

About Function Analysis

Function analysis is the distinguishing technique that sets the Value Methodology (VM) apart from all other project and process improvement methods. It is defined as “a detailed examination of a project . . . to identify, classify, and organize its functions; allocate . . . resources; and prioritize functions for value improvement.”¹

Its goal is to **identify elements of the project with the greatest opportunity to improve value**. Objectives include developing a consensus as to the scope of the project and better understanding what it must do to meet customer needs. Aspects are analyzed relative to the functions, such as cost, schedule considerations, and risks associated with the various aspects of what the project must do.

BCI’s Application of Function Analysis

1. Define Functions

- a) **Identify Functions.** The VM team considers the scope of the project and its need, purpose, and objectives while randomly identifying the functions the project must perform. Functions are expressed as abstract verb-noun phrases that describe what elements of the project do.
- b) **Classify Functions.** Functions are classified as either basic, secondary, higher-order, lower-order, project design objectives, one-time, all-the-time, or unwanted.
- c) **Organize Functions.** Functions are arranged into a Function Analysis System Technique (FAST) Diagram, based on their classifications and “How-Why” relationships to one another.

2. Allocate Resources

Based on the cost model prepared using the latest project estimate available, the Pareto Principle is applied to identify functions with a high associated cost.

3. Prioritize Functions

Functions with the best opportunity for value improvement are identified. The functions that are correlated with any one or combination of the following are prioritized for brainstorming to identify alternative ways to perform them.

- a) Objectives for the VM Study
- b) Performance (Quality)
- c) Cost
- d) Schedule
- e) Risk

¹ “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.” VM Guide, A Guide to the Value Methodology Body of Knowledge, ©2020 SAVE International®, p. 150

Function Identification and Classification

A function is a nonspecific, two-word abstraction, consisting of a verb and a noun, that describes what an element of a project does.²

- The verb answers the question, “What does it do?”
- The noun answers the question, “What does it do it to?”

While the ideal function uses just two words, sometimes a two-word noun is needed for clarification purposes, resulting in a three-word function.

Function Classifications³

Higher-Order Function (HO)

The specific goals or needs that the basic function(s) fulfills and are beyond the scope of the VM study subject. *A result of the subject of the study.*

Basic Function (B)

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.

Secondary Function (S)

A function that supports the basic function(s) and results from the approach to achieve the purpose of the project, product, process, service, or organization. *Secondary functions can either fall on the horizontal “How-Why” function logic path of the FAST Diagram or they may occur at the same time as another secondary function or be caused by it and be connected vertically in an expression of “When.”*

Lower-Order Function (LO)

Functions that are not part of the scope of the VM study [*subject*] and are inputs for a project, product, process, service, or organization. *A function that initiates the subject. It may be expressed as an activity.*

Project Design Objective (DO)

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

One-Time Function (OT)

A function that occurs only once relative to the project, product, process, service, or organization.

² VM Guide, A Guide to the Value Methodology Body of Knowledge, ©2020 SAVE International®, p. 54

³ VM Guide, A Guide to the Value Methodology Body of Knowledge, ©2020 SAVE International®, p. 54, *annotations indicated in italics*

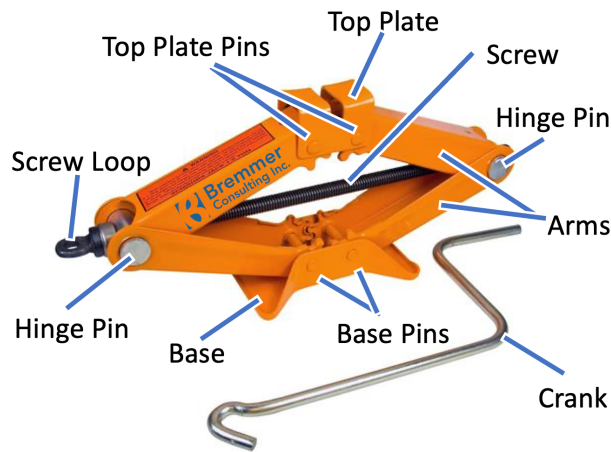
All-the-Time Function (ATT)

Functions that happen continuously or occur in a repetitive, ongoing basis, relative to the project, product, process, service, or organization.

Unwanted Function (U)

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

Scissor Car Jack



Component	Function	Classification
Arms	Support Load Elevate Top Plate	Secondary Secondary
Base	Stabilize Jack	Secondary
Coating	Protect Metal	All-the-Time
Crank	Transmit Force Rotate Screw Loop	Secondary Secondary
Hinge Pins, Top Plate Pins, and Base Pins	Rotate Arms	Secondary
Screw	Rotate Arms Elevate Top Plate	Secondary Secondary
Screw Loop	Connect Crank Rotate Screw	Secondary Secondary
Top Plate	Contact Vehicle Frame	Secondary
The Whole Jack	Transfer Load Elevate Vehicle Frame Separate Surfaces Simplify Operation	Basic Secondary Secondary Subject Objective

Component	Function	Classification
The Need/Outcome Fulfilled by the Jack	Remove Wheel	Higher-Order
	Replace Wheel	Higher-Order
User	Apply Force	Lower-Order

Functions vs. Activities

Functions are intended to be abstract—broad enough to foster innovative ways to perform them. An activity is “a specific task, action, or operation that describes how a function is performed . . . Activities are a means leading to the attainment of a function.”⁴

For example, “crank screw loop” is a means of performing the function “rotate screw loop” and “transmit force.” **The problem when activities are used as functions is that they are so specific that the function limits itself to itself.** For example, an alternative way to “rotate screw loop” or “transmit force” might be to use a motor, rather than manually crank it. “Crank screw loop” would limit the function to using a crank.

Another example would be the basic function of a pump: “convey liquid.” An alternative way to convey liquid might be to use gravity flow instead of a pump. “Pump liquid” limits the function to a pump.

The Certified Value Specialist (CVS) facilitator is a subject matter expert (SME) who guides the VM team in articulating functions as they are identified.

Scope

Among the functions listed on the previous page, another issue arises: “apply force” is an action of the user, rather than a function of the scissor car jack. In addition “remove wheel” and “replace wheel” are made possible by the jack, but are not functions performed by the jack, itself. These functions are outside the scope of the scissor car jack and, therefore, outside the scope of the VM study.

Function Organization via FAST Diagram

Function Analysis System Technique (FAST) is a group process that creates a diagrammatic representation of the “how-why” logic of functions, and their relationships.⁵ A FAST diagram arranges the functions of the subject of the VM study into logical relationships, such that when read from left to right or right to left, the functions answer the following questions:

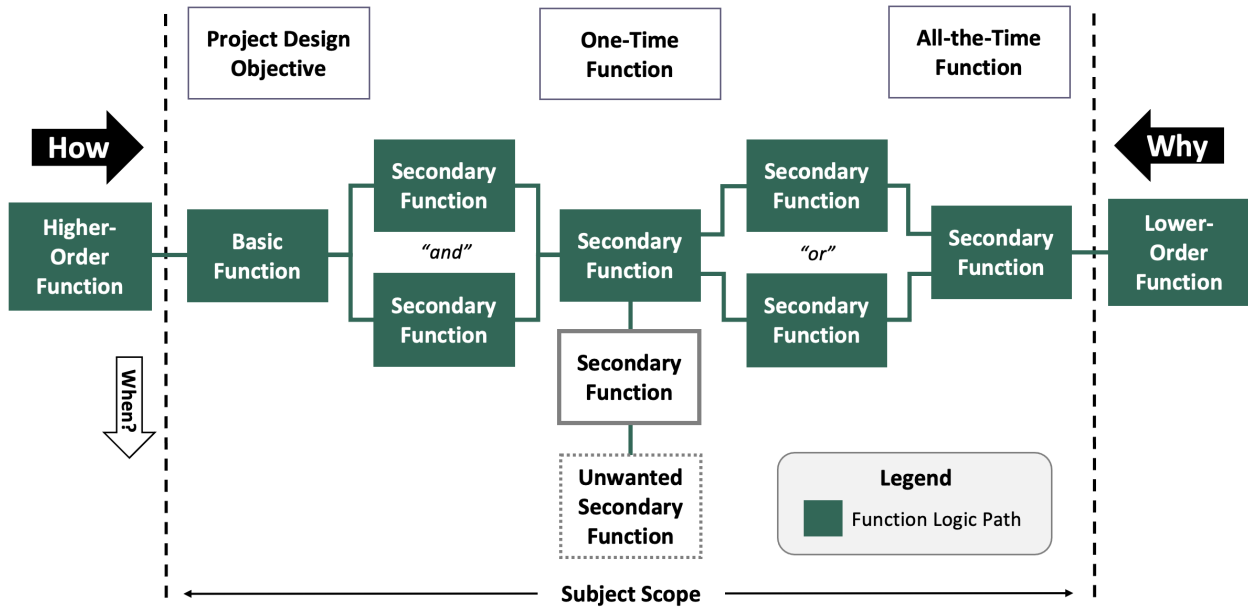
- **How:** “How does it (function)...?” is answered “...by (function to the right of that function)”
- **Why:** “Why does it (function)?” is answered “...to (function to the left of that function)”

⁴ VM Guide, A Guide to the Value Methodology Body of Knowledge, ©2020 SAVE International®, p. 54

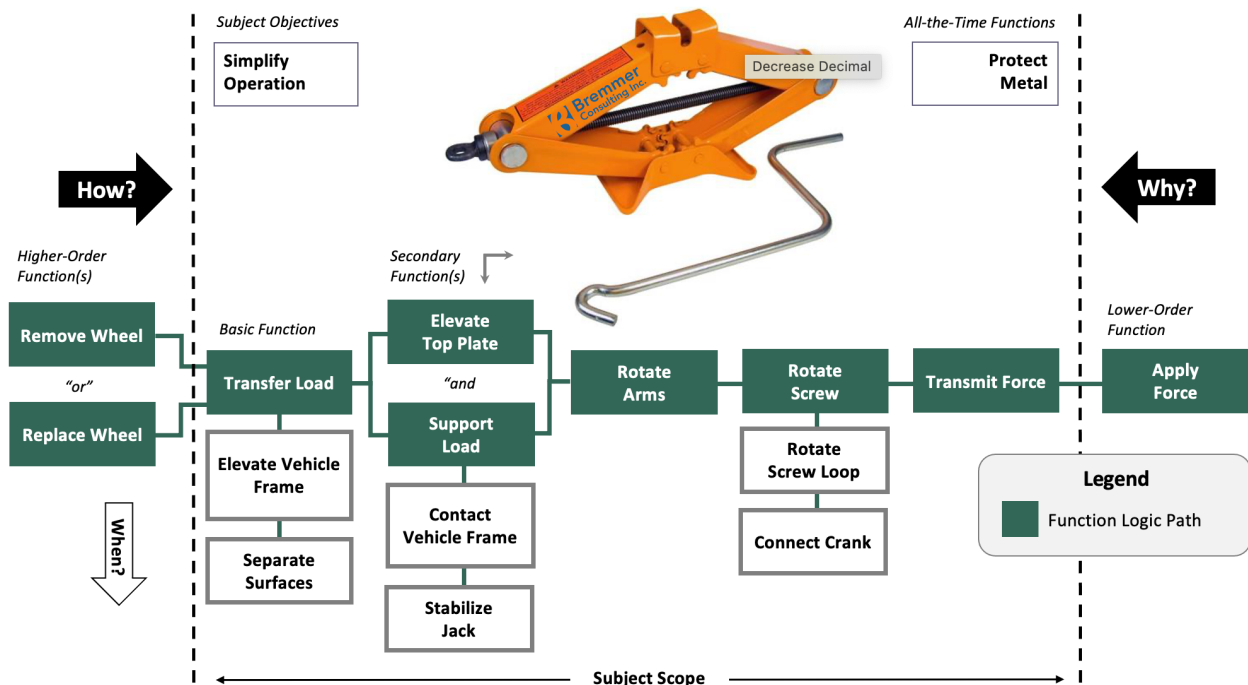
⁵ VM Guide, A Guide to the Value Methodology Body of Knowledge, ©2020 SAVE International®, p. 54

All functions to the right of the basic function are *supporting functions* that make the basic function possible. They are connected horizontally along the function logic path. Functions that happen **When** another function occurs or are caused by another function are connected vertically to that function.

Generic FAST Diagram



Scissor Car Jack FAST Diagram



Why Organize Functions Into a FAST Diagram?

FAST diagramming further develops the VE team’s understanding of the project—how the functions relate to and support each other. It also helps identify redundant, non-essential, and missing functions, aiding in identifying the functions with the greatest opportunity for value improvement.

Resource (Cost), Schedule, and Risk Allocation to Functions

The FAST diagram developed for a VM study includes a correlation of high-cost, schedule-sensitive, and high-risk elements to the functions.

Cost

During the Information Phase, the project cost estimate is used to develop a cost model. The Pareto Principle is applied to identify the majority of the resources—roughly 80% of the project cost—that will be expended on 20% of its elements/components.

While a typical VM Study scope may have 80% of the costs found in roughly 20%–50% of the elements/components, it still identifies cost areas to target for value improvement—especially if they seem unusually high relative to the project scope.

In the case of the scissor car jack Pareto analysis on the following page, 80% of the cost is found in 29% of the components: the functions of the arms, screw, and screw loop would be targeted as areas of significant cost.

Schedule

The screw and screw loop have supply chain issues, representing schedule-related concerns.

Risk

The risks associated with the scissor car jack are high if the jack tips over or the contact between the vehicle frame and top plate fails, either resulting in the vehicle crashing to the ground. The risk is medium if the user loses control of the crank.

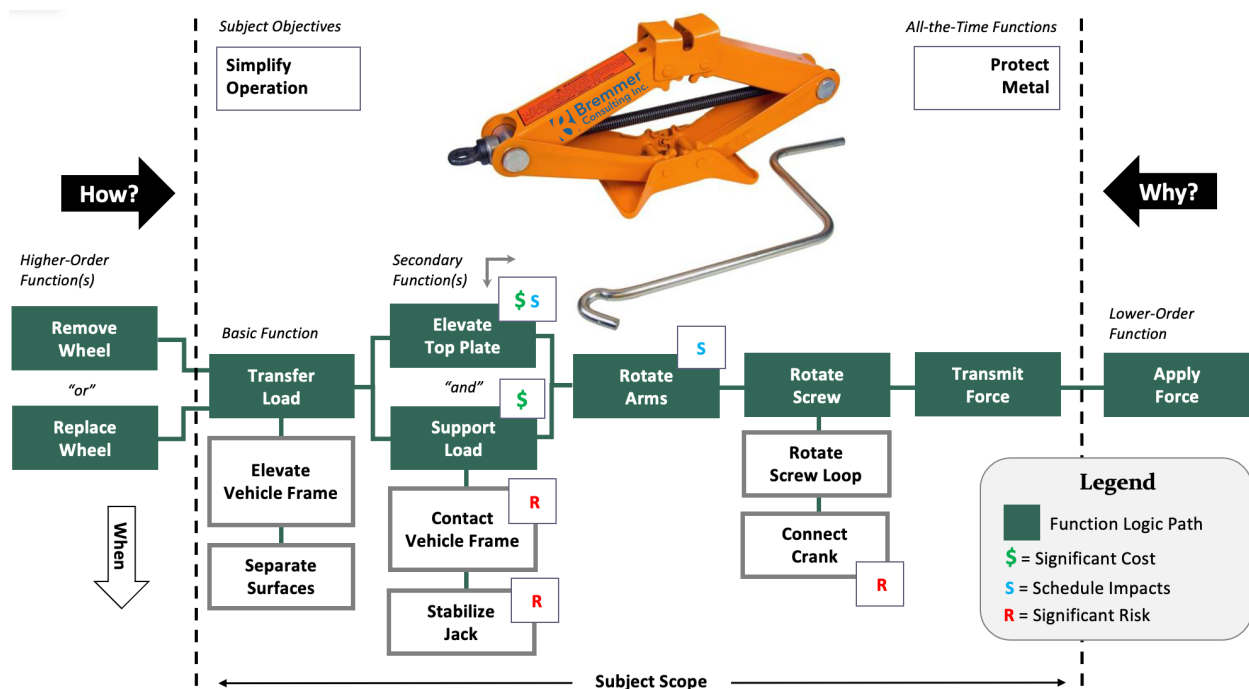
#	Component	Function	Percent of Cost	Schedule (Procurement)	Risk
1	Arms	Support Load Elevate Top Plate	52%		
2	Screw and Screw Loop	Rotate Arms Elevate Top Plate	28%	Supply Chain Issues	
3	Crank	Transmit Force Rotate Screw Loop	9%		Medium
4	Base	Stabilize Jack	7%		High
5	Pins	Rotate Arms	2%		

#	Component	Function	Percent of Cost	Schedule (Procurement)	Risk
6	Top Plate	Contact Vehicle Frame	1%		High
7	Coating	Protect Metal	1%		
Not Applicable	The Whole Jack	Elevate Vehicle Frame Simplify Operation	Not Applicable		
Not Applicable	The Need/Outcome Fulfilled	Remove Wheel Replace Wheel	Not Applicable		
Not Applicable	User	Apply Force	Not Applicable		

Functions Prioritized for Creativity Phase Brainstorming

Functions are prioritized for brainstorming based on factors including VM study objectives, associated cost, schedule considerations, and high associated risk. **Identifying functions that are associated with any combination of these helps focus the brainstorming phase on the functions with the highest opportunity for value improvement.**

Scissor Car Jack FAST Diagram With Cost, Schedule, and Risk Allocated to Functions



Because the step of allocating cost, schedule, and risk to functions needs to be done quickly and there is rarely time to dissect a project cost estimate to allocate cost to functions, BCI chooses to streamline the process. This is done by leveraging the VM team's gut feel based on the project analysis that took place during the Information Phase.

In the case of the scissor car jack, the following functions would be prioritized for brainstorming, along with any others that relate to the objectives of the VM study, e.g., if the manufacturer wanted the VM team to look at ways to make the jack easier to use, i.e., "simplify operation."

- Connect Crank
- Contact Vehicle Frame
- Elevate Top Plate
- Rotate Arms
- Simplify Operation
- Stabilize Jack
- Support Load