

CLICK ON THE BOOKMARKS -THE SECOND ITEM FROM TOP ON THE LEFT SIDE THEN CLICK THE LINKS TO NAVIGATE

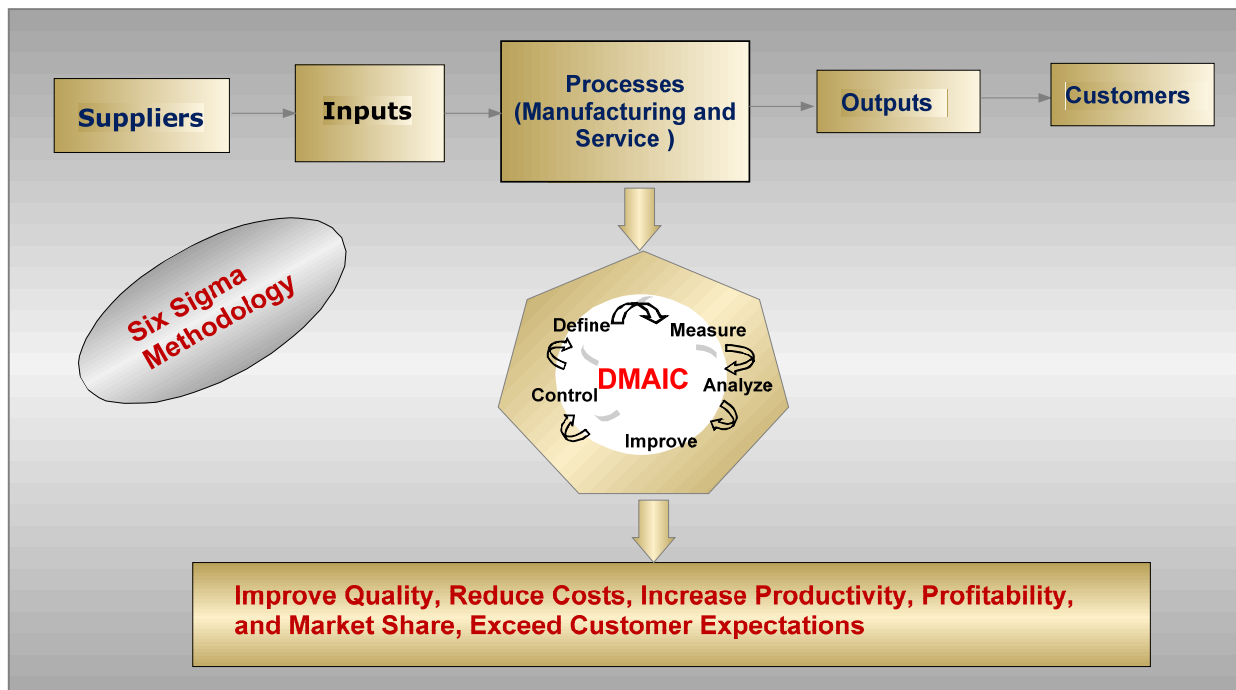
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## Six Sigma: DMAIC Process

All Six Sigma Projects follow a DMAIC Methodology Which Stands for

Define  
Measure  
Analyze  
Improve  
Control

The DMAIC process is shown below



### DMAIC Concepts

#### Six Sigma Define Phase

The purpose of the define phase is to

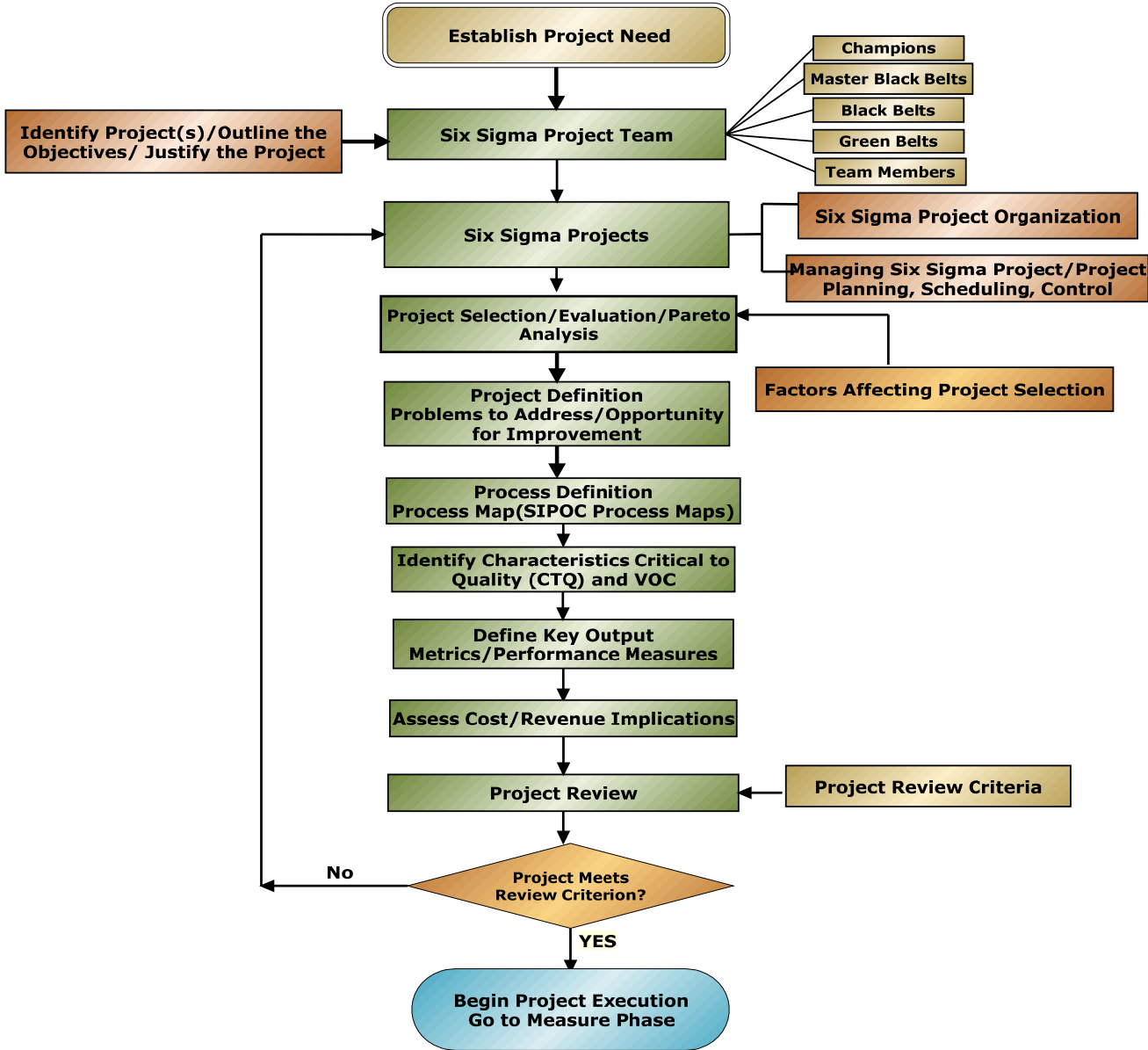
- identify and select projects (business case),

- define the problem clearly that identifies customer requirements and the characteristics those are critical to quality (CTQ) from customers' perspective,
- outline the objectives and measurable,
- justify the project,
- address the voice of customer (VOC),
- address the cost/revenue implications, and
- identify and define the improvement opportunities

The selection of project is performed under the direction and participation of the champion, master black belts, or black belts.

An Example of Define Phase: Flow Chart showing Activities

Six Sigma Define Phase



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## Six Sigma Measurement Phase

### OBJECTIVES of Six Sigma Measure Phase

- Understand the current process and performance
- Finalize CTQs and metrics related to project goals/objectives
- Identify the metrics/variables to be measured
- Define input and output variables and the relationship between them (use Cause-and-Effect diagram)
- Develop operational definitions for all measurements
- Identify data collection plan and procedures and design data collection forms
- Assess measurement systems
- Perform measurement system analysis
- Collect necessary data
- Validate data/ draw valid conclusions using appropriate statistical tools and methods
- Evaluate process capability/performance of metrics
- Identify key input and output variables

### Deliverables from the Measure Phase

- Input variables on which data are to be collected (or, x data to be collected)
- Operational definitions
- Data collection plan and procedure
- Data types and sampling
- Measurement system analysis
- Sigma level
- Process capability analysis

## Measurement Phase: Flow Chart showing Activities

### Six Sigma Measurement Phase



## Six Sigma Analysis Phase

In the analysis phase, the root causes of the problems are determined (What is wrong?)

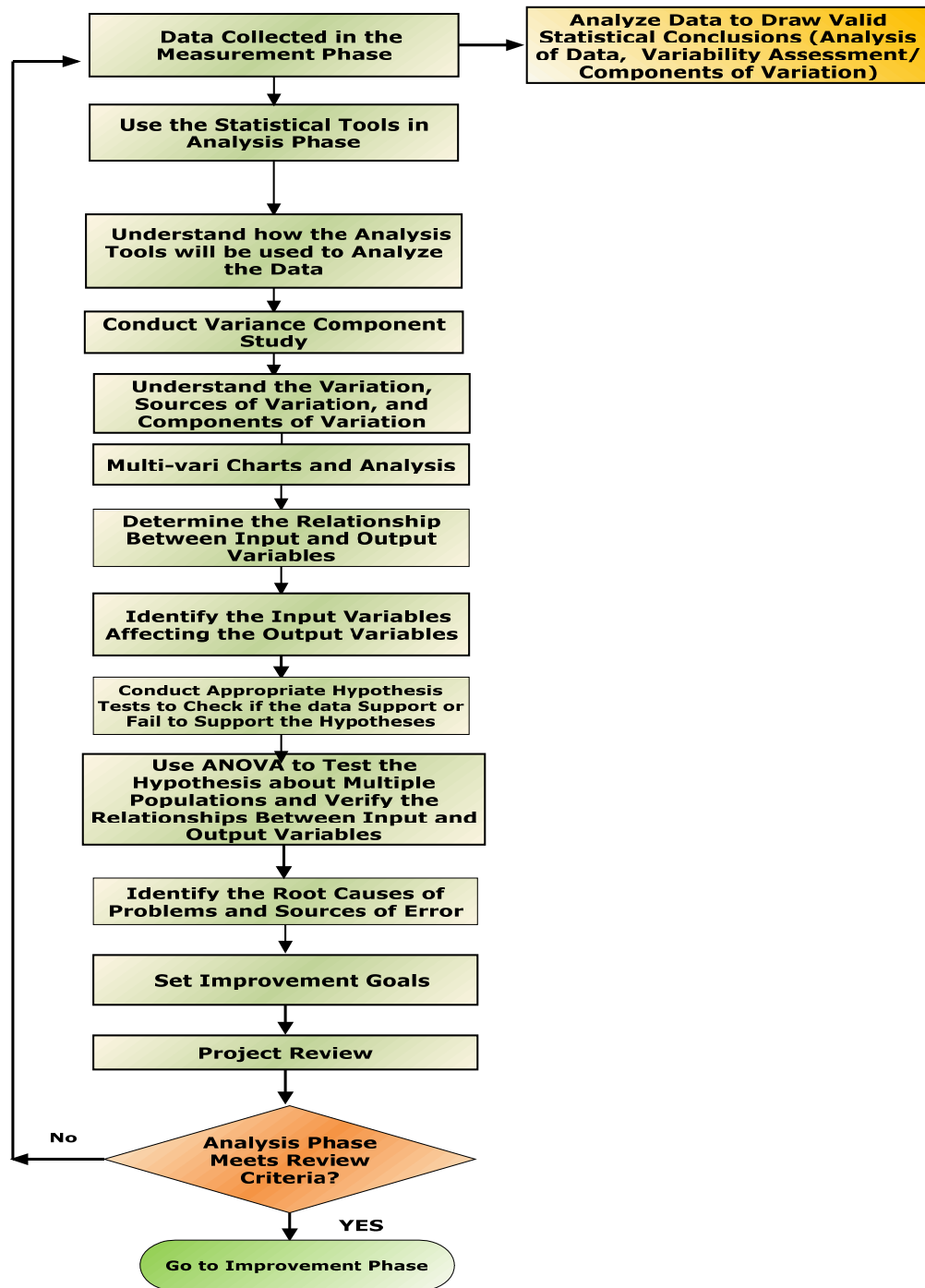
- This phase involves examining the processes and the data to understand the causes of the problems and opportunities for improvement
- The x and y data collected in the measurement phase are analyzed to understand the relationship between the response variable y and the input variables x using the relationship  $y=f(x)$
- The key deliverable from the analysis phase is *validated root causes*

### OBJECTIVES of Six Sigma Analysis Phase

- Understand the current process performance, and the data collected in the measure phase
- Understand the statistical tools to be used in the analysis phase
- Understand how the analysis tools will be used to analyze the data
- Understand the variation, sources of variation, and components of variation in the process
- Determine through analysis how the input variables influence the output variables
- Determine the key input variables that influence the output variables
- Analyze the data to determine whether they support or fail to support the hypothesis about magnitudes of certain population parameters (test the research hypotheses)
- Use the appropriate inference procedure tools (hypothesis tests) to draw appropriate conclusion about the mean, variance, standard deviation of selected variables
- Use the analysis of variance (ANOVA) techniques to analyze data taken from multiple populations
- Revise the process maps if necessary to make sure that the process maps represent the actual or desired flow of the process
- Study the process to identify the sources of errors, the root causes of the problems, bottlenecks, and non-value added activities (waste) from the process,
- Establish improvement goals

## Analysis Phase: Flow Chart showing Activities

### Six Sigma Analysis Phase



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## Six Sigma Improvement Phase

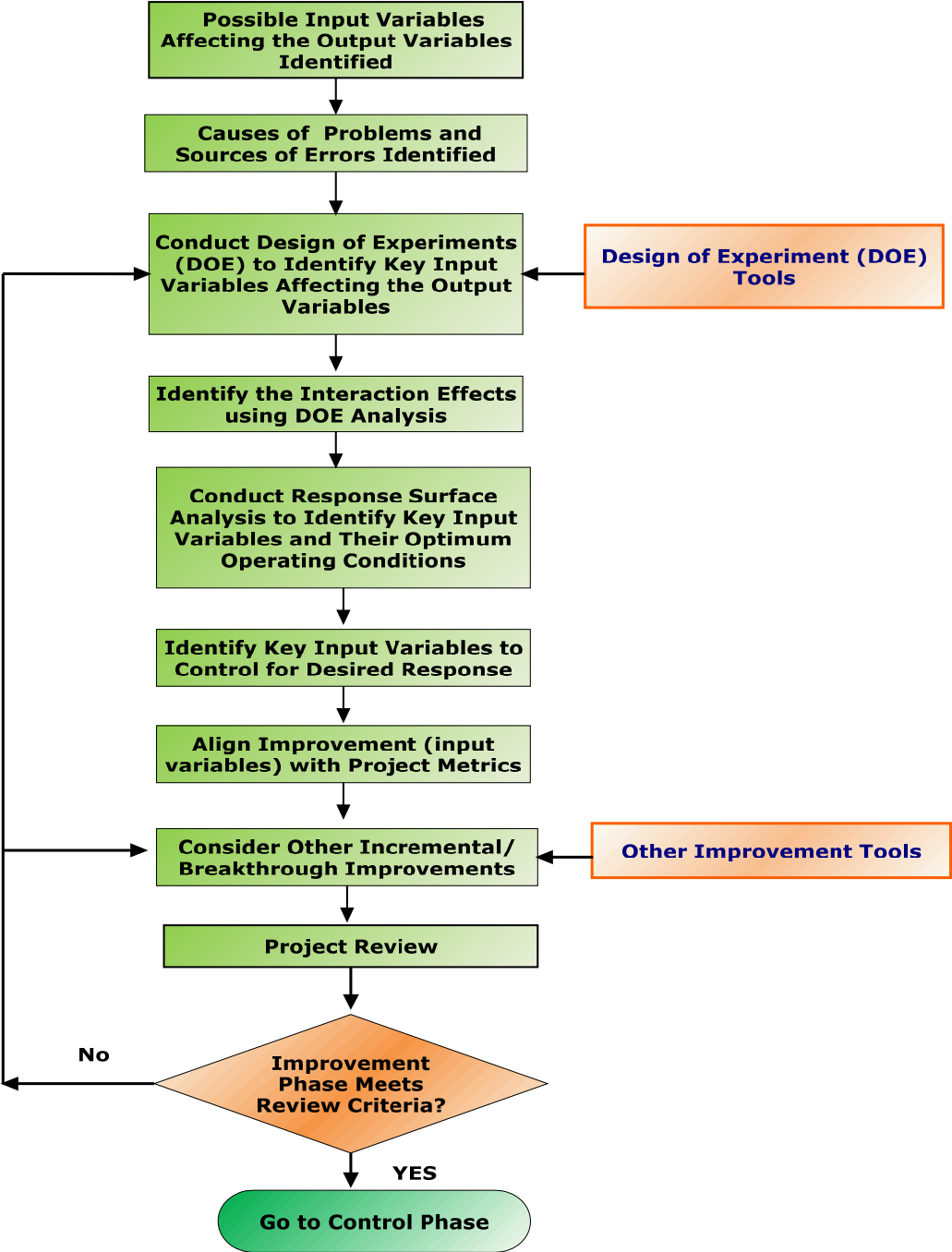
OBJECTIVES of Six Sigma Improvement Phase
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- Evaluate the process map
- Perform detailed analysis of the process map to identify the input variables affecting the response
- Determine possible causes of problems and sources of errors
- Conduct design of experiments (DOE) analysis to identify and confirm the key input variables
- Identify interaction effects using DOE,
- Conduct multi-vari study
- Conduct response surface analysis for key input variables and their optimum operating conditions
- Align the identified key input variables with the project metrics
- Apply other improvement tools (kaizen, cycle time reduction, value stream mapping, process re-engineering) for incremental and breakthrough improvement, Identify key input variables to control for desired response



Improvement Phase: Flow Chart showing Activities

Six Sigma Improvement Phase



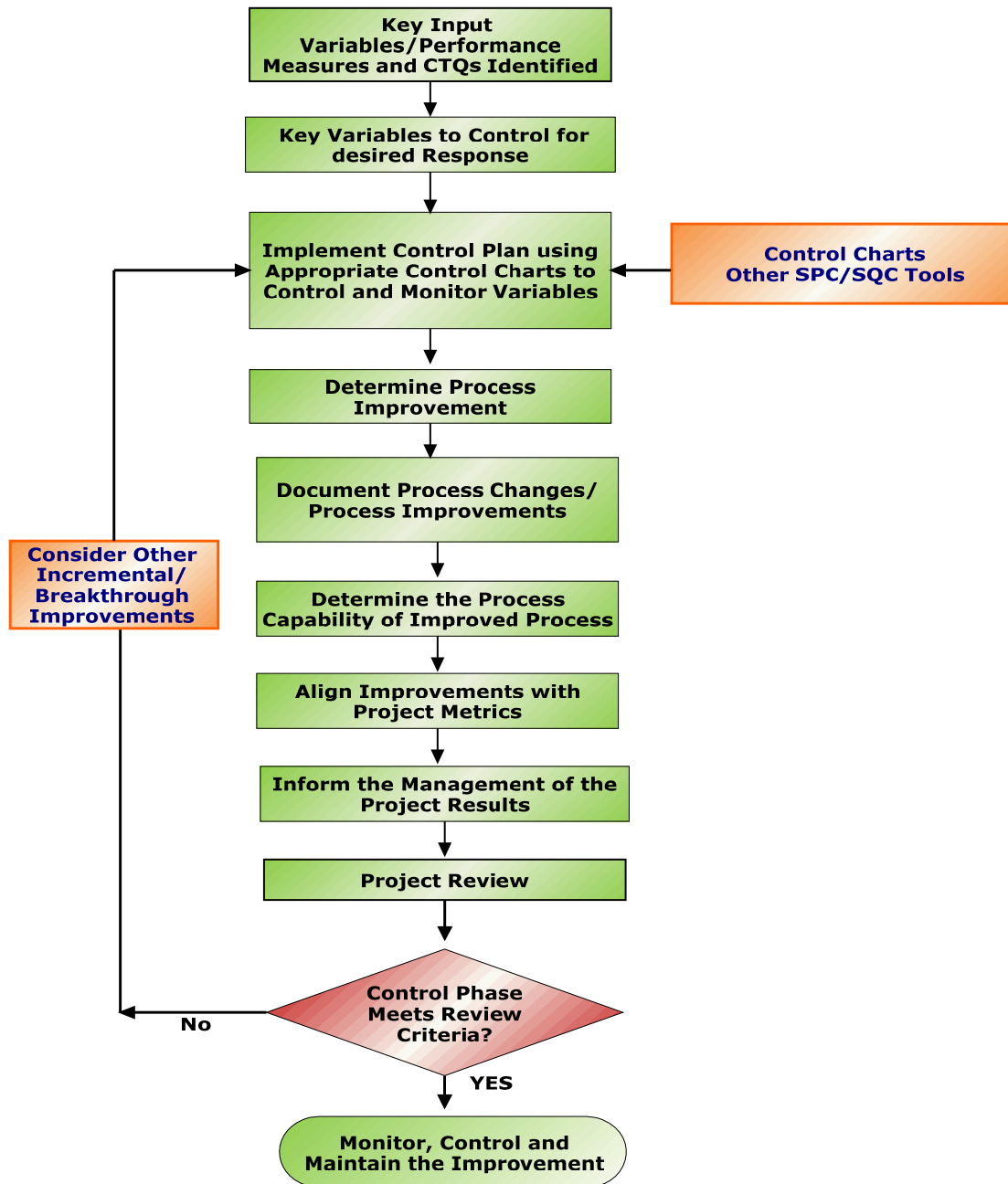
## Six Sigma Control Phase

OBJECTIVES of Six Sigma Control Phase
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- Impose control techniques on the critical factors or key performance measures and CTQs
- Implement control plans using appropriate control charts to control and monitor the key variables Determine the process capability of the improved process
- Sustain the project improvements by monitoring and controlling the key performance measures and CTQs
- Document the process changes
- Document the improved process,
- Identify the Statistical Process Control tools to monitor and control out-of-control conditions
- Inform the management of the project results
- Maintain the improvements

## Control Phase: Flow Chart showing Activities

### Six Sigma Control Phase



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