facilities
- Confirm appropriate development of the airport (entry level airport for commercial).
- Balance the goal of looking at the population, environmental, etc. for the appropriateness from an economic standpoint for overall airport development (future demand and expansion)
- Feasibility of what facilities we need for meeting 3C requirements and to meet budget, what we can do/not do
- Identify realistic schedule for Phase I development based on availability of funds and to meet 3C requirements

8

Performance Attributes

Criteria Scoring Matrix

	Criteria	Definition	Weight	Preference		Preference		Preference		Preference		Preference	
A	Environmental Management	Meet the plan and the BMPs to be compliant during the development and operation of the project	8.16%	A	B	A	C	A	D	A	E	A	F
					3		4		4		4	4	
B	Schedule	Least impact to schedule and availability of funds to develop	8.16%	B	C	B	D	B	E	B	F	B	G
					3		3		3	1	1		
C	Operability	Meet 3C requirements for a commercial aerodrome; turbo-prop; eliminates threats to operations	36.73%	C	D	C	E	C	F	C	G	C	H
				3		4		4					
D	Financial Profitability	Does the traffic demand merit continuous operations or future expansion? Revenue generation (tickets, cargo, etc.)	24.49%	D	E	D	F	D	G	D	H	D	I
				4		1	1						
E	Economic Viability	The airport's contribution to the local economy; job opportunities, taxes, land values, able to move the people that are conducting economic activities in the area	14.29%	E	F	E	G	E	H	E	I	E	J
					2								
F	Constructability	Availability of materials and labor; equipment availability	8.16%	F	G	F	H	F	I	F	J	F	K

How Important:

4 = Major Preference

3 = Medium Preference

2 = Minor Preference

1 = No Preference (each)

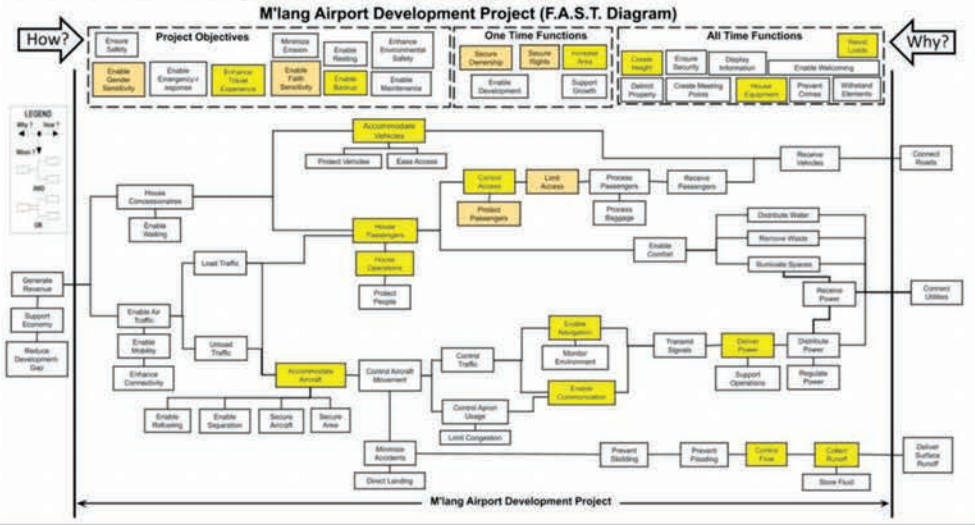
9

Project Risks

- It might not attain the level of profitability for airlines, that scheduled air services may not continue, or even start at all
- Land acquisition status, if not adequately supported by the right documents, could open the project to challenge and cause for delay or discontinuance
- Delays due to budget releases can be foreseen as a problem for the procurement of supplies and materials, as well as other possible delays due to force majeure and unfavourable weather conditions
- Flooding if adequate drainage is not provided on time
- Use of individual septic tanks for sewer may not be sustainable as passenger traffic increases
- Lesser priority now given pandemic, and economic recovery funding requirements
- Slowdown in tourism, trade and overall shift in economic activities
- Additional Risks identified by the VE/VA Team:
  - Poor Drainage System in the Area
  - Liquefaction Potential of the Site
  - Revenue and Demand risks
  - Operating Risks
  - Government Support

10

Function Analysis - FAST Diagram



11

Function Analysis

Basic Function (What must this project do?):

House Concessionaires
Enable Air Traffic

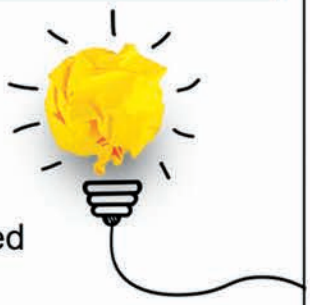
Brainstormed creative ideas by key functions (combination of cost and risk)—

Accommodate Vehicles
Enhance Travel Experience
Enable Backup
Increase Area
Create Height
House Equipment
Resist Load
House Passengers
Manage Risks

House Operations
Accommodate Aircraft
Enable Navigation
Enable Communication
Deliver Power
Control Flow
Collect Runoff
Control Access

12

Creative Ideas



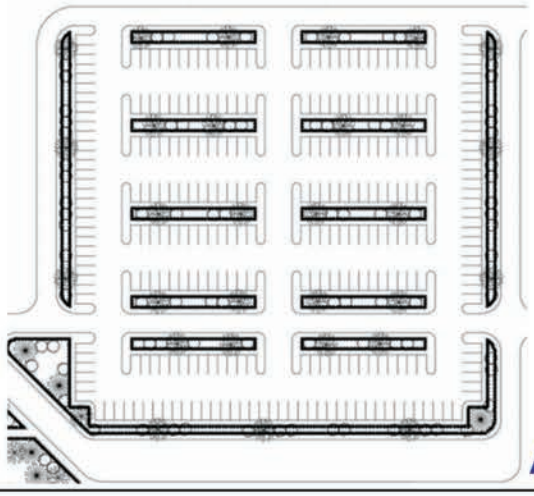
- **251 Ideas Brainstormed**
  - 15 VE/VA Alternatives developed, costed
  - 10 Design Suggestions developed, not costed
  - 76 Design Comments identified

13

Value Engineering/ Value Analysis Proposals

14

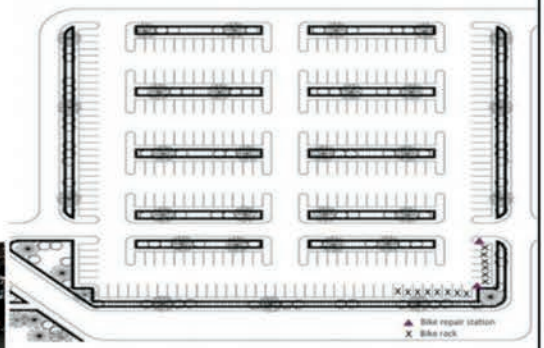
AV-01 Allow for bicycle parking



BASELINE ASSUMPTION

15

AV-01 Allow for bicycle parking

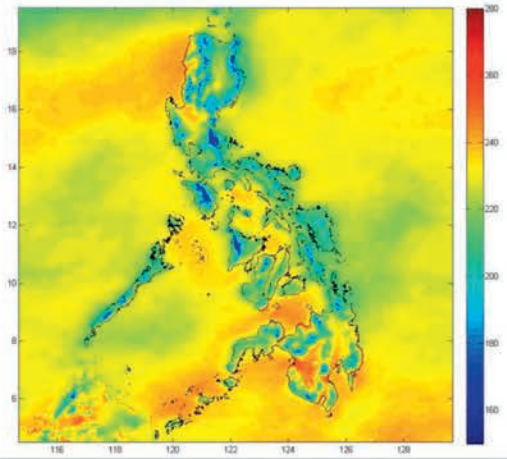


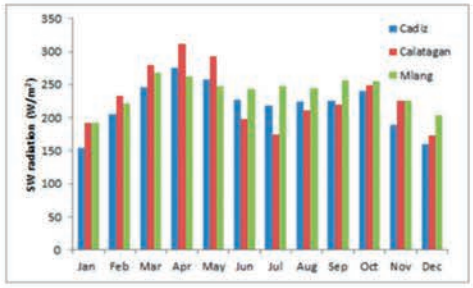
Cost Add (₱310K) **Performance 7.3260**

PROPOSED ALTERNATIVE

16

EB-12 Hybrid solar and fossil fuel power system





PROPOSED ALTERNATIVE

17

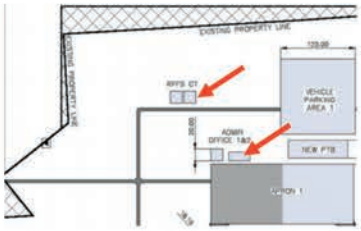
EB-12 Hybrid solar and fossil fuel power system

Cost Add (₱15M) **Performance 5.6935** **PROPOSED ALTERNATIVE**

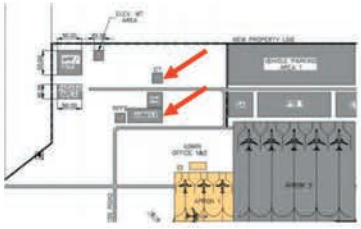
18

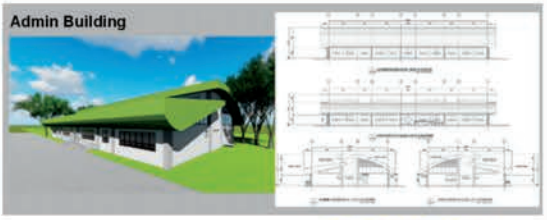
CH-08 Integrate control tower structure with admin building

Phase 1:



Phase 2:

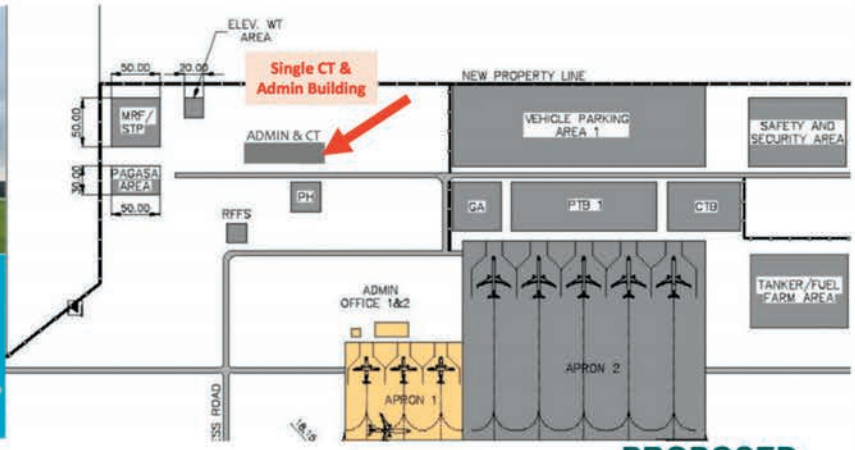




BASELINE ASSUMPTION

19

CH-08 Integrate control tower structure with admin building



Cost Savings ₱6M **Performance 2.1320** **PROPOSED ALTERNATIVE**

20

HP-04 Design architectural theme/facade to suit local culture

BASELINE ASSUMPTION

21

HP-04 Design architectural theme/facade to suit local culture

Design Suggestion

Performance 3.4323

PROPOSED ALTERNATIVE

22

HO-02 Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

BASELINE ASSUMPTION

23

HO-02 Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

PROPOSED ALTERNATIVE

24

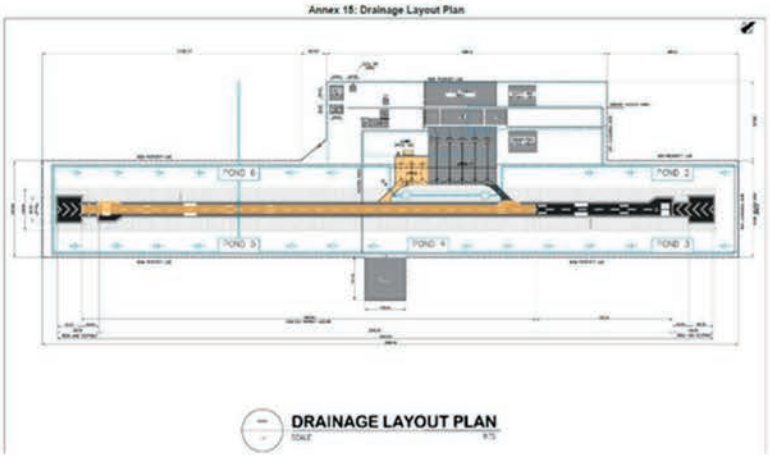
HO-02 Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction

Cost Savings ₱91M **Performance 2.9485**

PROPOSED ALTERNATIVE

25

CF-02 Introduce bio-drainage



To control the problems of surface and sub-surface run-off, there are no specific designs suggested in the Feasibility Study.

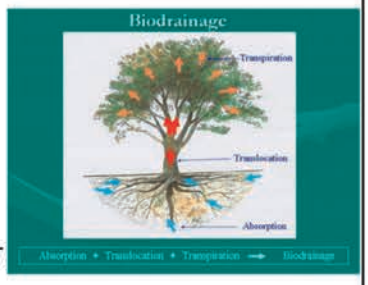
BASELINE ASSUMPTION

26

CF-02 Introduce bio-drainage

BIO-DRAINAGE is defined as:

- The process of removing the excess soil water through transpiration using bio-energy of the plant and radiation energy of the sun.
- It is an option to prevent the development of water logging in canal command areas.
- It has specific role in checking advancement of seepage from water courses and a viable option for safe disposal of large volume of saline water available in saline areas underlain with surface and sub-surface drainage system



PROPOSED ALTERNATIVE

27

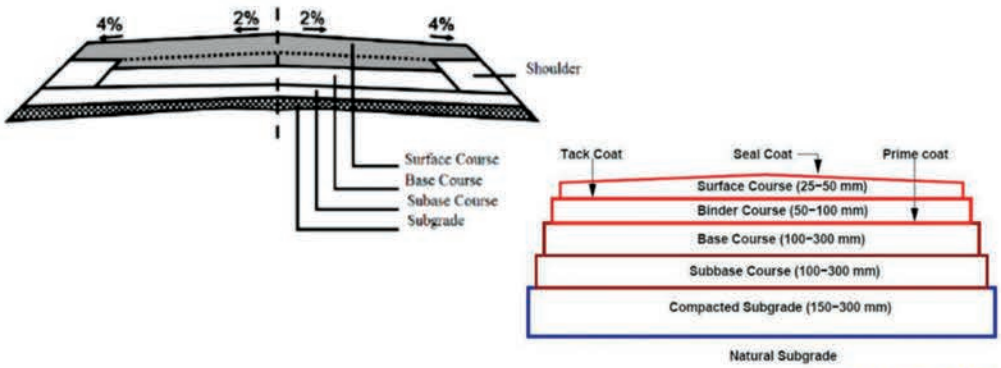
CF-02 Introduce bio-drainage

Indonesia's largest drainage canal

Design Suggestion **Performance 1.5305** **PROPOSED ALTERNATIVE**

28

CF-03 Use permeable pavement to manage stormwater runoff at non-runway areas



BASELINE ASSUMPTION

29

CF-03 Use permeable pavement to manage stormwater runoff at non-runway areas

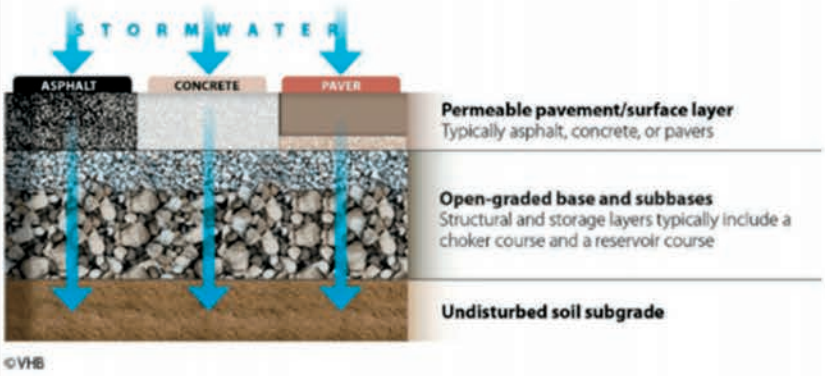


Figure 1. Generic permeable pavement cross-section.

Cost Add ₱36.8M **Performance 1.6225** **PROPOSED ALTERNATIVE**

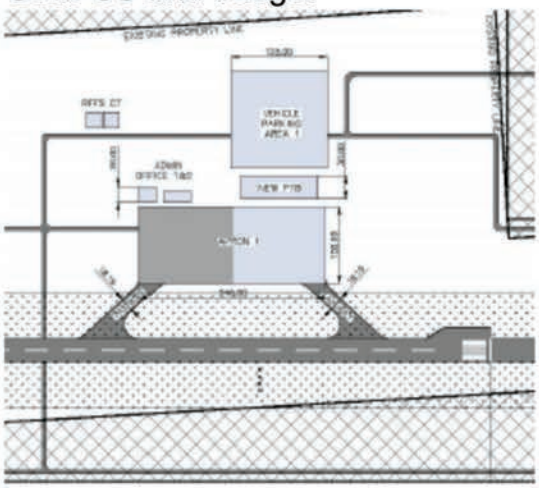
30

CA-12 Key card access doors to secured areas

Cost Add (₱579K) **Performance 2.8472** **PROPOSED ALTERNATIVE**

31

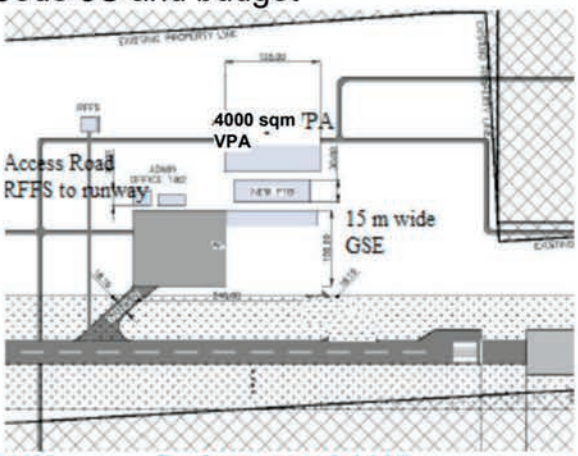
MS-01 Identify scope for Phase 1 to comply with Aerodrome Reference Code 3C and budget



BASELINE ASSUMPTION

32

MS-01 Identify scope for Phase 1 to comply with Aerodrome Reference Code 3C and budget



Cost Savings ₱144M **Performance 2.0098**

PROPOSED ALTERNATIVE

33

MS-16 Conduct additional geotechnical investigation

BENEFITS	RISKS/CHALLENGES
• It will provide information on the quality of materials available	• Rarely, there may not be suitable materials available within economic distance
• It will allow for more accurate estimation of the cost of materials	•
• It will identify cost savings opportunities	•
• Material pricing and availability can impact construction	•

Cost Add (₱100K) **Performance 2.8768** **PROPOSED ALTERNATIVE**

34

MR-02 Financial Analysis Review

Proposed Total Project Cost: (Local Fund Source-GAA) and Revenues

Total Infrastructure Component	P 2,604,084,972.00
Total Maintenance & Operational Cost	P 457,794,207.00
Total Reinvestment Cost	P 130,204,249.00
Total Project Cost	**P 3,192,083,428.00**
Estimated Total Revenues	**P20,008,820,642.00**

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MR-02 Financial Analysis Review

Resulting Financial Analyses (including sensitivity analysis 1), Phases 1 & 2

Criteria	Original Assumptions	Case 1 +10% Cost	Case 2 -10% Rev	Case 3 Case 1 + Case 2
Cash Payback	6.03 years	6.14 years	6.99 years	5.51 years
ROI	20%	19.14%	16.82%	21.37%
B/C Ratio at 12%	2.00%	1.96%	1.94%	3.04%
NPV at 12% (P billion)	1.34	1.22	1.098	2.36
IRR at 40% and 30%	35.90%	33.24%	34.69%	36.45%

The financial results were further subjected to a (worse-case) sensitivity analysis scenario i.e. +20% cost, -20% revenue and both cases.

36

MR-02 Financial Analysis Review

Observations to the Financial Results

- Good financial results focused on use of high (demand) forecast
- OPEX and CAPEX were fixed for several years
- No separate financial analysis for Phase 1 (and Phase 2)
- Yearly income and expenses streams show deficits in the first 5 years; the financial picture begins to turn positive starting 2027

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Next Steps

- Preliminary VE/VA Report
- Interim VE/VA Report
- Draft Final VE/VA Report with Capacity Building Workshop Report
- Final Report with Capacity Building Workshop Report

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Out-brief Handout (sample)

[CLIENT NAME]
[PROJECT NAME]
VE/VA

Summary of Value Engineering Proposals & Design Suggestions

Idea No.	Idea Title	Score	Performance Score	Initial Cost Savings / (Cost Add -)	O&M Cost Savings / (Cost Add -)	Total Life Cycle Cost Savings / (Cost Add -)	Needs to be addressed by VE/VA Team	Include in Phase 1 (Short Term) Aerodrome Category 3C	Include in Phase 2 (Medium to Long Term) Aerodrome Category 4C	VE/VA Team Recommended Package
AV	**Accommodate Vehicles**									
AV-01	Allow for bicycle parking	4	7.3260	-₱310,000	₱0	-₱310,000			-₱310,000	-₱310,000
AV-03	Designate areas for public transport vehicles	4	1.2251	-₱3,000,000	-₱550,000	-₱3,550,000	Consider additional narrative on WB page 2 Provide justification for scores on Performance tab		-₱3,550,000	-₱3,550,000
AV-08	Provision of communal toilets	5	0.4080	-₱5,000,000		-₱5,000,000	Address comments on WB page 2 and Performance tab		-₱5,000,000	-₱5,000,000
AV-09	Provision for overnight/long-term parking	DS	3.2550	N/A	N/A	N/A	Provide justification for performance scores		N/A	N/A
ET	**Enhance Travel Experience**									
ET-01	Provision of wifi, charging station, work station in the airport	DS	0	N/A	N/A	N/A			N/A	N/A
ET-11	Provision of prayer room	DS	1.6528	N/A	N/A	N/A	Address comments on		N/A	N/A
EB	**Enable Backup**									
EB-01	Use of solar power system	DS	1.4390	N/A	N/A	N/A			N/A	N/A
EB-12	Hybrid solar and fossil fuel power system	4	5.6935	-₱3,000,000		-₱3,000,000	Provide justification for		-₱3,000,000	-₱3,000,000
CH	**Create Height**									
CH-06	Operate with Flight Service Station (FSS) in lieu of control tower for 3C only	4	1.5974	₱73,000,000		₱73,000,000	Address comments on WB page 2	₱73,000,000		₱73,000,000
CH-07	Investigate alternative elevator design/configuration (hydraulic piston - "lift")	DS	0.3264	N/A	N/A	N/A			N/A	N/A
CH-08	Integrate control tower structure with admin building	5	2.1320	₱6,000,000		₱6,000,000			₱6,000,000	₱6,000,000
RL	**Resist Load**									
RL-04	Use chopped scrap tires as base material	4	-0.1935	-₱37,275,000		-₱37,275,000		Not recommended	Not recommended	-₱37,275,000
HP	**House Passengers**									
HP-01	Design using local building materials (locally fabricated and locally sourced) to support local economy	DS	7.0812	N/A	N/A	N/A		N/A		N/A
HP-04	Design architectural theme/facade to suit local culture	DS	3.4323	N/A	N/A	N/A		N/A		N/A
HO	**House Operations**									
HO-02	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction	4	2.9485	₱91,000,000	₱0	₱91,000,000			₱91,000,000	₱91,000,000
AA	**Accommodate Aircraft**									
AA-12	Clear runway of stray animals and birds (to include mitigating measures)	DS	4.4890	N/A	N/A	N/A		N/A		N/A
EN	**Enable Navigation**									
EN-10	Identify emergency bay area (an extended parallel taxiway)	4	6.2486	-₱6,505,000		-₱6,505,000	Include narrative on WB		-₱6,505,000	-₱6,505,000
CF	**Control Flow**									
CF-02	Introduce bio-drainage	DS	1.5305	N/A	N/A	N/A	Address comments on		N/A	N/A
CF-03	Use permeable pavement to manage stormwater runoff at non-runway areas	4	1.6225	-₱36,875,000		-₱36,875,000			-₱36,875,000	-₱36,875,000
CA	**Control Access**									
CA-12	Key card access doors to secured areas	4	2.8472	-₱554,000	-₱25,000	-₱579,000	Provide justification for		-₱579,000	-₱579,000
CA-16	Usage of QRcode in tickets for passenger entry to PTB	DS	0.6530	N/A	N/A	N/A			N/A	N/A
MR	**Manage Risks**									
MR-02	Government subsidy may be explored (review financial analysis)	DS	N/A	N/A	N/A	N/A		N/A		N/A
MS	**Miscellaneous**									
MS-01	Identify scope for Phase 1 to comply with Aerodrome Reference Code 3C and budget	4	2.0098	₱144,168,000		₱144,168,000		₱144,168,000		₱144,168,000
MS-02	Identify scope for Phase 2 to comply with Aerodrome Reference Code 4C and budget	4	4.5160	₱357,788,000		₱357,788,000			₱357,788,000	₱357,788,000
MS-16	Conduct additional geotechnical investigation	4	2.8768	-₱100,000		-₱100,000	Address comment on Cost	-₱100,000		-₱100,000

Value Study Report

Below is an abbreviated table of contents for a Value Study Report. It is followed by an annotated outline to provide guidance to value practitioners and government agencies when preparing and reviewing a Value Study Report.

COVER

TABLE OF CONTENTS

PART I: VALUE STUDY RESULTS AND PROPOSALS

1. Executive Summary

1.1 Value Study Results
1.2. Value Study Background

2. Value Study Proposals

2.1 Table of Value Proposals
2.2 Individual Value Proposals

PART II: APPENDICES – VALUE STUDY DOCUMENTATION

Appendix A: Value Study Overview
Appendix B: Project Analysis
Appendix C: Function Analysis
Appendix D: Idea List and Idea Evaluation
Appendix E: Supplemental Information
Appendix F: Certification Statement

Value Study Report Section	Description
Cover	This section specifies the cover page format requirements to ensure all information is presented consistently. Covers should include the following: • Report Title Draft vs. Final, etc. • Agency Logo – This should be equal to or larger than the CVS® firm's logo • Project Photo/Image – This should be a large portion of the cover • Project Name and Location • Project Number • Study Dates – The range of dates representing the study duration • Report Date – This is the date the report is submitted to the reviewing agency • Name/Logo of CVS® firm
Table of Contents	The Table of Contents (TOC) orients the reader and facilitates review and navigation. Each major heading in the TOC should be appropriately hyperlinked or bookmarked. Page numbering shall start with the Value Study Results, and each appendix shall have its own numbering (A-1 for Appendix A, B-1 for Appendix B).
PART I: VALUE STUDY RESULTS AND PROPOSALS	Part I of the value study report is focused on the information of direct benefit to those involved with the value study subject (i.e., the project team, key decision-makers, stakeholders, etc.). This first section of the report body includes the Executive Summary and the Value Study Proposals, and contains detailed information concerning the value proposals.
1.0 Executive Summary	The Executive Summary provides an overview of the overall value study effort. It should be written as if it may be the only portion of the report decision-makers will read to determine if action is warranted relative to the recommendations developed by the value team. It must grab their attention and entice them to read through the more in-depth documentation in the remainder of the report. The Executive Summary includes a Value Study Results summary (one page) and the Value Study Background (one to two pages maximum).

Value Study Report Section	Description

1.1 Value Study Results	The Value Study Results is a brief synopsis of the entire value study effort. A standard template shall be used to capture the relevant information. This one-page document has the dual purpose of serving as a summary of the results, and also, as a vehicle for marketing the broader benefits of the agency's Value Program. Therefore, there is a desire to maintain consistency of this document from one report to the next in terms of the information contained and overall appearance.
	
	The Value Study Results template includes the following information:
	
	• Agency Logo
	• Project Name
	• Project Location
	• Representative image/graphic that best conveys the study benefits
	• Value Study Dates
	• Value Study Timing (planning, feasibility, preliminary design, etc.)
	• Original Project Cost
	• Proposed Initial Cost Avoidance
	• Schedule Savings
	• Value Study Return on Investment
	• Qualitative Impacts
	  ◦ Reliability
	  ◦ Operations & Maintenance
	  ◦ Functionality
	• Project Overview
	• Value Study Benefits
	• Key Recommendations

1.2 Value Study Background	This section of the report provides additional context to assist the reader in developing a deeper understanding of the conditions and environment in which the value study was performed. This section should be one to two pages maximum and address the following topics: • Key Challenges and Issues - Discuss the major challenges, risks, and issues facing the project. • Constraints - Elaborate on the key constraints that were placed on the project team and the Value Study effort. • Value Study Objectives - Based on the challenges, issues, and constraints that were identified above, what were the explicit objectives of the value study? • Value Study Highlights - What key information was uncovered during the value study that led to important value improvements identified in this report? How did the VM process lead the team to identify and develop these value improvements (i.e., use of Function Analysis, team creativity, risk analysis, etc.)?

Value Study Report Section	Description

2.1 Table of Value Proposals	This section is intended to provide a quick summary of the proposals that were developed as part of the value study. There shall be a single table that lists all proposals, both quantitative and qualitative. The information contained within the table includes the following.
	
	Draft Value Study Report - The draft report shall include strategies recommended by the value team.
	
	• Proposal Number
	• Proposal Title
	• Initial Cost (increase/decrease)
	• Life Cycle Cost (Gross) (increase/decrease)
	• Preliminary Decision (include a space in the table but leave blank in the draft report)
	  ◦ Accept: any proposal that is accepted in part or in whole. The concept is “intent to integrate.” It is possible that the proposal ultimately is not feasible and is not implemented in later design.
	  ◦ Reject: any proposal that is 100% rejected.
	• Preliminary Decision Rationale
	
	Final Value Study Report - The final report shall incorporate the acceptance and rejection of the proposals as determined by the Preliminary Decision Document. Thus, the strategies and/or proposals within the strategies may change from the draft to the final report. The final report contains:
	
	• All items listed in the Draft Report.
	• Preliminary Decision - This section should now be completed and include a record of acceptance or rejection. If the proposal is accepted with conditions, is accepted with modification, or rejected, a brief justification shall be included explaining the decision. If the proposal was accepted outright, no justification is necessary.

Value Study Report Section	Description
2.2 Individual Proposals	This section provides guidance on the structure and content of individual value proposal write-ups. The primary focus of these write-ups is to provide enough detail for the reader to make an informed decision. Individual value proposal write-ups should include the following items: **Proposal Title and Number** - The title is typically the reader's introduction to a developed proposal; it creates the reader's first impression of the proposal. Generally, the developed proposal title is written during brainstorming. While this initial title may be understood by the value team during the context of the workshop, it does not always translate well to the reader of the report. A complete value proposal title should include the following three components: the new idea, the current/baseline plan, and the reason to change. For example, instead of using a title such as "Use gravel for roads," the title should be more specific: "Use gravel in lieu of paving for temporary roads during construction". **Value Proposal Synopsis** - A brief (one- to two-sentence) statement summarizing the proposal's value proposition. It should address questions such as: Why is it a good idea?; What is the value team's perspective?; and Why is this proposal better than the baseline concept (risks, performance, safety, etc.)? This is the 15-second elevator sales pitch; it should be succinct and impactful. It is not intended to replace the fuller explanation in the discussion that follows. **Cost Avoidance** - Bottom-line number of estimated cost avoidance for this value proposal. This can also show cost increase, if applicable. Because this figure refers to cost avoidance, a positive number indicates a reduction in cost and a negative number indicates an increase in cost. **Schedule Savings** - The time savings anticipated to result from the proposal. **Qualitative Benefits** - Identify the impact of the proposal on the following three areas (at a minimum): • Reliability - Impact on the robustness and service life of the value study subject. • Operations & Maintenance - Impact on future and long-term operations (i.e., energy, personnel, etc.) and maintenance (i.e., spare parts, routine maintenance, repairs, etc.) related to the value study subject. • Functionality - Impact on the performance and/or quality of the value study subject. Indicate the impact using one of three terms: • Improved - Performance will be improved from the baseline. • Maintained - Performance will not change relative to the baseline. • Degraded - Performance will be reduced from the baseline. **Baseline Concept** - The intent of this section is to briefly describe the baseline concept that would be changed by the relevant value proposal.

Value Study Report Section	Description
2.2 Individual Proposals	**Value Proposal Description** - The intent of this section is to provide a brief summary of the value proposal relative to the baseline concept. **Advantages and Disadvantage**s - The intent of this section is to provide the "why" for this specific proposal. Why is this value proposal better or worse than the baseline concept? Advantages and disadvantages should be presented as bulleted lists, enabling the reader to quickly and easily understand the potential benefits and drawbacks of the value proposal. These should be more specific than "increased cost" or "decreased cost". Schedule, risk, maintenance, durability, life cycle impacts and other similar characteristics related to the project should be addressed. Remember, cost is generally associated with something specific (i.e., reduced labor, equipment, materials, unwanted secondary function, etc.), so it is best to identify the underlying cause of the cost movement. **Discussion and Justification** - The intent of this section is to provide an in-depth analysis of the value proposal. This analysis dives deeper into how the value proposal can be implemented in the design, as well as providing detailed justification for why it is a better idea than the baseline. Sufficient detail should be included to allow the reader to see this is as a viable proposal that will improve the project value. The following items are examples of what may be included in this section: • Technical Considerations • Performance Impacts • Cost Considerations • Schedule Impacts • Risk Considerations • Project Management Considerations • Stakeholder Acceptance • Implementation Considerations **Review Comments** - As part of the individual value proposal write-up, any comments and feedback received during the mid-point review should be mentioned here and addressed by the value team, if applicable. By doing this, the value team demonstrates that they have heard and listened to comments and concerns of the project team and/or stakeholders and have addressed those comments and concerns to show that the value proposal is still viable. **Sketches/Diagrams** - Sketches and diagrams of both the baseline design concept and the value proposal should be included, where applicable, to assist the reader in visualizing how the proposal differs from the baseline concept. **Assumptions and Calculations** - Any assumptions made or supporting calculations that were developed to support the quantities used in the cost estimate(s), for both initial and life cycle cost (LCC) should be included. **Cost Estimates** - Include as detailed a cost estimate as possible (avoid one-line, or lump-sum estimates) to support cost reporting (potential cost avoidance, cost savings or costs added) and modified acceptance easier to understand what was accepted. The more detailed, precise quantities used, the more credible the costs reported. Provide the source of costs where applicable: vendor quotes, previous contracts, etc. LCC estimates should be included when relevant.

Value Study Report Section	Description
Part II: APPENDICES – VALUE STUDY DOCUMENTATION	The information in this section of the report provides all remaining supporting documentation relevant to the project and value study effort. This information provides documentation of the VM tools and techniques applied during the value study. This information will be used during the Post Workshop Evaluation Process and to ensure compliance with the agency's VM standard.
Appendix A: Value Study Overview	The purpose of the overview is to establish the context of the value study effort. This is an opportunity to capture what happened during the workshop and how it influenced the direction and results of the team's effort. **Project Description** **List of Documents Reviewed** - Include a list of the documents that were reviewed and used by the value team to develop their understanding of the project, product, or process and establish study goals, objectives, and constraints. Be sure to note versions or publication dates of any documents provided for review. This section of the report should include a note instructing the reader to contact the PM to obtain full copies of the documents listed. This will make it clear that the PM should be the main POC for obtaining these documents as needed. **In-Brief** - Provide a synopsis of the in-brief presentation. Identify any highlights or key discussions (do not include PowerPoint slides). **Site Visit** - State whether a site visit was performed for the value study. If a "virtual" site visit was performed, indicate how it was conducted. If a site visit was performed, identify key observations and highlight any takeaways that contributed to the value team's understanding of the project. **Mid-Point Review** - Include a paragraph describing what type of presentation was made and what key issues/points were identified or emphasized to the value team. Identify participants and include any specific comments that may have influenced the rest of the workshop or the recommendations/proposals developed by the team. **Presentation** - Identify what type of presentation was made, summarize key issues or points of clarification that were presented, and participants from all organizations represented. If any comments or questions were received that influenced the value team's recommendations, those should be captured in the report (do not include PowerPoint slides).

Value Study Report Section	Description
Appendix A: Value Study Overview	**VM Process** - This section provides a narrative description of the activities performed relative to VM Job Plan and later appendices. This section should summarize the work completed in each phase in support of the VM Job Plan and how it contributed to the overall process and outcome of the value study. For example, demonstrate how the identification of functions led to better ideas in the Creativity Phase. The following list identifies the type of information to include for each phase of the VM Job Plan. 1. Preparation Phase: Include a summary of the pre-workshop effort completed prior to the actual workshop. 2. Information Phase: Identify key information acquired during this phase and how this affected subsequent phases. 3. Function Analysis Phase: Identify technique(s) used to generate functions and resulting Function Analysis. 4. Creativity Phase: Identify ideas that were generated by the team and their disposition (i.e., developed, combined with other ideas, dismissed). The team is encouraged to generate and sort ideas based on functions. 5. Evaluation Phase: Identify how the team narrowed down the ideas from the previous step. Describe the technique used and resulting rationale that led to the team's decision. 6. Development Phase: Details of this phase will be demonstrated in the proposals that are developed and presented in Part I of the report. 7. Presentation Phase: Identify the communication technique used for the study and any special considerations that led to the team's delivery. 8. Implementation Phase: Include summary information of the preliminary decision meeting with the decision makers to establish disposition of the value proposals. Minimum information should include participants, meeting date, significant concerns that were identified, and accept/reject status. **Participants** - Note who participated in the value study workshop, the organizations represented, participants' role in the value study, and the level of participation (full-time, in-brief, mid-point review, out-brief). This section should also identify support roles and co-facilitators. There should be only one participant list, and it should identify the dates on which the value team met. **Agenda** - The report should include a detailed, actualized agenda for the value study. This is important in evaluating time allocated to phases of the VM process as well as the workshop as a whole.
Appendix B: Project Analysis	This section of the report is intended to capture activities that were performed relative to cost, performance, schedule, and risk in relation to the VM Job Plan. This section should include the following types of information, include a brief paragraph that describes the action(s) taken, and include applicable content: • Cost models used in the preparation of the value study (i.e., Pareto Chart). • Flowcharts developed in support of the value study. • Performance or quality assessments or evaluations. • Schedule Analysis - Any such analysis performed as part of the value study, techniques, and a statement of findings/recommendations. • If a formal cost estimate review validation was performed as part of the value study, techniques, and a statement of findings, or recommendations should be included. • If risk analysis was performed as part of the value study, summarize the techniques used, and provide a statement of findings or recommendations. Include a risk register or other documents developed, if applicable. • Include any additional Information Phase-type analysis as necessary.

Value Study Report Section	Description
Appendix C: Function Analysis	Function Analysis is the heart of Value Methodology. As such, this portion of the study and the report is a focal point representing the industry. Appendix C should follow an approach that includes: what type of Function Analysis was used and why was that particular method chosen; how were the functions prioritized for use in the Creativity Phase, and; how did the functions broaden the team's creativity? At a minimum, Random Function Identification shall be performed. Some examples of different types of Function Analysis that may be included in this section are listed below. • Random Function Identification • Function-Resource Matrix • Function Analysis System Technique (FAST) Diagram
Appendix D: Idea List and Idea Evaluation	This section of the report is intended to capture value study activities that were performed relative to the Creativity and Evaluation Phases of the VM Job Plan. This section should include the following types of information: • Total number of ideas generated and the total number of ideas developed. • List of ideas organized by function. • Evaluation techniques used (e.g., nominal group technique, numerical ratings, evaluation matrices) and their results. Describe what method(s) was used and include relevant evaluation comments and discussions. • Any other types of Creativity or Evaluation Phase activities that demonstrate the tools and techniques used in the value study This information may be used as a supplementary resource to the value study report recipients as a source of additional ideas / related evaluation rationale.
Appendix E: Supplemental Information	If additional technical information is developed during the value study effort and deemed of use to the report recipients, it should be placed in Appendix E. It is recommended that a reference to this additional material is made in the appropriate sections of the report so that readers can easily find and navigate to this information. Examples may include: references, analysis, cut sheets, specifications, presentations, etc.
Appendix F: Certification Statement	The intent of the certification statement is to validate compliance with the agency VM standards and requirements. Sample certification statements are found below. --- **The undersigned Certified Value Specialist (CVS®) facilitator (along with any participating co-facilitators) attests that the Value Study documented by this report meets the agency VM standard and that the Value Study was facilitated in accordance with the SAVE International® Standards of Conduct.** **[Facilitator Signature]** **CVS® No. [###]** **Facilitator** **[Co-Facilitator Signature]** **VMA/CVS® No. [###]** **Co-Facilitator** --- **As the agency Value Officer, I attest that the Value Study documented by this report was executed in accordance with the agency VM standard.** **[Value Officer Signature]** **Agency Value Officer**

Credit to: USACE

Presentation Phase Checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

Presentation Phase Checklist

✓	**Task / Activity, if applicable**	**Comment(s)**
	Schedule the VM Presentation	

	Select the VM proposals to present
	• A subset of the developed ideas
	  ◦ Greatest Savings
	  ◦ Recommended Package
	  ◦ Groupings (Constructability, Architecture, ROW, etc.)	

	Prepare the visual presentation and handouts
	• PowerPoint presentation
	  ◦ Front end
	  ▪ Introduce project
	  ▪ Project overview
	  ▪ Introduce value study team
	  ▪ Explain the VM Job Plan that was performed
	  • Focus on Function Analysis
	  ◦ Proposals
	  ▪ Any special considerations
	  ▪ Cost savings/cost add
	  ▪ Highlight benefits and challenges
	  ▪ Imagery to tell the story and allow the team something to speak to
	  ◦ Closing
	  ▪ Cost estimate observations
	  ▪ Upcoming deadlines
	  • Draft Report
	  • Implementation Meeting
	  • Final Report
	• Prepare a handout that lists all developed proposals
	  ◦ Cost savings/cost add
	  ◦ Operations and maintenance cost
	  ◦ Evaluation Score
	  ◦ Performance Score	

	Start the presentation • Have each team member introduce themselves • Allow time for questions after each proposal is presented	
	Develop VM study report • Gather all files and information in one easily accessible location for reference during report construction	

APPENDIX

I

Implementation Phase Resources

The following resources are provided in this Appendix:

- **Value proposal determination form (sample)**
- **Implementation Phase checklist**
- **Implementation Phase commonly asked questions**

Value Proposal Determination Form (sample)

VALUE STUDY
NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY
M'LANG AIRPORT DEVELOPMENT PROJECT

Preliminary Implementation Decision & Rationale

The following table lists all proposals that were developed as part of the value study. Please note that both quantitative proposals (reduce the initial cost of the project) and qualitative proposals (add initial cost or do not have cost impact) are included in the table. The table includes the Proposal number, Proposal Title, and First Cost Decrease (Increase), Life-cycle Cost Decrease (Increase), and Total Cost Decrease (Increase) for each developed proposal.

In addition, space is included in the table for the Preliminary Implementation to either:

- **Accept:** any proposal that is accepted in part or in whole. The concept is "intent to integrate" It is possible that the proposal ultimately is not feasible and is not implemented in later design.
- **Reject:** any proposal that is 100% rejected.

The last column, Preliminary Implementation Decision Rationale, documents the justification of the decision to accept with conditions, accept with modification, or reject.

Idea No.	Idea Title	Score	Initial Cost Avoidance / (Cost Add)	O&M Avoidance / (Cost Add)	Total Life Cycle Cost Avoidance / (Cost Add)	Preliminary Decision: Accept or Reject*	Preliminary Decision Rationale*
AV	**Accommodate Vehicles**						
AV-01	Allow for bicycle parking	4	-₱310,000	₱0	-₱310,000		
AV-03	Designate areas for public transport vehicles	4	-₱3,000,000	-₱550,000	-₱3,550,000		
AV-08	Provision of communal toilets	5	-₱5,000,000		-₱5,000,000		
AV-09	Provision for overnight/long-term parking	DS	N/A	N/A	N/A		
ET	**Enhance Travel Experience**						
ET-01	Provision of wifi, charging station, work station in the airport	DS	N/A	N/A	N/A		
ET-11	Provision of prayer room	DS	N/A	N/A	N/A		
EB	**Enable Backup**						
EB-01	Use of solar power system	DS	N/A	N/A	N/A		
EB-12	Hybrid solar and fossil fuel power system	4	-₱3,000,000		-₱3,000,000		
CH	**Create Height**						
CH-06	Operate with Flight Service Station (FSS) in lieu of control tower for 3C only	4	₱73,000,000		₱73,000,000		
CH-07	Investigate alternative elevator design/configuration (hydraulic piston - "lift")	DS	N/A	N/A	N/A		
CH-08	Integrate control tower structure with admin building	5	₱6,000,000		₱6,000,000		
RL	**Resist Load**						
RL-04	Use chopped scrap tires as base material	4	-₱37,275,000		-₱37,275,000		
HP	**House Passengers**						
HP-01	Design using local building materials (locally fabricated and locally sourced) to support local economy	DS	N/A	N/A	N/A		
HP-04	Design architectural theme/facade to suit local culture	DS	N/A	N/A	N/A		
HO	**House Operations**						
HO-02	Construct a pre-engineered building (PEB) for the Passenger Terminal Building (PTB) in lieu of traditional on-site construction	4	₱91,000,000		₱91,000,000		

VALUE STUDY
NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY
M'LANG AIRPORT DEVELOPMENT PROJECT

Idea No.	Idea Title	Score	Initial Cost Avoidance / (Cost Add)	O&M Avoidance / (Cost Add)	Total Life Cycle Cost Avoidance / (Cost Add)	Preliminary Decision: Accept or Reject*	Preliminary Decision Rationale*
AA	**Accommodate Aircraft**						
AA-12	Clear runway of stray animals and birds (to include mitigating measures)	DS	N/A	N/A	N/A		
EN	**Accommodate Aircraft**						
EN-10	Identify emergency bay area (an extended parallel taxiway)	4	-₱6,505,000		-₱6,505,000		
CF	**Control Flow**						
CF-02	Introduce bio-drainage	DS	N/A	N/A	N/A		
CF-03	Use permeable pavement to manage stormwater runoff at non-runway areas	4	-₱36,875,000		-₱36,875,000		
CA	**Control Access**						
CA-12	Key card access doors to secured areas	4	-₱554,000		-₱554,000		
CA-16	Usage of QRcode in tickets for passenger entry to PTB	DS	N/A	N/A	N/A		
MR	**Manage Risks**						
MR-02	Government subsidy may be explored (review financial analysis)		N/A	N/A	N/A		
MS	**Miscellaneous**						
MS-01	Identify scope for Phase 1 to comply with Aerodrome Reference Code 3C and budget		₱144,168,000		₱144,168,000		
MS-02	Identify scope for Phase 2 to comply with Aerodrome Reference Code 4C and budget		₱357,788,000		₱357,788,000		
MS-16	Conduct additional geotechnical investigation		-₱100,000		-₱100,000		

**Preliminary Decision and Preliminary Decision Rationale are shown empty in the Draft Report*

Implementation Phase checklist

The following checklist is provided for those leading the VM study as well as those managing a VM program; it serves as an aid to ensure that consistency and completeness is maintained for a VM program.

✓	**Task / Activity, if applicable**	**Comment(s)**
	Review and assess VM proposals	
	Resolve VM proposals	
	Develop Implementation Plan	
	Track and audit results	

APPENDIX

J

VM Handbook Resources

The following references were consulted and used as a basis for the updated VM Handbook:

- **VM Guide: A Guide to the Value Methodology Body of Knowledge (July 1, 2020), SAVE International**
- **Value Study Report Guide (December 14, 2020), U.S. Army Corps of Engineers**
- **Value Study Guide, U.S. Army Corps of Engineers**
- **Value Methodology Fundamentals 1 (September 2020), RHA LLC**
- **Value Engineering Theory, Donald E. Parker, 1998**
- **Function Analysis Guide A Supplement to the SAVE Body of Knowledge (May 17, 2016), SAVE International & Miles Value Foundation**