Making Lean Six Sigma and CMMI Work for You

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Overview

- Review Lean (from last time)
- Finish Lean and Review Lessons
- Six Sigma
- Team Work Phases
- DMAIC
- CMMI
- A Lean Six Sigma CMMI project
- Review

Review Lean

- Lean is a word
  - Process Improvement methodology in which production and/or service processes are optimized to create maximum value for customers, while minimizing time, cost, and errors
    - “Better, Faster, Cheaper, and Less Risk"

Review Lean

- It's about speed and relationships between process steps
  - Focus is on process waste elimination and batch size reductions to create a one-piece flow
- Invented by Toyota Motor Company
  - A.k.a. "The Toyota Production System" or "TPS"
- Traditional Thinking and Processes (i.e., mass production)
  - "If you build it, they will come!"
- Lean Processes (fast and flexible)
  - Efficiency…"When they come, build it fast!"

Review Lean

- To become lean and follow in Toyota's footsteps is not impossible, nor easy
  - If it was, every competitor would be lean and Toyota would not be as successful against them
- The key to competing against companies practicing Lean is:
  - “If you can’t beat ‘em…join ‘em!”
- Get onboard and start working smarter!

Review Lean

- The five principles of Lean
  1. **Precisely specify value by specific product**
  2. **Identify the value stream of each product**
  3. **Make value flow without interruption**
  4. **Let the customer “pull” from the producer**
  5. **Pursue perfection**

#1: Precisely Specify Value By Specific Product

- Critical starting point is “value”
  - Value is defined by the customer
  - Only meaningful when expressed as a specific product and/or service that meets the customer’s need at a specific price and time (i.e., functional requirement)

#1: Precisely Specify Value By Specific Product

- Value is “created” by the producer, who builds the product, based on the defined requirements
  - Many companies produce what they think customers want, without asking them
  - Companies need to rethink value from the customer’s perspective
    - Voice of the Customer (VOC)

#2: Identify The Value Stream Of Each Product

- Value Stream (VS) is the set of all specific actions required to bring a specific product through three critical management tasks:
  1. **Problem solving** (from concept through production)
  2. **Information management** (from order taking through delivery scheduling)
  3. **Physical transformation** (from raw materials through finished product in customer's hands)

#2: Identify The Value Stream Of Each Product

- Identifying the entire value stream for each product typically exposes enormous amounts of waste (i.e., muda)
  - Three types of actions will be found:
    1. Unambiguous **value-added (VA)** steps
    2. **Non-VA (NVA)** steps, unavoidable due to current technologies and production assets **(Type 1 muda)**
    3. **Non-VA (NVA)** steps, immediately avoidable **(Type 2 muda)**

#3: Make Value Flow Without Interruption

- Traditional thought on how to create products in mass quantities is called “batch and queue” thinking
  - Batches always mean long waits as the product “waits” for the switch to the next activity
  - This keeps the people and equipment busy, but not the product (NVA)
  - Tasks can almost always be accomplished much more efficiently and accurately when the product is worked on continuously from raw materials to finished goods

#3: Make Value Flow Without Interruption

- Flow thinking is counterintuitive
  - This makes it hard to change to for most people
- Major breakthroughs come from looking at the whole value stream
  - Lean redefines the work of functions, departments, and firms to make a positive contribution to value creation and speak to the real needs all along the value stream to help value flow
  - It requires the creation of a Lean Enterprise for each product, rethinking of conventional production thought, and development of a Lean strategy

#4: Let The Customer "Pull" From The Producer

- Once departments and batches convert to product teams and flow, a product's cycle time falls dramatically. Reductions as follows:
  - Product development throughput time – 50%
  - Order processing throughput time – 75% and
  - Physical production – 90%
- Lean Enterprise systems can make products in production in any combination to immediately satisfy demands for them

#4: Let The Customer "Pull" From The Producer

- A Lean Enterprise capability allows a company to quickly design, schedule, and make exactly what the customer wants when they want it (a "Pull" system)
  - In a "Pull" system, the downstream process always does what the preceding process tells it to do
  - Producers can stop forecasting (guessing at) customer needs and trying to meet them (a "Push" system) and focus on making products when the customer tells them

#4: Let The Customer "Pull" From The Producer

- The customer pulls the product from the producer when needed (e.g., custom orders), rather than the producer pushing products (often unwanted) onto the customer (e.g., catalog orders)
- Resources are not spent until customer places an order for a product
  - Dispensers (soda, soft-serve ice cream, Icees)
- When technology advances or demands change, the new requirements can be rapidly infused into the product

#4: Let The Customer "Pull" From The Producer

- Customer demands become more stable when they can get what they want right away and producers stop discounting goods already made that no one wants
  - 50% of US printed books are shredded without being read

#5: Pursue Perfection

- When the first four steps are achieved, those involved see that there is no end to reducing effort, time, space, cost, and mistakes while providing a product which closely approaches what customers want
  - The idea of achieving “perfection” is no longer “a crazy idea”
  - Remember, Lean requires a mindset change

#5: Pursue Perfection

- When value flows faster, it exposes hidden muda in the value system
- The harder value is pulled by the customer, the more flow impediments are revealed to be removed
- Dedicated product teams in direct dialogue with customers always find ways to specify value more accurately and often learn ways to enhance flow and pull

#5: Pursue Perfection

- Eliminating muda sometimes requires new process technologies and concepts
  - They are usually surprisingly simple and ready for immediate implementation
- The best technique for perfection is "transparency"
  - All system stakeholders are allowed to see everything, so it is easier to discover better ways of creating value

#5: Pursue Perfection

- Those making improvements have near-instant and highly-positive feedback (e.g., money or peer recognition), which motivates them to make further improvement efforts

Dream Perfection, Then Do It!

- Now that you know the impossible is possible, using Lean Thinking, let your creativity flow
  - Dreaming up new ideas helps us achieve more than we otherwise would

Dream Perfection, Then Do It!

- Short-term achievements that can be made with Lean:
  - Converting from a traditional batch-and-queue production system to continuous flow with effective pull will:
    - Double labor productivity throughout the system
    - Reduce inventories 90%
    - Reduce errors reaching the customer, scrap, and job-related injuries 50%
  - New product times-to-market reduced by 50%

Dream Perfection, Then Do It!

- Wider varieties of products within product families can be offered at very modest additional cost
- Required capital investments will be very modest, even negative, if facilities and equipment can be freed up and sold

Dream Perfection, Then Do It!

- Long-term achievements that can be made with Lean:
  - Continuous improvements towards perfection
  - Double productivity and 50% inventory, error, and lead-time reductions again within 2 – 3 years
  - Endless improvements, thereafter

Final Thoughts On Lean

- In his 2003 book, "The Millionaire Real Estate Agent," Gary Keller, co-founder of Keller-Williams Realty, states that:
  - "Small goals tend to place limits on our potential and big goals have a tendency to pull us right through the small goals on the way to attaining the big goals!"
  - "Think big, act bold, and you'll live a better life"

Final Thoughts On Lean

- He calls modeling the cornerstone of success
  - "Success leaves clues…people who produce outstanding results do specific things to create those results"
  - "Actions are the source of all results…discovering exactly and specifically what people do to produce a specific result is called 'modeling' "
  - "Modeling is the pathway to excellence…the world's movers and shakers are often people who have mastered following other people's experience, rather than their own"

Final Thoughts On Lean

- Building from the successes of others is one of the fundamental aspects of most learning
- Always start with a set of proven foundational models for success
- When you add creativity to a practiced and proven model, you will have a much greater chance of achieving your highest possible results
- Get started ASAP!
- If you are a supplier, ask your Lean-practicing customer to assist you
- On your road to perfection, expect to make some mistakes…but learn from them!

Six Sigma

- Now that we understand how Lean Thinking significantly improves processes and products through waste elimination and increased process flow, lets add Six Sigma techniques and tools to get even better results
- Six Sigma is all about using techniques and tools to reduce process and product "variation"

Six Sigma

- Variation is “any unwanted condition” or “the difference between the current and desired endstate”
  - It is **a measure of how much two or more things vary, or differ, from one another**
    - **In Quality terms**, it is a measure of **how much a** producer’s **product** or service (current) **differs from the requirement** the customer specified (desired)
    - **In statistical terms**, it is “the **average of the square of the distance between each point** in a total population **and the** population’s **mean**”

Six Sigma

- Two variation types must be controlled and minimized to achieve improvements
  - **"Special Cause"** – That which causes individuals in a population to vary from the goal (i.e., "outliers")
  - **"Common Cause"** – That which causes the whole population to vary from the goal
- The key to process improvement, then, is to minimize variation when producing products (**how one varies from the next**) "and" aligning what is produced with the customer's needs (**how products vary from requirements**)

Six Sigma

- Variation occurs in all natural and man-made processes
  - To manage and reduce performance and software process variations, they must be traced back to their sources (root causes), measured, and addressed
  - If variation cannot be measured, it is only because the measurement systems are insufficiently precise and accurate

Six Sigma

- Producers embrace variation reduction as a primary means to improve product performance and reduce product defects
  - A primary goal of many firms' efforts is the continuous and systematic reduction of variation in key processes and product features
  - Identifying, addressing, and reducing sources of variation is critical to implementing Lean and Six Sigma initiatives

Six Sigma

- Like Lean Thinking, Six Sigma is a process improvement methodology
  - Smart and deliberate methodology for managing processes and products
  - Puts the **customer first** and uses **facts and data to drive better solutions**
  - Uses Statistical Process Control (**SPC**) to reduce variance
  - Seeks to **improve customer satisfaction**, **reduce cycle time**, and **reduce defects**; three areas where improvements usually represent dramatic cost savings

Six Sigma

- Although it involves measuring and analyzing an organization's business processes, Six Sigma is not merely a quality initiative; it is a business initiative
  - Requires more than small, incremental improvements
  - Requires breakthroughs in every part of an operation
    - **In statistical terms**, operating at Six Sigma means a **process or product performs** with almost no defects (**3.4 defects per million** opportunities (DPMO))

Six Sigma

- **In behavioral terms**, it is a **total management commitment and philosophy of excellence, customer focus, process improvement, and the rule of measurement**, rather than "gut feel" or intuition
- It is about making every area better able to meet the changing needs of customers, markets, and technologies; with benefits for employees, customers, and shareholders

Six Sigma

- Six Sigma shares its beginnings and history with Lean Thinking and was started in the 1980s as a replacement for Total Quality Management (TQM), the latest process improvement methodology of the day, to address its shortcomings
  - TQM had many of the same process improvement ideas and methods, but it was short on being easy to implement, so it was eventually abandoned
  - Six Sigma improved on previous quality programs by being **customer focused**; producing **major returns on investment**; and **changing how** management needs **to operate** to be successful

Six Sigma

- Six Sigma can produce some impressive results, but positioning an organization to do so requires a great deal of organizational teamwork
  - It means creating the infrastructure and having the systems to provide customers what they want, when they want it, and in the quantities they need
  - It means providing employees with the time and training to tackle work challenges, using analytical tools and techniques

Six Sigma

- Six Sigma is actually two separate, but related concepts
  - First, it is a **management system** (or methodology) **to achieve lasting business leadership** (i.e., highest market share) **through world-class performance**
  - Second, it is **a statistical measure reflecting the near-perfect performance of a process or product**
- By using the management system in the first bullet, an organization can achieve the second bullet (which is world-class performance) to achieve lasting business leadership, the "goal" of the first bullet

Six Sigma

- What is a sigma and why are there six of them?
  Warning*Math Major Alert!!!***Warning**
  - In statistics, the Greek letter, sigma, represents one standard deviation
  - A standard deviation is the square root of a population's variance
  - A population refers to a particular set of elements (e.g., items, objects, phenomena, or people) being observed and analyzed
  - Variance is the average of the square of the distance between each point in a total population and the mean
  - A mean is the average of a set of numbers

Six Sigma

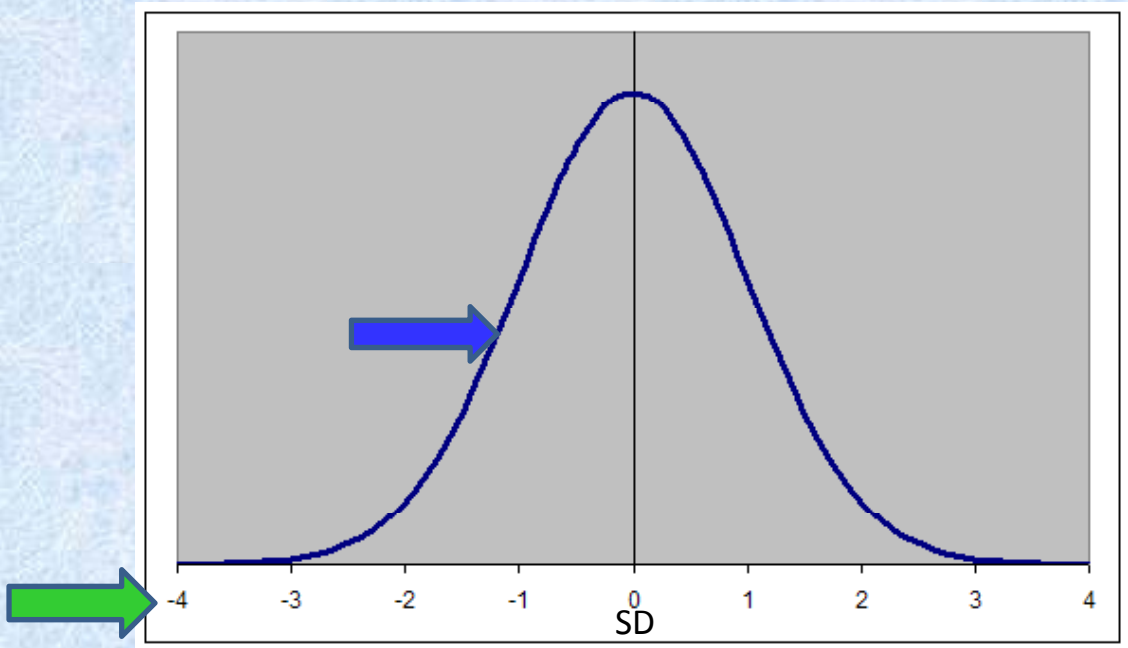
- When the data is plotted on a graph:
  - Data spread over a wide range indicates higher variance and standard deviation
  - Data centered around the average indicates a smaller variance and standard deviation
- When plotting performance, the lower the variance, the higher the performance

Six Sigma

- Many times, the population being observed is too large to measure every last element to see how it is performing
  - "Sampling" – measure representative subset of population to make inferences from it about the total population
  - Through sampling and analysis of the data collected, businesses can determine how their processes and products are performing (compared to a needed or planned performance) and make decisions about how to maintain or change processes, accordingly (i.e., control)
    - Statistical Process Control (SPC)

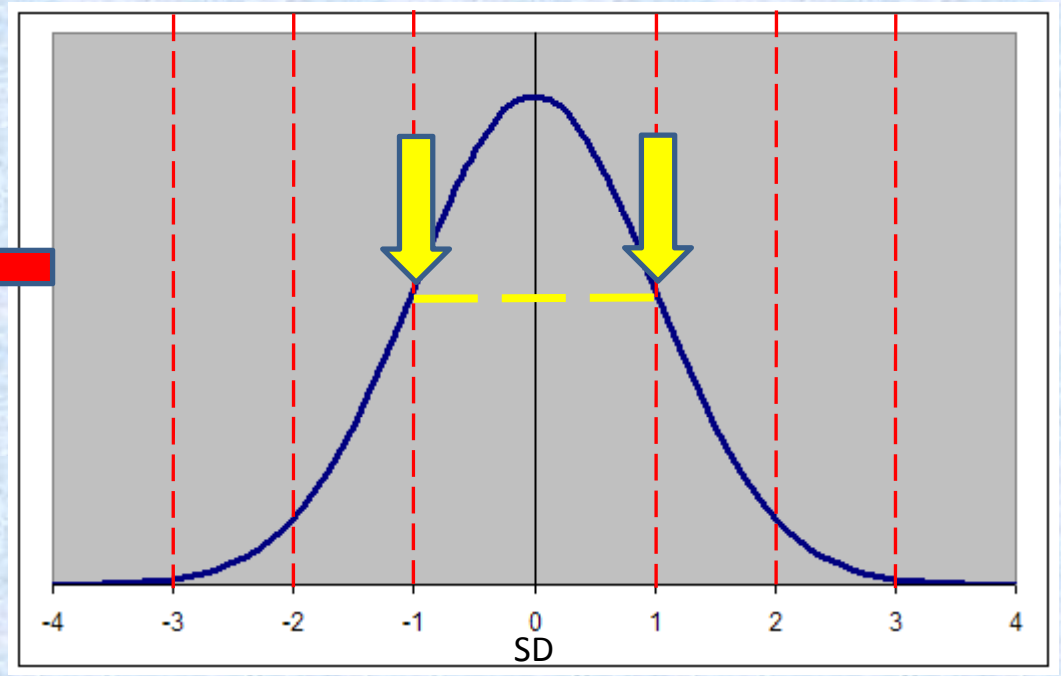
Six Sigma

- Lets look at how this looks when plotted
  - Below is a plot (in blue) of a population's "normal distribution"
  - It is known as a "Normal, Bell, or Bell-shaped curve"
  - The population is represented by the area under the curve
  - Each number below the curve represents the population's Standard Deviation (SD) or sigma



Six Sigma

Sigma	DPMO	Yield
0.0	933,200	6.68%
0.5	841300	15.87%
1.0	691,500	30.85%
1.5	500,000	50.00%
2.0	308,500	69.15%
2.5	158,700	84.13%
3.0	66,800	93.32%
3.5	22,700	97.73%
4.0	6,200	99.38%
4.5	1,300	99.87%
5.0	230	99.977%
5.5	30	99.997%
6.0	3.4	99.99966%



- An SD (sigma) is a calculated value and can be thought of as a fixed length or distance
- Using the statistical table above, we see that when we venture + or – 1 sigma (for a total of 2) from the mean, the area under the curve represents about 69% of the population

Six Sigma

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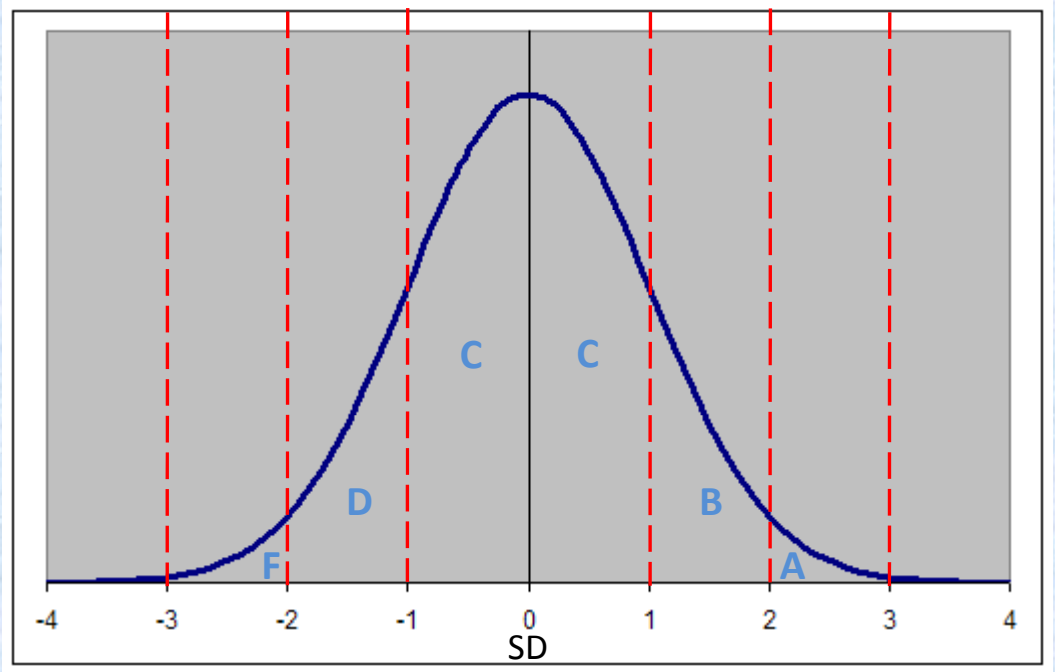

- We can interpret this a couple of different ways:
  - If this was a plot of the results of test scores, then 69% of everyone who took the test, scored within + or – 1 sigma of the average score on the test; 93.32% within + or – 1.5 sigma, 99.38% within + or – 2 sigma; 99.977% within + or – 2.5 sigma; and 99.99966 within + or – 3 sigma
  - Then, we could base a grade on one's sigma score

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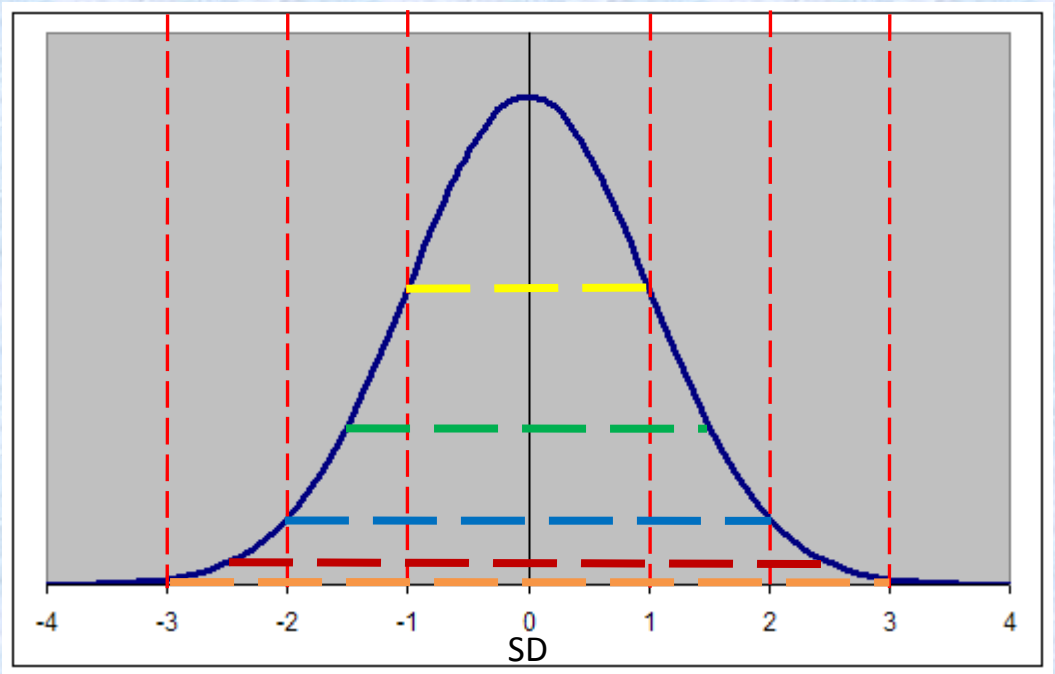

- If this was a plot of the results of how well a process performed to produce what a customer wanted (lets say the average and what the customer wanted are the same), then 69% of all products produced were within + or – 1 sigma of what the customer wanted; 93.32% within + or – 1.5 sigma, 99.38% within + or – 2 sigma; 99.977% within + or – 2.5 sigma; and 99.99966 within + or – 3 sigma

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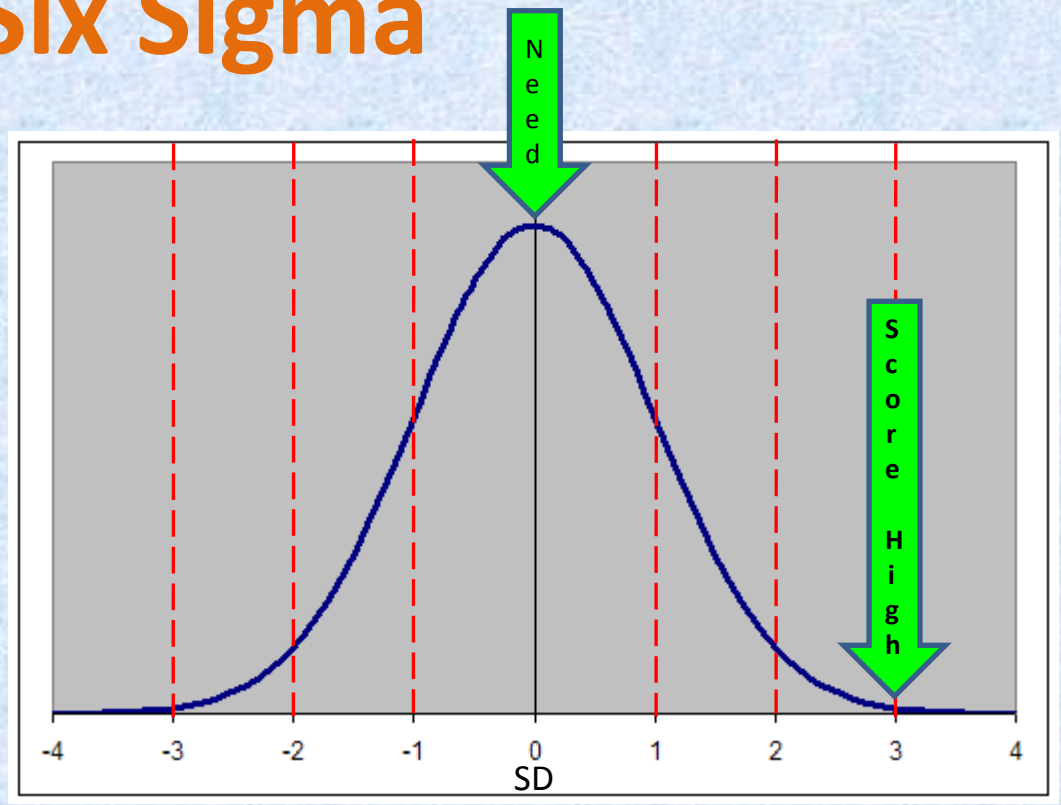

- In the first example, what was the goal of the population taking the test?
  - To score as high as possible above the average score
- In the second example, what was the goal of the population of products?
  - To come as close as possible to the customer's need

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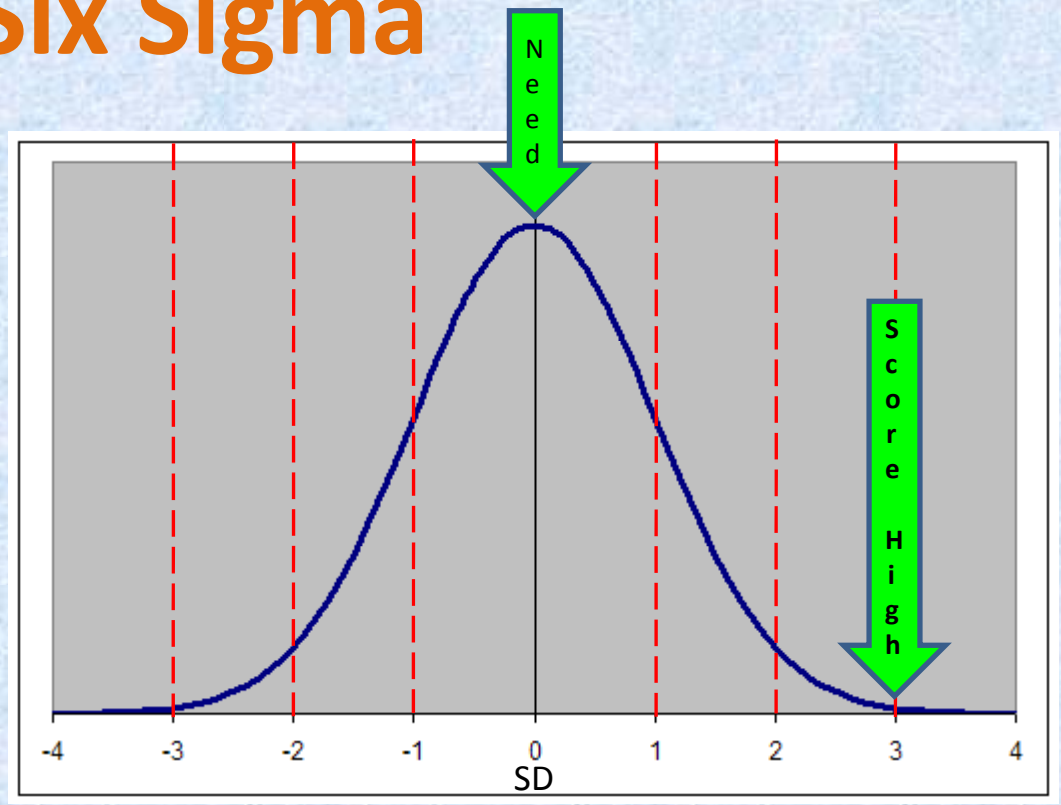
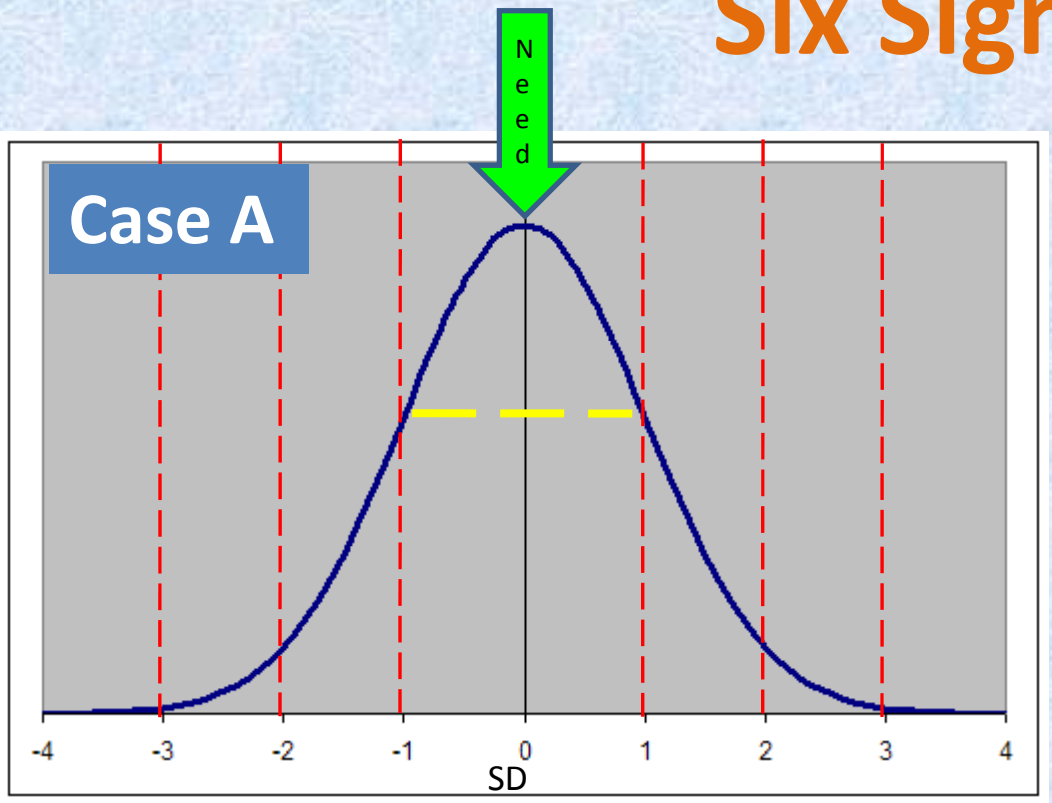
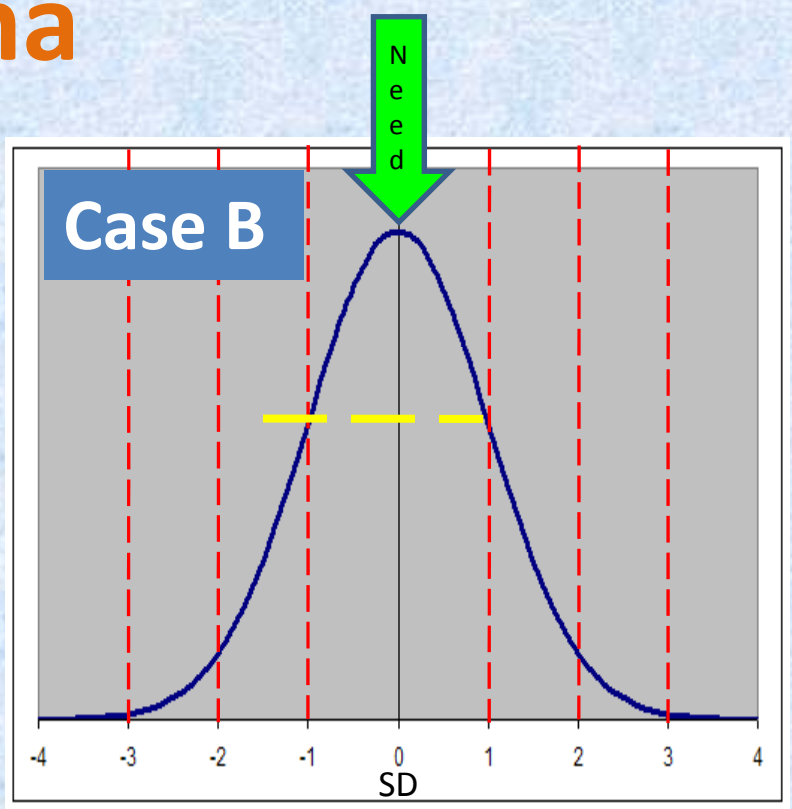


- In manufacturing, development, maintenance, and services, our goal aligns with the latter example
  - In other words, we are striving to meet our customer's need, repeatedly and consistently (gives us predictability)
  - We want our performance to be the same as the customer's need

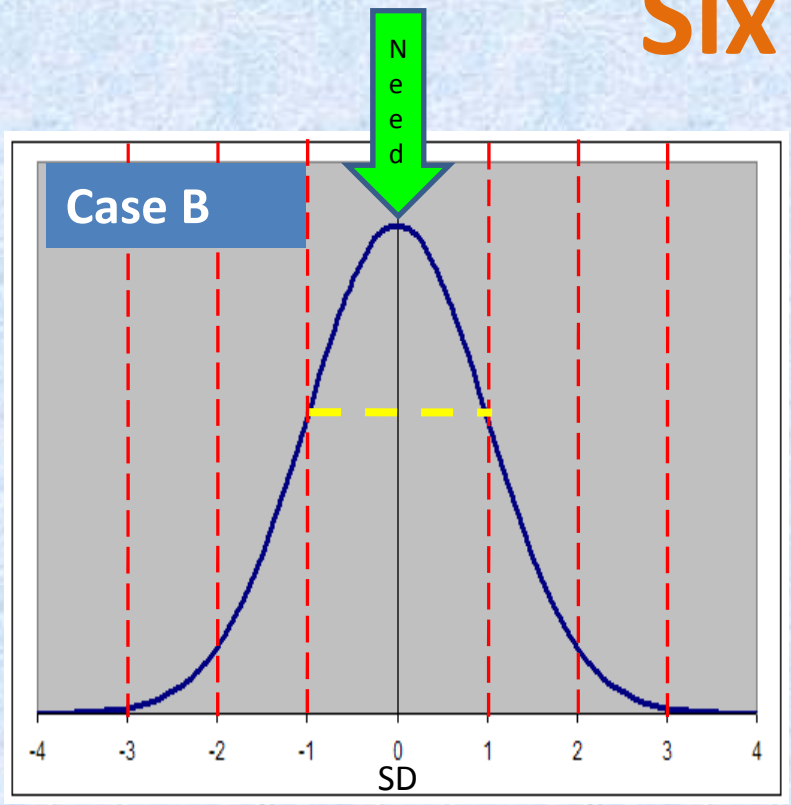
Six Sigma

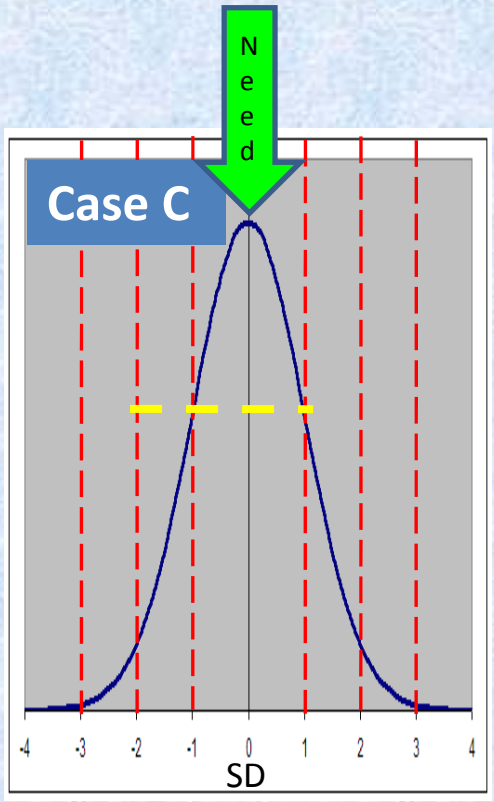




- The closer our performance is to the customer's need, the smaller the variance and SD become
  - Can you see in the examples above how the variance (width of the curve) and SD (distance between dashed red lines) in Case A is bigger than in Case B?
  - Which Case is performing better, then?
    - Right! Case B is correct!...Less variance

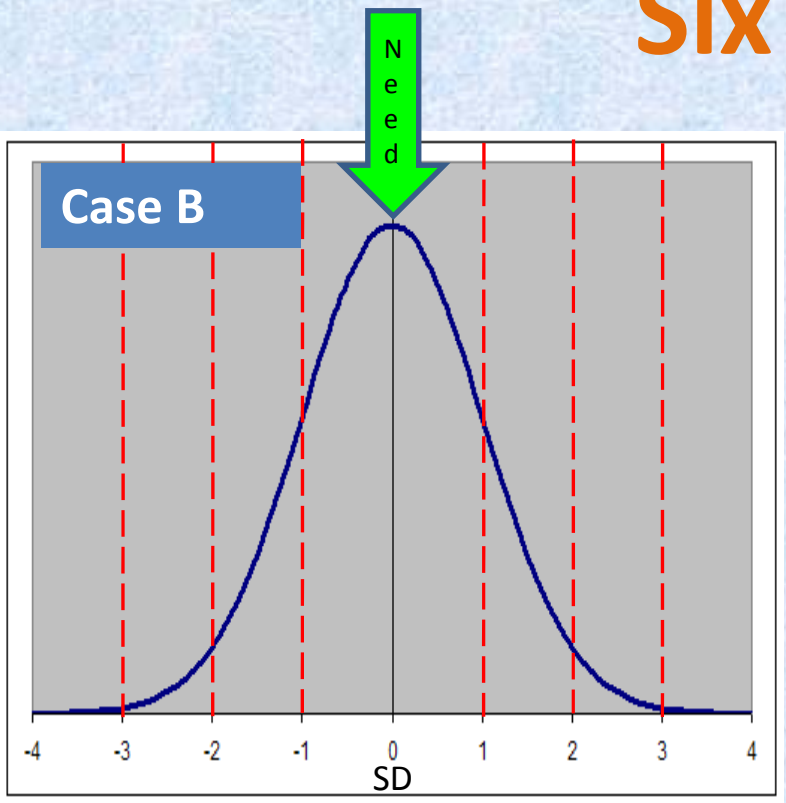
Six Sigma

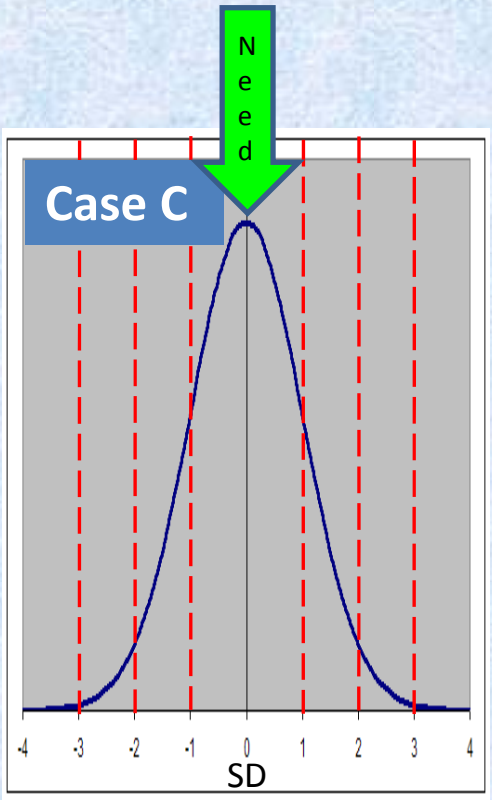




- And this can go on and on!
  - …And it should!
- Can you see how as performance of the process results in products that are closer and closer to the need, the variance and SD (sigma) become smaller and smaller?

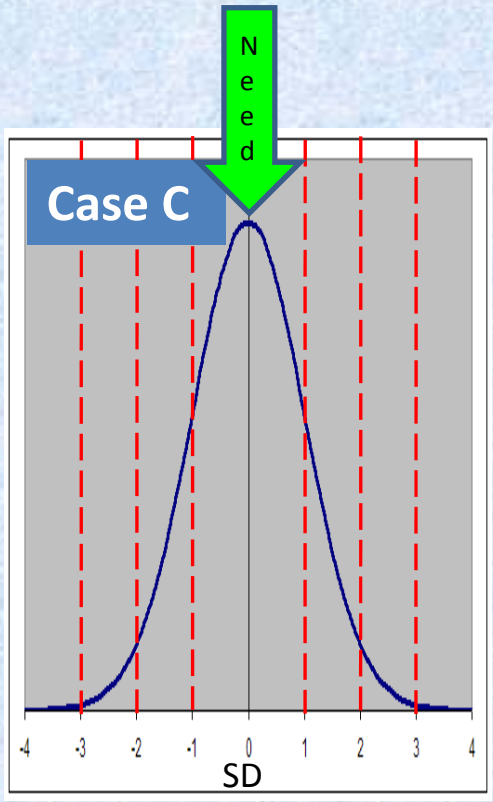
Six Sigma

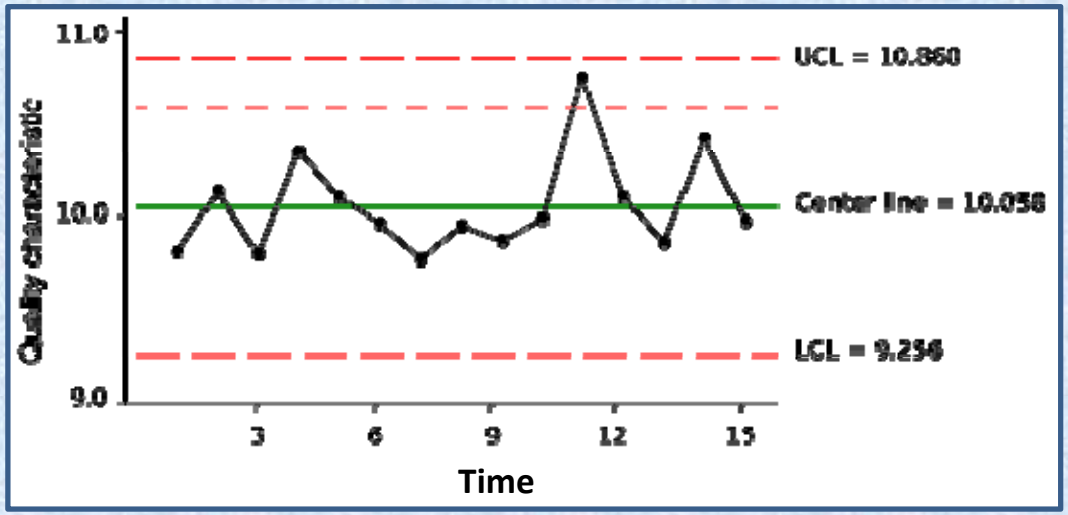




- OK, so now you are wondering, "OK, I get it! Better performance decreases my process and product variance and sigma. But what does this all have to do with Six Sigma? What 'about' Six Sigma?"
- "I see that every process has a six sigmas, no matter what"
- "If the process is optimized, that distance is narrow; and if it is not optimized, it is larger by some factor"

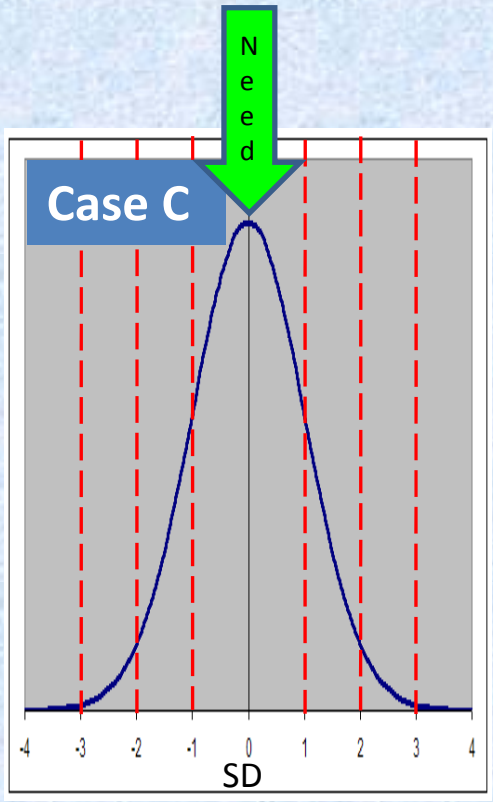
Six Sigma

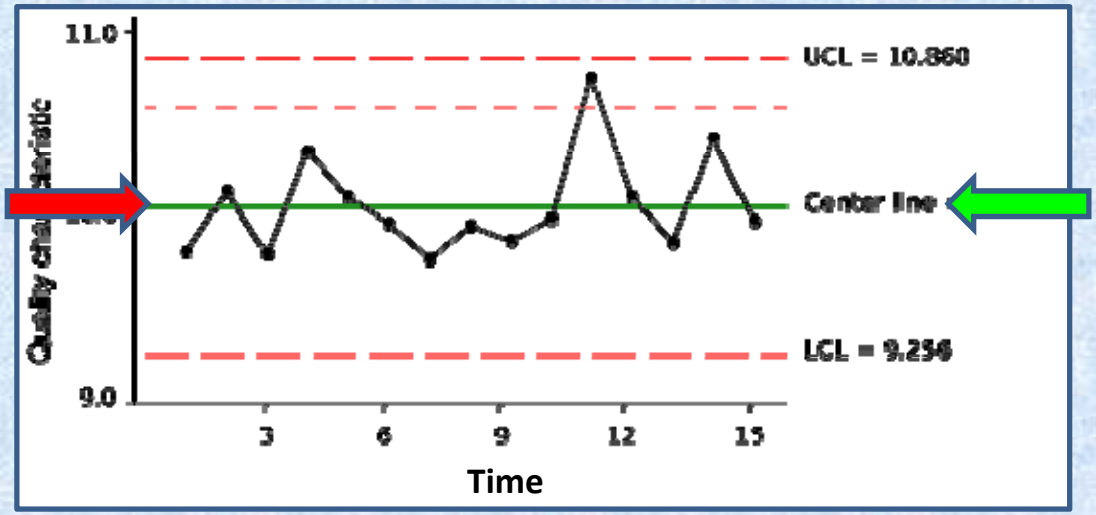




- Exactly! And now for the rest of the story!
  - Lets introduce the concept of a **control chart**
- Above, on the right, is an example of a control chart
  - There are several different types, but this one gives the basic information needed to explain the need for Six Sigma performance

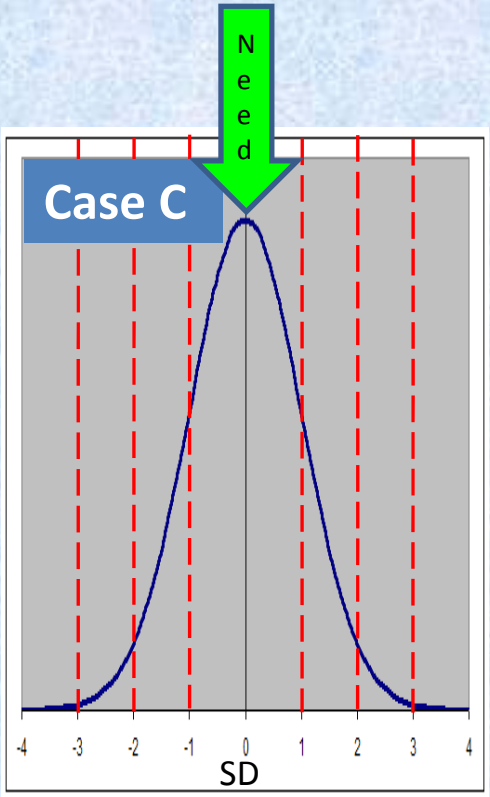
Six Sigma

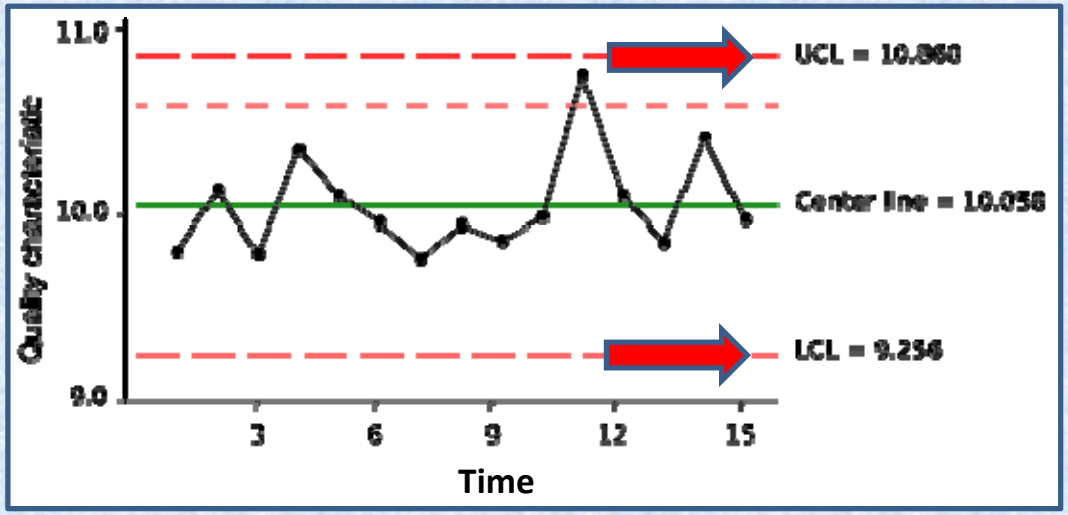




- First, notice that its information is expressed left-to-right
  - It doesn't matter what the orientation is, as long as it communicates what it needs to
- In the middle, a green line represents the customer's desired performance value

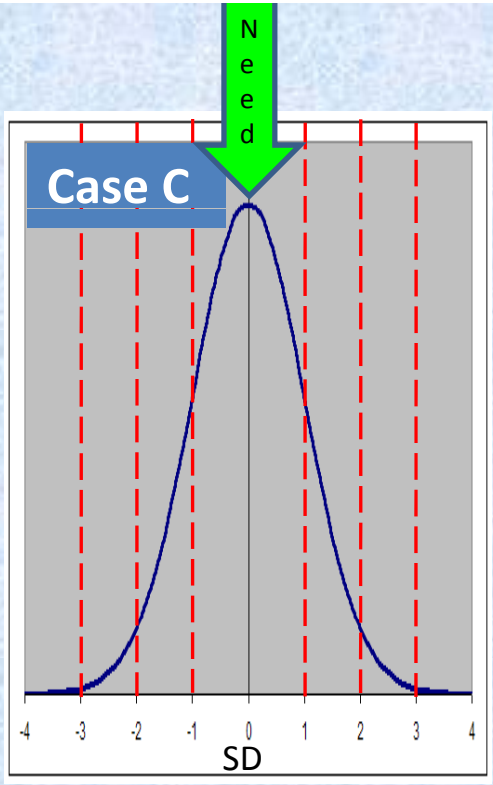
Six Sigma

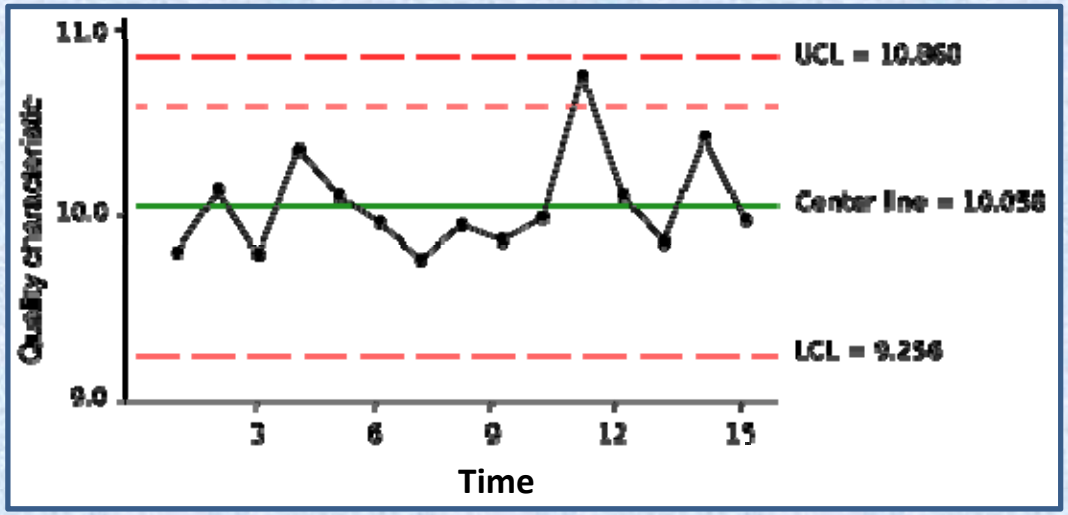




- Customers understand that a perfect process doesn't exist, and variance will occur, so they specify not only a **desired** performance **value**, but also a **highest and lowest** performance **value** they will accept
  - At the top, a dashed red line represents the highest acceptable performance value (Upper Control Limit (**UCL**)
  - At the bottom, a dashed red line represents the lowest acceptable performance value (Lower Control Limit (**LCL**)

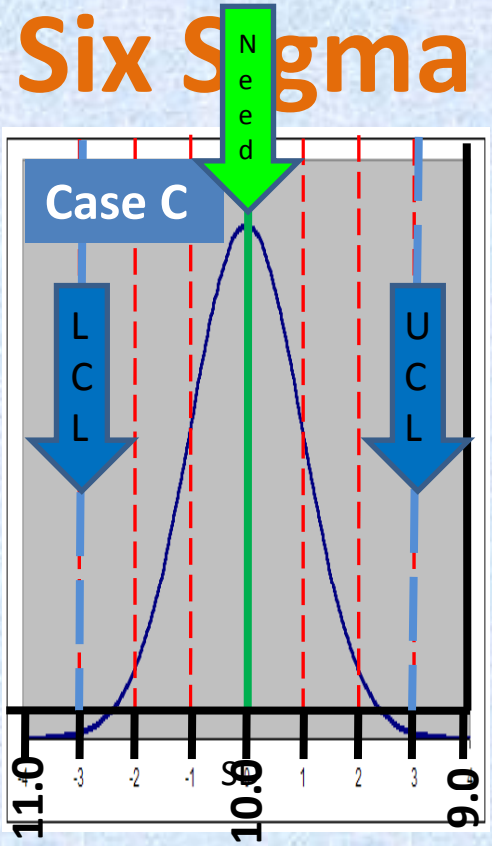
Six Sigma





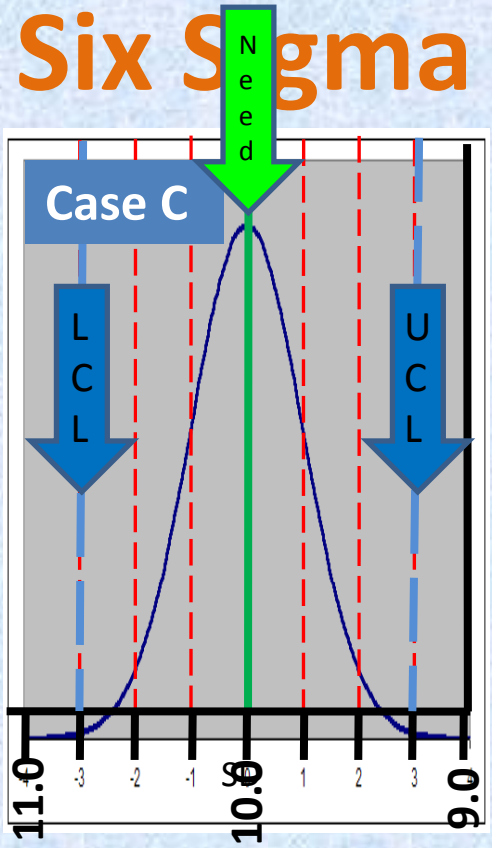
- As long as the process performance **values** center around the desired value and **fall within the UCL and LCL** (with a few exceptions for bad trends and such), they are **considered** to be of **value** to the customer
  - Anything else is waste (muda)!
- Now we'll make the connection to Six Sigma performance!

Six Sigma



- Lets reorient the control chart to the left by 90°, change the UCL and LCL lines to blue, widen the desired performance value line, and transpose the control chart over the process performance for Case C's normal distribution curve

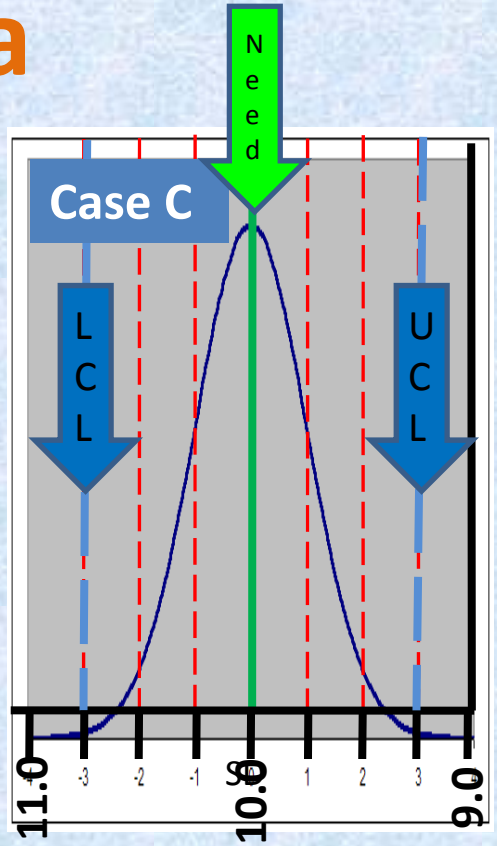
Six Sigma



- Now we have a process performance whose three sigmas on either side of the mean “fit” between the UCL and LCL
- In other words, the variance is narrow enough that all of the process’ six sigma performance provides the customer with the needed value requested

Six Sigma

Sigma	DPMO	Yield
0.0	933,200	6.68%
0.5	841300	15.87%
1.0	691,500	30.85%
1.5	500,000	50.00%
2.0	308,500	69.15%
2.5	158,700	84.13%
3.0	66,800	93.32%
3.5	22,700	97.73%
4.0	6,200	99.38%
4.5	1,300	99.87%
5.0	230	99.977%
5.5	30	99.997%
6.0	3.4	99.99966%



- Let's bring our Sigma Yield chart back to show that because we are operating at 6 sigma, 99.99966% of our population (resultant products) fall within the UCL and LCL
- This tells us that if we perform this process 1 million times, we can expect between 3 and 4 defects to result
- If we only reached 4 sigma, only 99.38% would result, or 6,200 defects per 1 million repetitions

Six Sigma

- A sigma measure is based on how well a process meets its customer ‘s requirements
  - Sigma measures were developed to help producers:
    - Focus measures on the business’ paying customers
    - Provide a consistent way to measure and compare different processes
  - Customer requirements and expectations are called “Critical to Quality” measures or **CTQs**
    - One of the keys of Six Sigma is to understand and assess how well a process performs on all CTQs
    - A process sigma measure gives everyone a common way to express how well or poorly a process performs

Six Sigma

- **Practicing** the **Six Sigma methodology** with a **goal of achieving six sigma performance** reduces process variance, and therefore, defects (which become almost nonexistent)
  - Near-perfect performance keeps customers happy, which is good and profitable for the business
    - A 5% increase in customer retention has been shown to increase profits more than 25%
    - It is estimated that companies lose 15 – 20% of revenues each year due to ineffective, inefficient processes
- So…how does one go about doing it?!!

Six Sigma

- Making the Six Sigma methodology a means of responding to critical business needs and ingraining proactive, customer-focused management into the daily routine is done through:
  - Senior Leadership (their role is critical)
  - Middle Management (their role is key)
  - Front-line employees who work directly with customers
    - This is often where the ideas, solutions, process discoveries, and improvements come from

Six Sigma

- Businesses refer to “variations” as “problems,” “too many defects,” “dissatisfied customers,” “unmet expectations,” and other terms that are more meaningful to them
  - We will use “problems” and “problem solving” in our discussion
  - Note that we could also use these techniques to exploit opportunities

Six Sigma

- **Improvement, problem-solving, and process-design teams** are the most visible and active component of Six Sigma efforts
  - They are created to solve organizational and process problems, and exploit opportunities
  - **Led by a Black Belt or Green Belt**, teams may number between 3 and 10 members (5 – 6 is preferred), **representing the different parts of the process** in question
  - Member **diversity is a key to** team **success**
    - People from different departments, job levels, backgrounds, skills, and seniority, who have experience with the problem, are typically selected

Six Sigma

- Team members treat one another as equals and each member's contribution is important to achieving the breakthroughs sought in such improvement efforts
- It's important to use a standard process or model each time for the team to achieve the needed process improvements
  - The improvement model used in Six Sigma is an acronym, known as **DMAIC** (pronounced "Duh 'MAY Ick")
  - It is a high-level, very flexible model whose tools and techniques are tailored to fit the process being improved

Six Sigma

- DMAIC stands for:
  - **D**efine (the problem)
  - **M**easure (the process and collect data)
  - **A**nalyze (analyze the data and make conclusions)
  - **I**mprove (decide what to do and implement it)
  - **C**ontrol (sustain gains made by improvements)
- DMAIC is a cyclical process and is continued until the effort is complete

Team Work Phases

- Teams work through six phases, from a statement of the problem until the implementation of a solution, with several actions in between
  - **1**: Identify and Select the Project(s)
  - **2**: Form the Team
  - **3**: Develop the Charter
  - **4**: Train the Team
  - **5**: Do DMAIC and Implement Solutions
  - **6**: Hand Off the Solution

Team Work Phases

- **#1: Identify and Select the Project(s)**
  - Management reviews a list of potential projects and selects those most promising
    - Meaningful (real benefit) and manageable (scope)
    - Identify high-priority problems and boundaries
    - Clearly explain the business necessity
    - Select a Champion/Sponsor

Team Work Phases

- **#2: Form the Team**
  - Management selects:
    - A team leader (Black Belt or Green Belt)
    - Team members
      - Good working knowledge of the situation
      - Not part of the problem
      - Motivated to be a team member

Team Work Phases

- **#3: Develop the Charter**
  - Very important project document
    - Written guide to the problem and project approach
      - Business case for pursuing the project
      - Goal(s)
      - Basic project plan
      - Scope
      - Considerations
      - Roles and responsibilities
    - Drafted by Champion, refined by team
      - Living document

Team Work Phases

- **#4: Train the Team**
  - Very important to project
  - Reviews and level-sets DMAIC process and tools across team
  - One-to-four weeks of training, interspersed with working on the project
    - One week training, two-to-four weeks working
    - Repeat, as necessary

Team Work Phases

- **#5: Do DMAIC and Implement Solutions**
  - Team manages project, using DMAIC, and implements the solution
  - Using project management principles:
    - Initiate project
    - Develop project and management plans
    - Design approach and solution
    - Execute plans
    - Monitor and Control
    - Test and deliver solution

Team Work Phases

- **#6: Hand Off the Solution**
  - Process Owner accepts solution
    - Acceptance paperwork formally signed
  - Close project
    - Close out any contracts with suppliers
    - Conduct "Lessons Learned" session, document lessons learned, and submit to Process Asset Library (PAL)
    - Write "End of Project" report and submit to stakeholders
    - Submit project performance inputs on all team members and submit to respective supervisors
    - Release team members
  - Celebrate (acknowledge project's completion)

DMAIC Explained

- DMAIC ensures the following happens:
  1. Validate the problem with facts and data
  2. Remain customer-focused
  3. Prove the problem root cause(s) with facts and data
  4. Make real change and strive for creative new solutions
  5. Manage risk by testing and perfecting solutions
  6. Verify the solution(s) results with facts and data
  7. Ensure changes brought by solutions are sustained

DMAIC Explained

- **D**efine (the problem)
  - Sets the stage for the entire project
  - Asks “Who, What, When, Where, How, How Much, and Why?”
  - Drives new and original ways of thinking about business problems
  - Helps in developing the project charter
  - Voice of the Customer (VOC)
  - Precursor to next step (Measure) decisions about where to collect data

DMAIC Explained

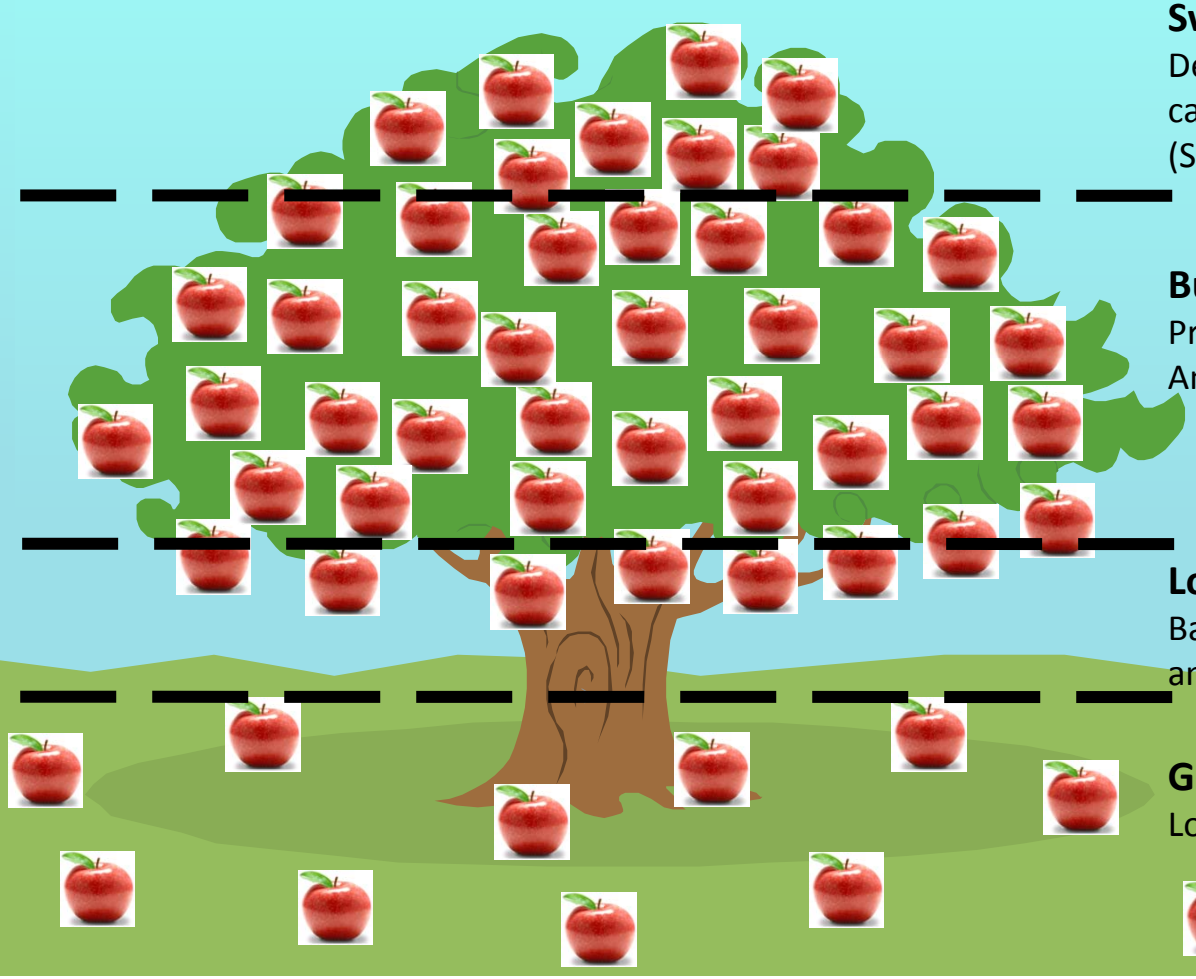
- **M**easure (the process and collect data)
  - Two main objectives:
    - Collect data to validate and quantify the problem or opportunity
    - Determine facts and figures that offer clues about the problem's cause(s)
  - Three main categories of measures
    - Outputs or outcomes (**results**)
    - Processes (**things that can be tracked and measured**)
    - Inputs (**things coming into processes for change into outputs**)
  - Sometimes, the measures already exist

DMAIC Explained

- **A**nalyze (analyze the data and make conclusions)
  - Apply problem-solving techniques to determine "root causes"
    - Look at Methods, Machines, Materials, Measures, Mother Nature, and People for sources
    - Use the right tools
      - Simple problems usually solved with simple tools
      - More complex or hidden problems may require more advanced tools (statistical techniques) to identify and verify cause(s)

DMAIC Explained

You Need the Right Tools to Do the Job



Sweet Fruit
Design for achieving highly capable performance (Six Sigma)

Bulk of Fruit
Process Characterization, Analysis, and Optimization

Low-Hanging Fruit
Basic Tools, Process Flow, and Pull

Ground Fruit
Logic and Intuition

DMAIC Explained

- **I**mprove (decide what to do and implement it)
  - Take analysis results and determine best approach and solution
    - Not so easy! (That's why team members are selected)
      - What the team decides to do here is the essence of what will reduce process variance (no magic bullet)
      - The team has the experts with solutions to all problems
    - May have to go back to charter to update problem and goal statements to reflect what is known at this point
    - Usually have to break free of old ways and thinking
    - May get new ideas by "Benchmarking"
  - Implement new approach to address root cause(s)
    - "**Pilot**" project (start small, learn, adjust, apply to more)
    - Monitor progress, verify impact, and communicate to stakeholders

DMAIC Explained

- **C**ontrol (sustain gains made by improvements)
  - Document, monitor, and assign accountability for sustainment
    - Redefine processes and capabilities
    - Implement process control
    - Complete project documentation
    - Help management focus on the few critical measures that indicate results and process health
    - "Sell" the project through presentations and demonstrations
    - Transition project responsibilities to owners
    - Ensure management support for long-range goals

CMMI for Development

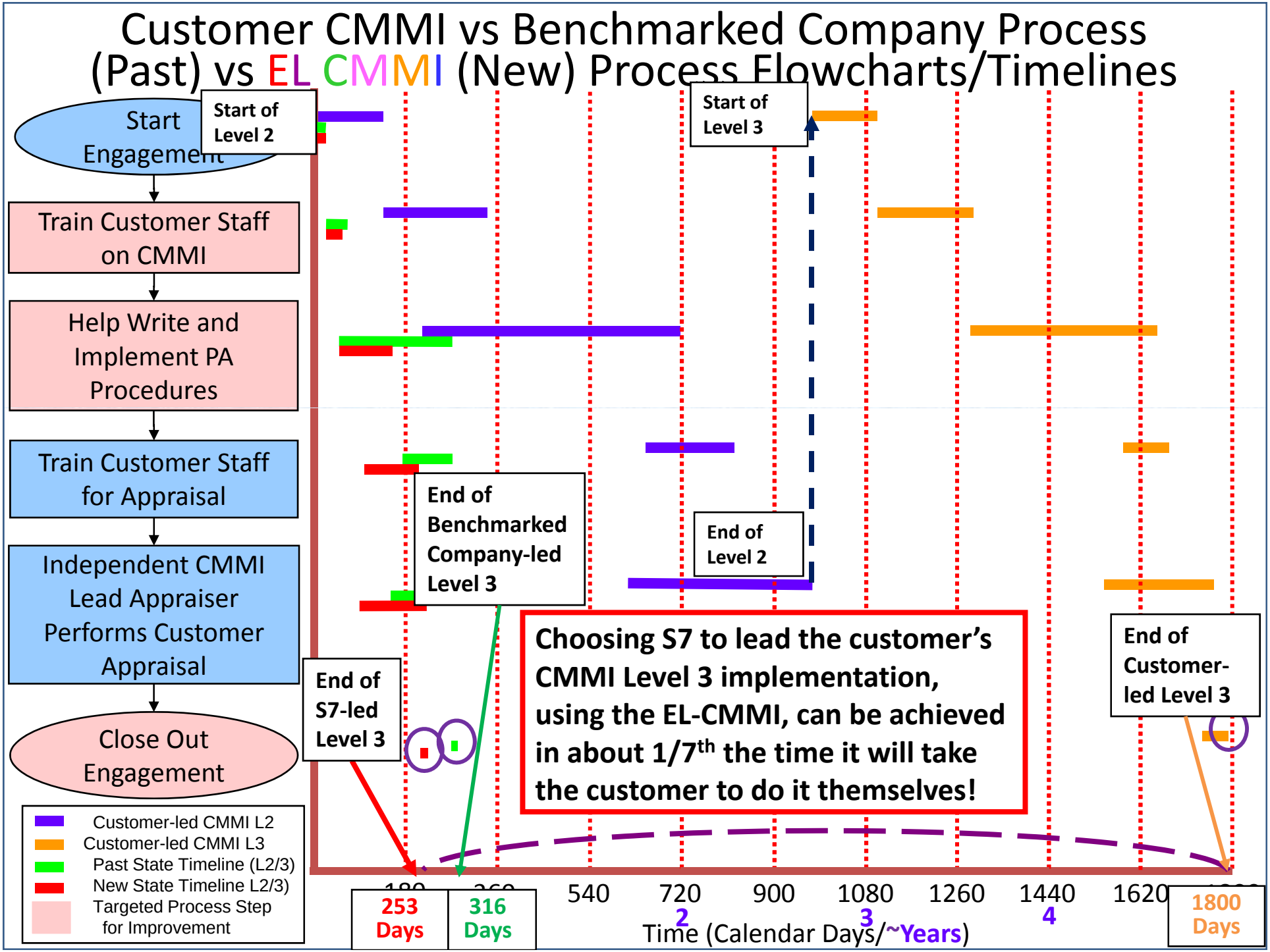
- We've talked about Lean and Six Sigma
  - So, now lets talk about CMMI at length!
  - NOT!
- This is the ASPIN, so I'll assume (Ya, I know!) you all know a lot about CMMI already
  - Lets just point out that Lean and Six Sigma share many of CMMI's principles

    …Just packaged a little differently
    - Less structured…just tells you methodologies and gives you tools
    - No "Best practices" offered…leaves things up to you
  - When you combine them, you get the best of all three
    - Here's how I used them…EL CMMI!

EL CMMI SIPOC Diagram

Suppliers	Inputs	Process	Outputs	Customers
•Synergy-7 •Customer Organization • CMU SEI	•CMMI Model •Customer SDLC (**Leverage Current Processes**) •Customer Guidelines •Customer Requirements •Customer Environment	•EL CMMI	•Defined and Documented Processes •Organizational Oversight Groups •CMMI-Compliant Procedures and Templates •Process Artifacts •Trained and Ready Customer Staff •Assessment That Customer Operates at Desired Level •Organization Sustainment Plan	•Customer Organization •Customer's Customers

Customer CMMI vs Benchmarked Company Process (Past) vs EL CMMI (New) Process Flowcharts/Timelines



Three Implementation Approaches (Cost)

- Do Nothing
- Customer-led
- Synergy-7-led; EL CMMI

The Cost of Doing Nothing
(No decision "is" a decision)

- Scope
  - 200-person software development organization
  - 0-person CMMI facilitation staff
  - Avg staff member salary w/benefits = $0K/Yr
  - Stay L1 for 5 years
  - Potential contracts: L3 = $5M/Yr; L2 = $3M/Yr (arbitrary notional data)
- Opportunity and Actual Costs/Gains
  - Opportunity costs = (5 years x $8M/Yr) = **$40M**
  - Opportunity gains = **$0**
  - Actual costs = 0 facilitators x $0K/Yr x 5 years = **$0 + (L3-L1 quality)**

The Cost of a CMMI Implementation
(Customer-Led Implementation…many don't make it)

- Scope
  - 200-person software development organization
  - 10-person CMMI facilitation staff (mid-senior)
  - Avg staff member salary w/benefits = $70K/Yr
  - 3 years to achieve L2; 2 years to achieve L3
  - Potential contracts: L3 = $5M/Yr; L2 = $3M/Yr (arbitrary notional data)
- Opportunity and Actual Costs/Gains
  - Opportunity costs = (3 years x $8M/Yr) + (2 years x $5M/Yr) = $24M + $10M = **$34M**
  - Opportunity gains = 2 years x $3M/Yr = **$6M**
  - Actual costs = 10 facilitators x $70K/Yr x 5 years = **$3.5M + (lost productivity of facilitation staff for 5 years + 3 years of L3-L1 quality + 2 years of L3-L2 quality) → "Other"**

The Cost of a CMMI Implementation (Synergy-7-Led Implementation; EL CMMI)

- Scope
  - 200-person software development organization
  - 2-person Synergy-7 CMMI facilitation staff (senior)
  - Notional vendor rate = $100/Hr
  - Minimum project hours = (2 vendors x 40 Hrs/Wk x 36 Wks) = 2880 Hours (Note: 36 Wks = .7 Yr)
  - 10-person CMMI facilitation staff (mid-senior) – "Knowledge Transfer"
  - Avg staff member salary w/benefits = $70K/Yr
  - Staff costs = 10 people x $70K/Yr x .7 Yr x 50% of the time = $245K
  - Additional project hours = needed hours for customer to continue seamless support to customers, while performing and achieving L3 implementation actions
  - Potential contracts: L3 = $5M/Yr; L2 = $3M/Yr (arbitrary notional data)
- Opportunity and Actual Costs/Gains
  - Opportunity costs = (.7 Yr x $8M/Yr) = **$5.6M**
  - Opportunity gains = 4.3 years x $8M/Yr = **$34.4M**
  - Actual costs = 2880 Hrs x $100/Hr = **$.3M + .25M + (part-time vendor hours needed for additional project hours + partial lost productivity of customer staff + .7 years of L3-L1 quality) → "Other"**

The Costs of a CMMI Implementation (Side-by-Side Comparison)

- Do Nothing (**L1 = 5 Years**)
  - Opportunity costs = **$40M** Opportunity gains = **$0M**
  - Actual costs = **L3-L1 quality for 5 years**
  - **Total Cost = $40M + (5 years of lost L3-L1 quality)**
- Customer-led (**L1 = 3Yrs; L2 = 2Yrs**)
  - Opportunity costs = **$34M** Opportunity gains = **$6M**
  - Actual costs = **$3.5M + "Other"**
  - **Total Cost = $31.5M + 3 years of lost (facilitation staff productivity + L3-L1 quality) + 2 years of lost (facilitation staff productivity + L3-L2 quality)**
- Synergy-7-led; EL CMMI (**L1 = .7Yrs; L3 = 4.3Yrs**)
  - Opportunity costs = **$5.6M** Opportunity gains = **$34.4M**
  - Actual costs = **$.3M (S7) + $.25M Facilitation Staff + "Other"**
  - **Total Cost = $28.2M + part-time vendor hours needed for additional project hours + .7 years of lost (facilitation staff productivity + L3-L1 quality)**

Conclusions

- The "Experience-Led" Capability Maturity Model Integration (**EL CMMI**) process forms the basis for Synergy-7 (S7) Enterprises to **provide expert facilitation services to** its **process improvement customers**, significantly decreasing the time and costs required **to achieve desired Capability** and/or **Maturity Levels**
  - S7 uses the **industry-standard model, the** Carnegie Mellon University's Software Engineering Institute's (SEI) **CMMI**
- **Choosing S7 to lead** the **customer's CMMI Level 3 implementation, using** the **EL CMMI**, can be **achieved in** about **1/7th the time** it will take the customer to do it themselves (if they need it that fast)!
- **Costs**/**Gains** to the customer
  - **Do Nothing: $40M+ (Loss)** **$68.8M Difference**
  - **Do-It-Yourself: $31.5M+ (Loss)** **$60.3M Difference**
  - **Let Synergy-7 lead it: $28.8M+ (Gain)** **559% ROI**
- **Which solution will your organization choose?**

Black Belt Improvements

- **What I changed and improved**
  - **Shortened the time it takes to:**
    - **Train Customer Staff on CMMI**
    - **Help Write and Implement PA Procedures**
    - **Close Out Engagement**
- **How I did it**
  - **Pre-prepared training and "templates"**
- **Impact to the organization**
  - **Saves the customer 2 months of benchmark company implementation time ($48,000)**
  - **Saves the customer 4.3 years of company "self-led" implementation time ($60+ M)**
  - **Significantly increases likelihood of customer process improvement success**

Review

- Review Lean (from last time)
- Finish Lean and Review Lessons
- Six Sigma
- Team Work Phases
- DMAIC
- CMMI
- A Lean Six Sigma and CMMI project
- Questions, Thoughts, Comments