SIX SIGMA

DEFINITION

Six Sigma is a rigorous, focused, and highly effective implementation of proven quality principles and techniques. Incorporating elements from the work of many quality pioneers, Six Sigma aims for virtually error-free business performance

THE SIX SIGMA PHILOSOPHY

Six Sigma is the application of the scientific method to the design and operation of management systems and business processes which enable employees to deliver the greatest value to customers and owners. The scientific method works as follows:

- Observe some important aspects of the marketplace or your business.
- Develop a tentative explanation, or hypothesis, consistent with your observations.
- Based on your hypothesis, make predictions
- Test your predictions by conducting experiments or making further careful observations. Record your observations. Modify your hypothesis based on the new facts. If variation exists, use statistical tools to help you separate signal from noise.
- Repeat steps 3 and 4 until there are no discrepancies between the hypothesis and the results from experiments or observations.

D

DEFINE

- Launch Team
- Establish Charter
- Plan Project
- Gather the Voice of the Customer
- Plan for Change

M

MEASURE

- Document the Process
- Collect Baseline data
- Narrow project focus

A

ANALYZE

- Analyze Data
- Identify Root Cause
- Identify and Remove Wastes

I

IMPROVE

- Generate Solutions
- Evaluate Solutions
- Optimize Solutions
- Pilot
- Plan and implement

C

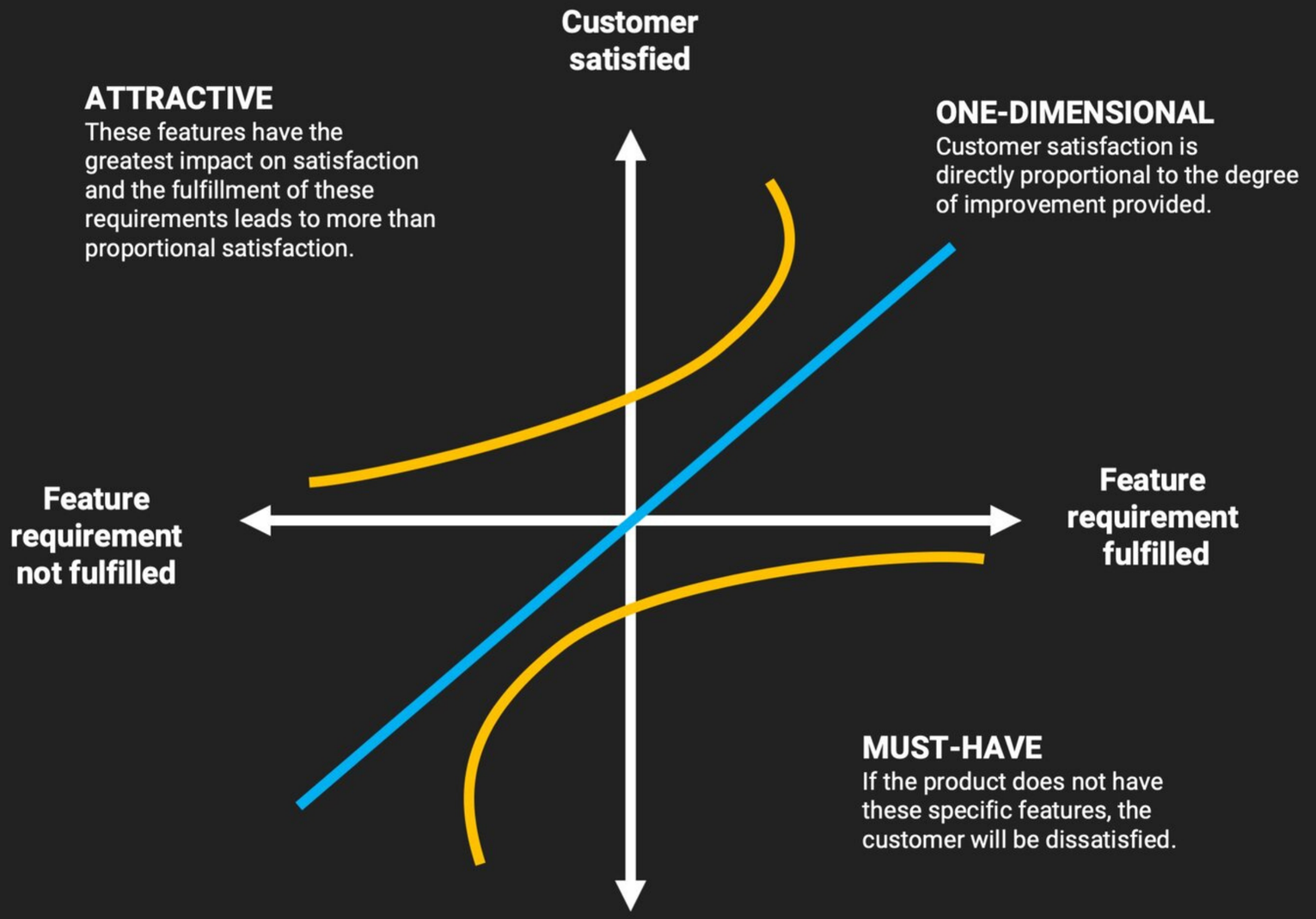
CONTROL

- Control the Process
- Validate project benefits

The purpose of Six Sigma methodology is to improve the quality or value of a product or service. Using the voice of the customer (VOC) as the foundation of a quality improvement project is essential to Six Sigma because the customer is the one who defines the quality and value of a product or service.

Obtaining valid customer input is a science itself. Market research firms use scientific methods such as critical incident analysis, focus groups, content analysis and surveys to identify the “voice of the customer.” Noritaki Kano developed the following model of the rela tionship between customer satisfaction and quality.

THE KANO MODEL



ATTRACTIVE
These features have the greatest impact on satisfaction and the fulfillment of these requirements leads to more than proportional satisfaction.

ONE-DIMENSIONAL
Customer satisfaction is directly proportional to the degree of improvement provided.

MUST-HAVE
If the product does not have these specific features, the customer will be dissatisfied.

The Kano model shows that there is a basic level of quality that customers assume the product will have. For example, all automobiles have windows and tires. If asked, customers don't even mention the basic quality items, they take them for granted. How ever, if this quality level isn't met the customer will be dissatisfied; note that the entire "Basic quality" curve lies in the lower half of the chart, representing dissatisfaction. However, providing basic quality isn't enough to create a satisfied customer. The "Expected quality" line represents those expectations which customers explic itly consider. For example, the length of time spent waiting in line at a checkout counter. The model shows that customers will be dissatisfied if their quality expectations are not met; satisfaction increases as more expectations are met. The "Exciting quality" curve lies entirely in the satisfaction region. This is the effect of innovation. Exciting quality represents unexpected quality items. The customer receives more than they expected. For example, Cadillac pioneered a system where the headlights stay on long enough for the owner to walk safely to the door. When first introduced, the feature excited people

Competitive pressure will constantly raise customer expectations. Today's exciting quality is tomorrow's basic quality. Firms that seek to lead the market must innovate constantly. Conversely, firms that seek to offer standard quality must constantly research customer expectations to determine the currently accepted quality levels. It is not enough to track competitors since expectations are influenced by outside factors as well. For example, the quality revolution in manufacturing has raised expectations for service quality as well.

Quality Function Deployment Once information about customer expectations has been obtained, techniques such as quality function deployment (QFD) can be used to link the voice of the customer directly to internal processes.

QFD is a customer-driven process for planning products and services. It starts with the voice of the customer, which becomes the basis for setting requirements. QFD matrices, sometimes called “the house of quality,” are graphical displays of the result of the planning process. QFD matrices vary a great deal and may show such things as competitive targets and process priorities. The matrices are created by interdepartmental teams, thus overcoming some of the barriers which exist in functionally organized systems.

QFD is also a system for the design of a product or service based on customer demands, a system that moves methodically from customer requirements to specifications for the product or service. QFD involves the entire company in the design and control activity. Finally, QFD provides documentation for the decision-making process. The QFD approach involves four distinct phases

- Organization phase: Management selects the product or service to be improved, the appropriate interdepartmental team, and defines the focus of the QFD study.
- Descriptive phase: The team defines the product or service from several different directions such as customer demands, functions, parts, reliability, cost, and so on.
- Breakthrough phase: The team selects areas for improvement and finds ways to make them better through new technology, new concepts, better reliability, cost reduction, etc., and monitors the bottleneck process.
- Implementation phase: The team defines the new product and how it will be manufactured.

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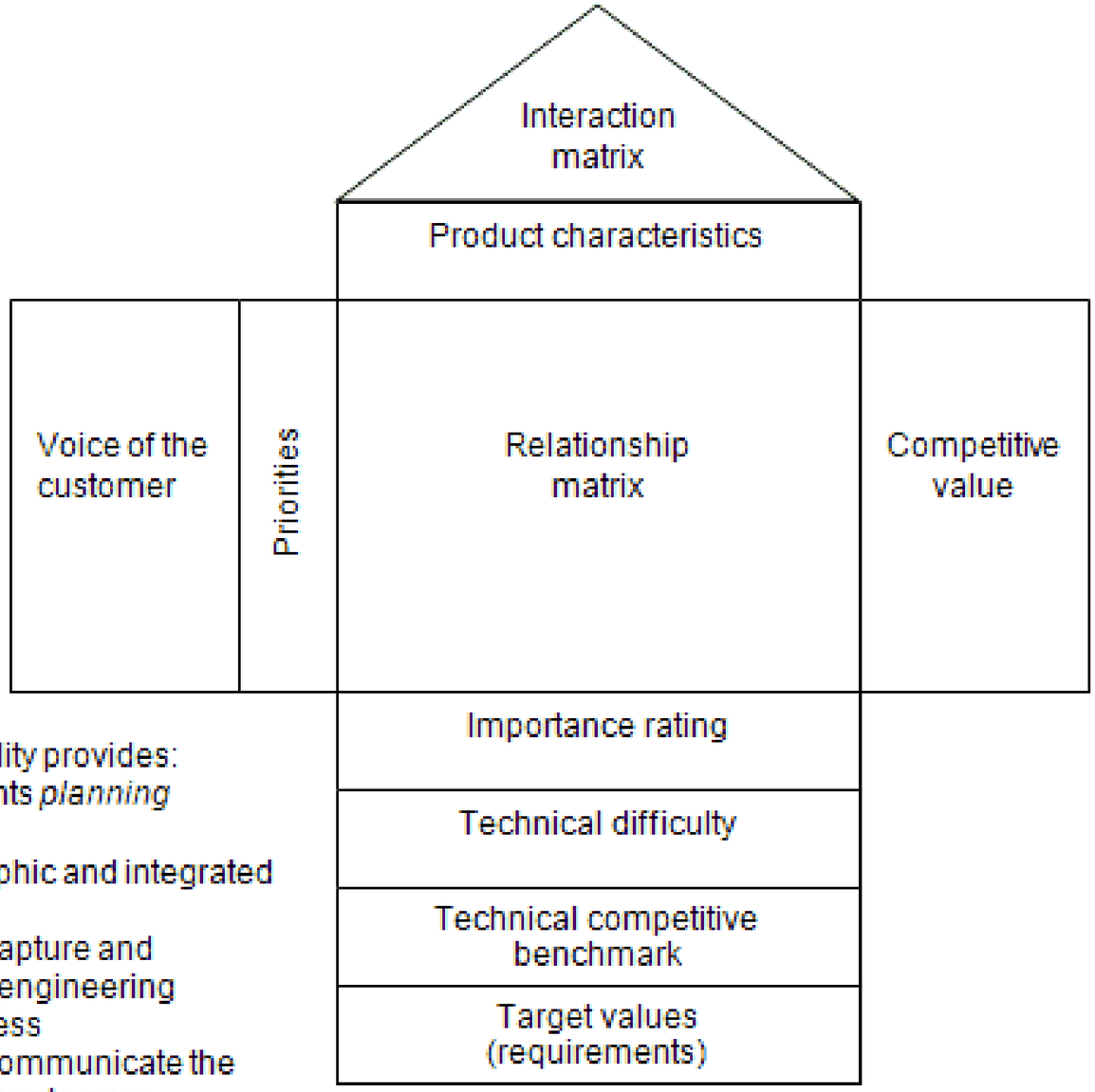
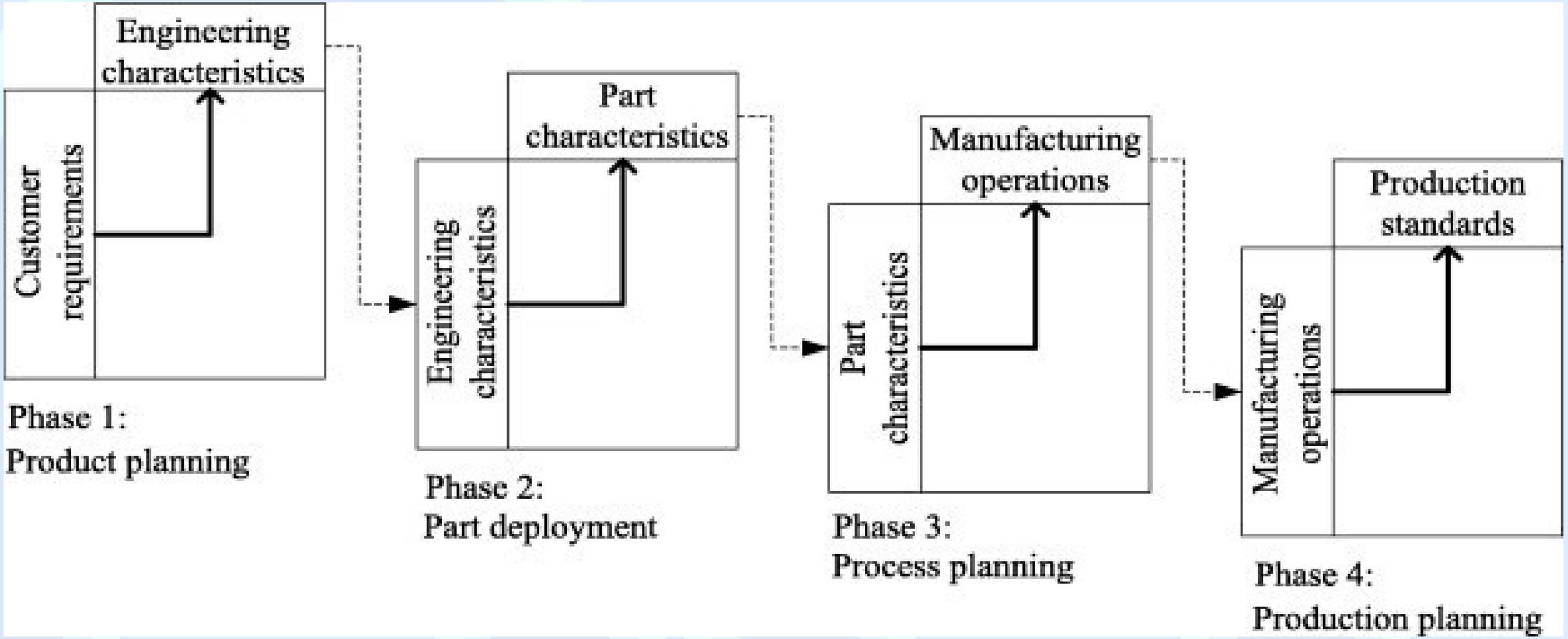


The house of quality provides:

- A requirements *planning* capability
- A tool for graphic and integrated thinking
- A means to capture and preserve the engineering thought process
- A means to communicate the thought process to new members of the QFD team
- A means to inform management regarding inconsistencies between requirements, risks, and needs of the customer

QFD is implemented through the development of a series of matrices. In its sim plest form QFD involves a matrix that presents customer requirements as rows and product or service features as columns. The cell, where the row and column intersect, shows the correlation between the individual customer requirement and the product or service requirement. This matrix is sometimes called the "requirement matrix." When the requirement matrix is enhanced by showing the correlation of the columns with one another, the result is called the "house of quality." This figure shows one commonly used house of quality layout.

The house of quality relates, in a simple graphical format, customer requirements, product characteristics, and competitive analysis. It is crucial that this matrix be devel oped carefully since it becomes the basis of the entire QFD process. By using the QFD approach, the customer's demands are "deployed" to the final process and product requirements



The Macabe approach, proceeds by developing a series of four related matrices ,product planning matrix, part deployment matrix, process planning matrix, and production planning matrix. Each matrix is related to the previous matrix

Data Collection and Review of Customer Expectations, Needs, Requirements, and Specifications Another approach to QFD is based on work done by Yoji Akao. Akao (1990, pp. 7–8) presents the following 11-step plan for developing the quality plan and quality design, using QFD.

1. First, survey both the expressed and latent quality demands of consumers in your target marketplace. Then decide what kinds of “things” to make.
2. Study the other important characteristics of your target market and make a demanded quality function deployment chart that reflects both the demands and characteristics of that market.
3. Conduct an analysis of competing products on the market, which we call a competitive analysis. Develop a quality plan and determine the selling features (sales points).
4. Determine the degree of importance of each demanded quality

5. List the quality elements and make a quality elements deployment chart.
6. Make a quality chart by combining the demanded quality deployment chart and the quality elements deployment chart.
7. Conduct an analysis of competing products to see how other companies perform in relation to each of these quality elements.
8. Analyze customer complaints.
9. Determine the most important quality elements as indicated by customer quality demands and complaints.
10. Determine the specific design quality by studying the quality characteristics and converting them into quality elements. 11. Determine the quality assurance method and the test methods.

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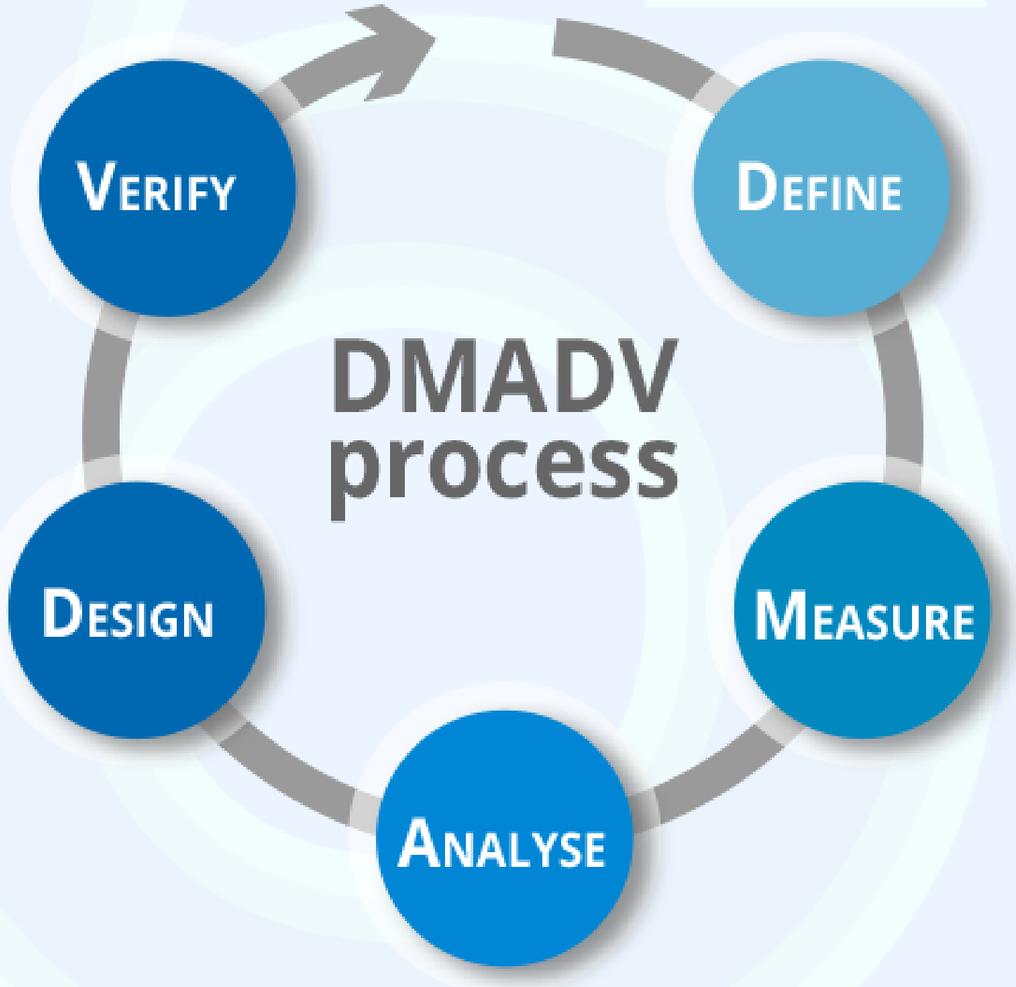
The Six Sigma project deals with Six Sigma methodology like DMAIC, DMADV-DFSS, Business Process Management and Statistical tools, these 3 make the Six Sigma Management System.



Six Sigma Statistical Tools

Now that you know about how the Six Sigma statistics work, the next thing you must gain insights into is the Six Sigma statistical tools. Here is the complete Six Sigma tools list that you must know.

1. Pareto Chart

When it is about the Six Sigma quality tools, the Pareto chart tops the list. This chart comes from the idea known as Pareto Principle. According to the Pareto Principle, nearly 80 percent of the outcome results from 20 percent of the cause. The Pareto chart is a special kind of bar chart that enable you to easily identify a few critical causes, thereby allowing you to focus on the vital issues.

2. Gage R&R

Gage R&R is one of the significant Sigma Six tools for process improvement. To solve a problem, accurate measurements are at the core. The Gage R&R allows you to determine whether the continuous measurements like pressure, weight, and diameter are reproducible and repeatable. It helps in checking the accuracy of the measurements.

3. Histogram

A histogram is one of the 6Sigma tools used for the process improvement of businesses. A histogram refers to a snapshot of continuous, numeric data. It allows you to identify the spread as well as the center of data in much less time. It enables you to locate where maximum data fall and provide you with insights into the maximum and minimum value.

4. Process Capability

Every process has a specific upper and lower bound. The process capability analysis helps in quantifying how well a process can meet the set specifications. It can also provide you with an idea about the ways to improve the poor processes.

5. Attribute Agreement Analysis

Attribute agreement analysis is also one of the important Six Sigma analysis tools. It is an ideal tool for categorical assessments, like Fail or Pass. It allows you to determine whether the people rating the different categories agree with other appraisers, with themselves, as well as with known standards.

6. ANOVA

ANOVA is one of the popular Six Sigma tools that is widely used by organizations around the globe. It is a collection of statistical models that are used for the analysis of differences among mean. In simple words, this statistical tool enables you to compare two or more two means easily.

7. Regression

Regression is a Six Sigma statistical tool that is helpful in the determination of the existence of a relationship between one or more input variables and the output variable. For instance, using the tool, you can determine whether there is a relationship between the sales revenue and the marketing expenditure of a company. If there exists any relationship, you can make use of the regression equation for describing the relationship and predicting the values of future output for the provided input values.

8. t-Tests

A t-test is another statistical tool that is used for comparing the average of one sample to the average of another sample. It can also be used for comparing the average of one sample to a given target.

9. Control Charts

The control chart is an important Six Sigma tool for risk analysis. To ensure the quality of services and products, it is vital to have a stable process. A control chart helps in distinguishing a special-cause variation from the natural and acceptable variation. It allows the identification of unusual variations, thereby allowing you to take the necessary actions.

10. DOE

Design of Experiments (DOE) offers a data collection strategy that allows making adjustments to the inputs to determine the existence of relationships between the outputs and inputs. After collecting essential data and identifying the vital inputs, this tool can be used to determine the optimal settings.

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WHAT IS VOICE OF THE CUSTOMER?

The voice of the customer, or VOC, is the structured process of directly soliciting and gathering the specifically stated needs, wants, expectations and performance experiences of the customer about the products and/or services you have provided to them.
Customer needs can usually be classified as being related to quality, cost, safety, service, and delivery — and, more and more frequently today, social responsibility. It is the satisfaction of those needs that should drive the organization. The challenge is how an organization gathers and synthesizes all the voices, many of which may be in conflict with each other.

There are a number of ways an organization can capture the VOC. Among them are:

- Direct observations
- Surveys
- Interviews
- Focus groups
- Complaint data
- Customer service reps
- Sales reps
- Existing company data
- Industry data

knowing the VOC, the organization will be able to benefit in several ways.

- The customer pays the bills, so knowing what their needs, wants, and expectations are is an important factor in securing their business.
- By understanding the VOC, an organization may be able to do a better job for the customer than some competitors, thus picking up more business..
- If the organization and the customer are speaking the same language and define things in similar terms, you can reduce any misunderstandings.

SIX SIGMA ROLES AND RESPONSIBILITIES

Project Champions (Sponsors) are the managers of the business, function, or value stream which has been identified as high priority for a Six Sigma team. They play a pivotal role in that they own the processes of the business and, therefore, must ensure process improvements are captured and sustained.

They typically also manage Six Sigma Green Belts (GB's) and must understand the challenges faced by GB associates (for example, removing roadblocks). They also must work with BB's and MBB's to ensure that their business area has developed, and is implementing, a long-term vision of a Six Sigma operating environment across the entire operative base.

- **Support: Provide visible support for Six Sigma MBB, BB and GB's and provide access to resources needed to conduct the project.**
- **Scope: Set very clear scope for all Six Sigma projects. Ensure that the project is clearly defined, has a scope which can be managed within 4-6 months, and which has high likelihood of success. Watch the project as it progresses to ensure that the scope stays strictly within the bounds originally set.**
- **Expectations: Set high expectations on the value of the results. Ensure the goals are not sub-optimized. The Six Sigma process has proven in many cases to deliver value far beyond initial estimates. Less-than-aggressive goals will yield less-than-aggressive results.**
- **Facts: Challenge Experts on their Knowledge of facts and the basis of their conclusions.**
- **Involvement: Sponsors are expected to interact with project teams on a regular basis to participate in problem solving, make decisions, and allocate resources. Plan to spend at least 2 hours every other week with the project team.**
- **Hand-over: Sponsors will be responsible for ensuring that the business takes ownership of the implementation and delivers the value indicated in the Control phase. This requires a specific individual who will own the delivery of the project metrics.**
- **Results: Sponsors, as well as 6sigma mentors and business controllers, are responsible for ensuring that project results hit the bottom line of the organization.**

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