

*The*

**SIX**

**SIGMA**

**Memory  
Jogger™ II**

LSL

USL



**A Pocket Guide of Tools  
for Six Sigma  
Improvement Teams**



GOAL QPC

IMPROVING THE WAY ORGANIZATIONS RUN

*The*  
**SIX**  
**SIGMA**  
**Memory**  
**Jogger™ II**

**A Pocket Guide of Tools for  
Six Sigma Improvement Teams**

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**First Edition**  
**GOAL/QPC**

## **The Six Sigma Memory Jogger™ II**

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## Six Sigma Overview

### *What is Six Sigma?*

Sigma is a statistical concept that represents the amount of variation present in a process relative to customer requirements or specifications. When a process operates at the six sigma level, the variation is so small that the resulting products and services are 99.9997% defect free.

“Six Sigma” is commonly denoted in several different ways. You might see it written as “ $6\sigma$ ,” “6 Sigma,” or “6s.”

In addition to being a statistical measure of variation, the term *Six Sigma* also refers to a business philosophy of focusing on continuous improvement by understanding customers’ needs, analyzing business processes, and instituting proper measurement methods. Furthermore, it is a methodology that an organization uses to ensure that it is improving its key processes.

While Six Sigma corresponds to being 99.9997% defect free, not all business processes need to attain this high a goal. Companies can also use the Six Sigma methodology to identify which of their key business processes would benefit most from improvement and then focus their improvement efforts there.

In this book, we often use the more generic terms *sigma* or *process sigma* to refer to the current capability of a process (i.e., how well the process is performing relative to customer specifications).

## Process Capability

Amount of Variation	Effect	Sigma Value
Too much	Hard to produce output within customer requirements or specifications	Low (0–2)
Moderate	Most output meets customer requirements	Middle (2–4.5)
Very little	Virtually all output meets customer requirements (less than four parts per million not meeting specifications)	High (4.5–6)

To increase your organization's process-sigma level, you must decrease the amount of variation that occurs. Having less variation gives you the following benefits:

- Greater predictability in the process.
- Less waste and rework, which lowers costs.
- Products and services that perform better and last longer.
- Happier customers who value you as a supplier.

The simple example below illustrates the concept of Six Sigma. Note that the amount of data in this example is limited, but it serves to describe the concept adequately.

Two companies deliver pizza to your house. You want to determine which one can better meet your needs. You always want your pizza delivered at 6 p.m. but are willing to tolerate a delivery anytime between 5:45 p.m. and 6:15 p.m. In this example, the target is 6 p.m. and the customer specifications are 5:45 p.m. on the low side and 6:15 p.m. on the high side.

You decide to order two pizzas at the same time every night for ten days—one pizza from Company A, and one from Company B. You track the delivery times for ten days and collect the following data:

### Comparison of Delivery Times

Company A		Company B	
Day	Delivery Time	Day	Delivery Time
1	5:58	1	5:51
2	6:20	2	6:04
3	5:49	3	5:59
4	6:05	4	6:00
5	6:10	5	6:10
6	5:42	6	5:56
7	6:01	7	6:02
8	5:53	8	6:11
9	6:12	9	5:59
10	6:05	10	6:09

As the chart above shows, Company A had two occurrences—on Day 2 and Day 6—of pizza arrival times that were outside of your tolerance window of between 5:45 and 6:15. In Six Sigma terminology, these two occurrences are called *defects*. This performance can also be described visually with the following graphs:

The applicable tools for the Measure step include the following:

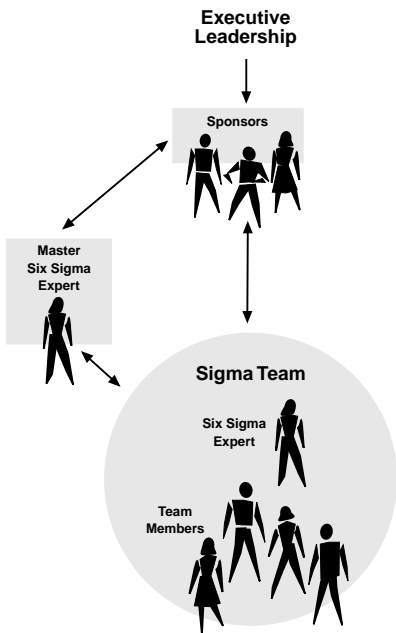
<b>Tool</b>	<b>Description</b>	<b>Page</b>
Control Charts	Help you look for patterns over time in process variation, quantify the current capability of your process, and identify when special events interrupt normal operations.	75
Data Collection	Helps you systematically collect base-line data.	95
Data Points/ Data Types	The type of data you have will determine which tool(s) to use.	101
Flowchart	Pinpoints steps in the process that don't add value and helps you identify problems in the process that contribute to waste and defects.	116
Histogram	Reveals how often a problem occurs in different settings. A stratified Histogram helps you identify process characteristics that might provide clues about the potential causes of problems.	129
Measurement Systems Analysis (MSA)	Helps you understand measurement variation.	168
Operational Definitions	Precise descriptions that describe how to get a value for each characteristic you are trying to measure.	176
Pareto Chart	Displays the relative importance of problems. As in the Define step, it helps you focus your attention and develop a detailed problem statement.	178
Process Sigma	Calculations that describe the current process capability. Calculating a base-line process-sigma level provides a gauge for you to evaluate your progress.	204
Run Chart	Plots data from Check Sheets and other sources and helps you look for patterns over time in process variation.	221

*Continued on the next page*

## DMAIC team structure

In most Six Sigma efforts, companies divide the responsibilities for accomplishing the improvement into four major roles: the sponsor; the team coach, typically called the Master Six Sigma Expert; the team leader, typically called the Six Sigma Expert; and the team member.

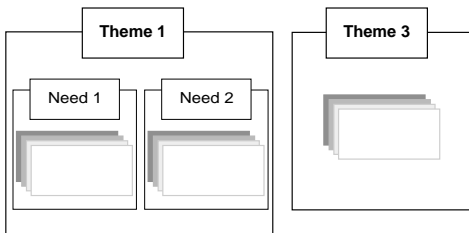
### The DMAIC Team Structure





1. **Gather sorted customer needs from your data-collection process. The needs you use in the CTQ Tree can include the themes or specific needs from a Customer-Data Affinity Diagram (see below).**

### A Customer-Data Affinity Diagram



*Tip* Use the Kano Model (see page 158) prior to identifying CTQs to ensure your team has not missed any critical customer needs.

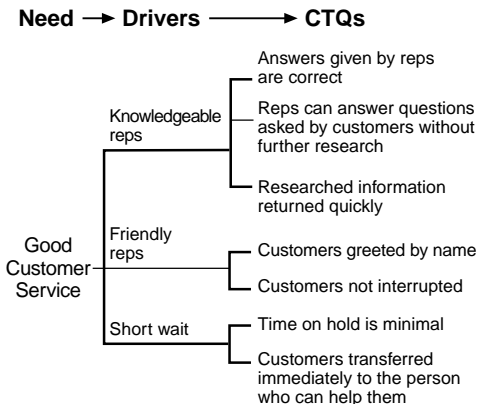
2. **List the major customer needs from the Customer-Data Affinity Diagram on the left side of the CTQ Tree**
3. **Try to view each need from the customer's point of view. As you consider each need, ask, "What would that mean?" from the customer's standpoint. Each answer becomes a driver for the CTQs. Keep asking, "What would that mean?" until you reach a level where it would be absurd to continue. Your answers at this level are the CTQs.**

#### Example:

- "Good customer service" means "knowledgeable reps."

- “Knowledgeable reps” means the answers they give are correct.
- It would be absurd to ask what “correct answers” means, so you should stop at this point. “Correct answers” is an appropriate CTQ.

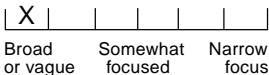
### A Sample CTQ Tree



**General** ↔ **Specific**  
**Hard to measure** ↔ **Easy to measure**

## A Comparison of Problem Statements

Takes too long to close the books at the end of the month



**What:** *Closing the books*

**Does not include:**

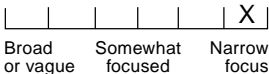
Which departments have problems

When the problem started

Whether the problem happens all the time or comes and goes

What types of financial records have the biggest delays

Increase in the number of open inner packs of Fiber Flakes cereal from the #3 sealing machine during the last three days



**What product is involved:**  
*Fiber Flakes cereal*

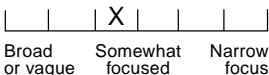
**What problem occurs:**  
*Increase in open packs*

**Which packs:**  
*Inner packs*

**Where does problem occur:**  
*Sealing machine #3*

**When did problem occur:**  
*The last three days*

Inaccurate hospital bills for surgery patients at City Hospital



**What:** *Inaccurate bills*

**Which patients:** *Surgery patients*

**Where:** *City Hospital*

**Does not include:**

What types of inaccuracies?

What kinds of surgeries?

When did the problem start?



## Histogram

*Process centering,  
spread, and shape*

### *Why use it?*

To summarize data from a process that has been collected over a period of time, and graphically present its frequency distribution in bar form.

### *What does it do?*

- Displays large amounts of data that are difficult to interpret in tabular form
- Shows the relative frequency of occurrence of the various data values
- Reveals the centering, variation, and shape of the data
- Illustrates quickly the underlying distribution of the data
- Provides useful information for predicting future performance of the process
- Helps to indicate if there has been a change in the process
- Helps answer the question “Is the process capable of meeting my customer requirements?”

### *How do I do it?*



#### **1. Decide on the process measure**

- The data should be variable data, i.e., measured on a continuous scale. For example: temperature, time, dimensions, weight, speed.