

Function-Based Design® – An Integrated Value Engineering Approach

Abstract

Value management has been successful for years, but we seem to struggle year after year to grow the industry the way many of know it should. We continue to promote that the value methodology can provide benefits throughout the delivery process of a project or program. However, what we find is that most organizations apply the methodology much later in a project, usually around 30% design, if we are lucky, but often as late as 60%. What ends up happening is that we move along down the project development path, only to stop, do a workshop, and then go back, make changes, and then continue forward. Many Project Managers want to avoid using the methodology because it impacts their delivery schedule in a negative way. Might this approach be part of our challenges with getting organizations to better embrace the value management process? What if.....we integrated the VE job plan throughout the delivery process!

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Function-Based Design® – An Integrated Value Engineering Approach

Let's begin at the beginning...How does your organization define value? To help continue to support the notion that value engineering is not cost cutting, an organization must understand what is important to them. Value can be defined differently, organization to organization, project by project, program by program and even project manager to project manager. Value might be defined in the following manner:

- Meet Performance
- Meet Function
- Reduce Impact
- Improve Processes
- Reduce Schedule
- Reduce Operations & Maintenance
- Improve Efficiencies
- And others!



Once an organization understands the definition of value, it is important to ensure that management and staff understand the importance of value. Organizations continually strive to make improvements as discussed above, and meeting established values may lead to:

- Meeting organizational/personal/professional goals
- Providing better customer service/satisfaction
- Providing more improvements
- Providing less impacts
- Being fiscally responsible

- Learning new possibilities and innovations
- Better problem solving
- Doing more with less
- Achieving performance measures

Now that we have a better understanding of value, the next question is, how do we integrate value into the way we do business. There are a number of ways; this includes using formal management tools, including value engineering/analysis and risk analysis – understand the tools available to you and don't be afraid to use them. We must begin to make value an integral part of each organization; look for opportunities to apply the tools; and make value an integral part of the way we work, not just at a formal workshop. As an example, we run into problems in our everyday lives both professionally and personally; problems such as budget short-falls, schedule delays, resource constraints, new requirements, unforeseen conflicts, problems, and shifting priorities. We should use the value process to help us through many of these challenges.

Our organizations, programs and projects are constantly bombarded with problems in need of solving, throughout all phases of development. So why should we wait until we've got much of the design completed before we ask the question, "How else might we do this" or "How do I solve the challenges identified"? Why not integrate the value methodology into project delivery as we go along, based on function and performance. If we focus our outcomes based on performance/function it will help us to:

- Build consensus among project stakeholders,
- Develop a better understanding of project goals and objectives,
- Develop a baseline understanding of how the project is meeting the performance goals and objectives, also referred to as Purpose and Need,
- Identify areas where project performance can be improved,
- Develop a better understanding of an alternative concept's effect on project performance,
- Develop a deeper understanding of the relationship between performance and cost, and
- Use value as the basis for selecting the best approach or solution.



So, if we are going to focus on Function-Based Design®, we must first understand FUNCTION. Function is defined as the original intent or purpose that a product or service is expected to perform, expressed in two words, an active verb and a measurable noun. As we all know, Function-Based Benefits allow for a better understanding, describes needs in the simplest of terms, allows an understanding of function to cost and allows us to map out our functions. So if we take it one step further and focus on Function-Based Design®, we can expect the following:

- Ensures that the project meet the established criteria
- Ensures that the project focus is on "what" must the project accomplish, to establish an appropriate scope that meets purpose and need

- Ensures that the appropriate functions/performance attributes have been used as the basis for design
- Ensures management and stakeholders’ needs have been met versus “wants”, which can help to manage project budgets and schedules
- Ensures that projects will be scoped appropriately, including realistic budgets and schedules
- Designs value into the project (integration)
- Helps the entire project team focus on innovations and value enhancements
- Provides for a more cost effective design that truly meets the intended functions
- Integrates risk assessments into the project


The integration of value management into the way we do business can be done through each phase of a project, not just at one specific phase. The value methodology has always been promoted as something to be used throughout the development life of a project. However, what has seemed to occur is that we do it, because we have to, and at a specific phase of a project, and we often only do it once. Let’s take a step back and try and look at value engineering in a more holistic manner. Let’s begin to “integrate” the process into the way we do business, actually design value into the project as we go along. If we can begin to get management and project managers to make this a part of the Project Development Programs or Project Management Plans, then it becomes more of a “way of doing business”, not an afterthought.

Be aware, that this process could begin at any one of the phases, but what is represented here is what might occur at each phase, if we begin at the beginning. Depending on where the process begins, may determine the level of effort for each step in the job plan. As an example, if you begin at a later stage and Function Analysis was not complete, you would add that into that particular phase of the project. I would propose that this integration would look something like the following:

Preliminary Design

In the preliminary phases of a project there is very little information and the focus is much more of a planning level to help determine the actual scope of work. Function-Based Design® would use a couple of the steps in the six step job plan by doing the following:

Information Phase – Establish the overall project goals and constraints. Basically understand what the drivers are for the project or program. Establish performance attributes to know “How the Project Must Perform” to define success.

PERFORMANCE CRITERIA MATRIX												
											TOTAL	%
		A										#DIV/0!
			B									#DIV/0!
				C								#DIV/0!
					D							#DIV/0!

Perform a very preliminary risk assessment to help to determine impacts to budget and schedule and potential impacts.

Function Analysis Phase – Brainstorm functions as a way to develop the project’s Purpose and Need and develop the scope of the project.

Environmental

Information Phase – This phase of a project may be a stand-alone phase in a project. If so, develop performance attributes to understand “Environmental Success”. These might be different from the overall performance attributes of a project. Usually environmental would be a performance attribute related to a project, but there may be separate performance attributes that are specifically related to environmental success. This might include; cultural, biological, historical, etc.

Creative Phase – Use the creative phase to help to develop alternatives for mitigating environmental impacts or even to evaluate various alternatives for the overall project.

Evaluation Phase – Develop an evaluation matrix using the performance attributes to aid in the selection of final environmental options to be included in the environmental document. Be aware that decisions cannot be made in this phase until all of the environmental requirements are met, including public input. This should become a part of the evaluation criteria to help to make final decisions.

Development Phase – This would merely be the normal process of developing the required environmental documentation, whether it be a FONSI (Finding of No Significant Impact), EA (Environmental Assessment) or full blown EIR (Environmental Impact Report).

Design Process

30% Design

Information Phase – Review the established Performance Attributes, as developed in an early project stage, to ensure that the project Purpose and Need has been maintained. What we have often seen in public projects is that the Purpose and Need or scope, begins to change or creep, which will lead to increased project cost and often extends the schedule, both which are not beneficial to the project.

Update the risk register to further identify, rate and rank additional risks while using the creative phase to develop a mitigation plan for each of the identified risks, as described below.

Probability of Occurrence	Highly Likely > 70%	Likely 51 - 70%	Possible 21 - 50%	Unlikely 5 - 20%	Very unlikely < 5%	MATRIX KEY			
Severity of Impact	Catastrophic 100	Substantial 50	Moderate 20	Marginal 5	Negligible 1				
Risk Rating	Extremely High Red (80 - 500)		High Orange (15 - 49)	Moderate Yellow (3 - 14)	Low 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 Impact %	Severity of Impact (numeric)	Risk Rating	\$\$ Impact	Schedule Impact	Avoid? Mitigate? Accept?	Plan of action and risk champion/owner.
1.0					0.0				
2.0					0.0				
3.0					0.0				
4.0					0.0				

Function Analysis Phase - Assuming that the previous steps have used the integrated approach, now is the time to review and update the Function Analysis step in the job plan. We should have additional information and increased understanding of all of the required project elements. This ensures that the scope of the project is completely understood before we get too far along in the project or program.

Creative Phase – Use creativity throughout the design process to brainstorm approaches to the design and to mitigate identified risks to ensure function/performance requirements are met.

Formal VE Workshop – This is a great opportunity to do a formal workshop with either the existing design team, with a few extra subject matter experts, or if so desired by the client, an outside, 3rd party team to evaluate the 30% design. However, if the integrated approach has been used, there may not be a need for a formal workshop.

60% Design

Information Phase – It is important to ensure that the previous phases have been integrated appropriately into the project. Now is the time to confirm that the enhancements identified in the 30% phase were integrated into the design. Confirm that the performance attributes should remain as previously established and ensure that these have been addressed and that the Purpose and Need for the project have stayed consistent. Again, it is time to review and update the risk register. Those risks that have been mitigated can be retired in the risk register, and additional risks should be identified, rated and ranked and a mitigation plan developed.

Creative Phase – The project management team should identify any new project challenges/problems and brainstorm any new alternatives and/or approaches along with brainstorming mitigation for newly identified risks.

Evaluation Phase – The previously established performance attributes should be used to evaluate new opportunities to decide which alternatives should be moved into the next phase of design. It is important to use the existing performance attributes to ensure consistency in decision-making is maintained throughout the project.

Development Phase – Integrate the new value enhancements into the next phase of the design.

Implementation Phase – It is now important to begin to report to management and provide an “audit” report on the project and how the Function-Based Design® approach and the value enhancements have positively impacted the project. This is a key opportunity to gain management’s support of the process.

90% Design

Information Phase – This again is an opportunity to confirm that the value enhancements identified during the 60% phase of design, have been integrated into the 90% design. Also to confirm that the performance attributes have been addressed adequately and that the Purpose and Need of the project have remained consistent. The risk register should be reviewed, many of the risks should have been retired or those that have been accepted, have been addressed in the plans and specifications. The importance of this step is to help to reduce the opportunity for potential claims during construction. One last update should be accomplished to ensure that any additional risks have been identified and provide one more opportunity for mitigation.

Creative Phase – If any additional risks have been identified or any other challenges, this should be an opportunity for one last look at improving the project.

Evaluation Phase – Any additional ideas should be evaluated using the performance attributes, as in previous project phases.

Development Phase – Integrate the new value enhancements into the final phase of the design.

Implementation Phase – Provide an “audit” report to management on the entire process to identify and promote the Integrated Function-Based Design® approach.

Design Phase Completion

There should be a final close out of the process. A final audit report should be provided to management that identifies:

- Total risk avoidance and mitigation efforts
- Value enhancements integrated into the project
- Final risk database update and then transfer the risk register to construction

Construction

Although the Function-Based Design® approach is completed at this point in the project, it is important to continue our approach to “value” enhancements with the construction team. Through value engineering change proposals (VECP), it is important to ask our “partners”, the contractors, to continue the project’s value journey. This should include discussions of value enhancements that might be considered from the contractor’s perspective.

Additionally, there should be a discussion of risk, by reviewing the risk register that was used throughout the Function-Based Design® process and adding any potential risks that have been identified by the contractor. We have to realize that contractors often see risk very differently from owners and the design team. Although the project has already been bid, this is a great opportunity to identify any other potential risks and then have time to mitigate them early in construction.

Key Roles and Responsibilities in Function-Based Design®

Champion/VE Coordinator

A Champion of value management should be identified to help the Project Managers to integrate value management into their projects. This would include tracking the various audit reports and ensuring management is provided with the appropriate reports and ensuring program goals established for the VE program are being met and that processes are being integrated into projects. The Champion should be properly trained in the value methodology to be familiar with various tools and SAVE International© job plan. This would include a 40-hour Module I course as approved by SAVE International©.

Project Manager

A Project Manager should be responsible for including the various integration pieces into their individual project management plan and included in the project schedule and budget as appropriate. Project Managers should be trained in the value methodology to adequately lead their Project Development Team (PDT) through the various steps of the SAVE International© job plan throughout the design process. This would include a 40-hour Module I course. This should include both internal and external (consultant) Project Managers.

Management

Management should establish value enhancement goals to be met for their program and for each project. Management should request the formal audits and be provided with the audit report. It is important that management be a strong supporter of the Function-Based Design® approach and provide appropriate training for their staff. It is management’s role to share the audit reports to upper management to help show the benefits and success of the value management integration efforts. This will continue to perpetuate the success of the organization as well as innovations, cost and schedule savings as well as other key performance attribute successes.

Implementation

Training

Module I Course – Provide a Module I certification course to Champion and Project Management staff and others as deemed appropriate.

Introductory Courses - Provide a 1-3 hour introduction course to the Function-Based Design® approach, including the value methodology.

Risk Analysis - Introductory courses on risk analysis and complete the risk register.

Project Management Plan

Update the Project Management Plan to include the Function-Based Design® approach.

Roll-out

Aid in a formal roll-out of the Function-Based Design® approach including outreach to staff and consultants and contractors, as necessary.

Conclusion

This approach allows the value management industry to begin to help our owners/clients look at value in a different light. In lieu of what has become the norm for VE; stop the project, do a workshop, redesign changes and then continue on with design; we design value into the entire approach. We know that this is how design is supposed to progress, however, with the continued push to get projects completed in less time, we have less and less time to really focus on value enhancements and opportunities. We tend to focus on just getting the project out to construction. Remember that there must be appropriate training and a formal roll-out of the program to ensure success. Let's take a deep breath and allow our teams to truly excel and succeed by embracing an overall approach to Value Management.