SIX SIGMA OVERVIEW

PM SIMPLIFY

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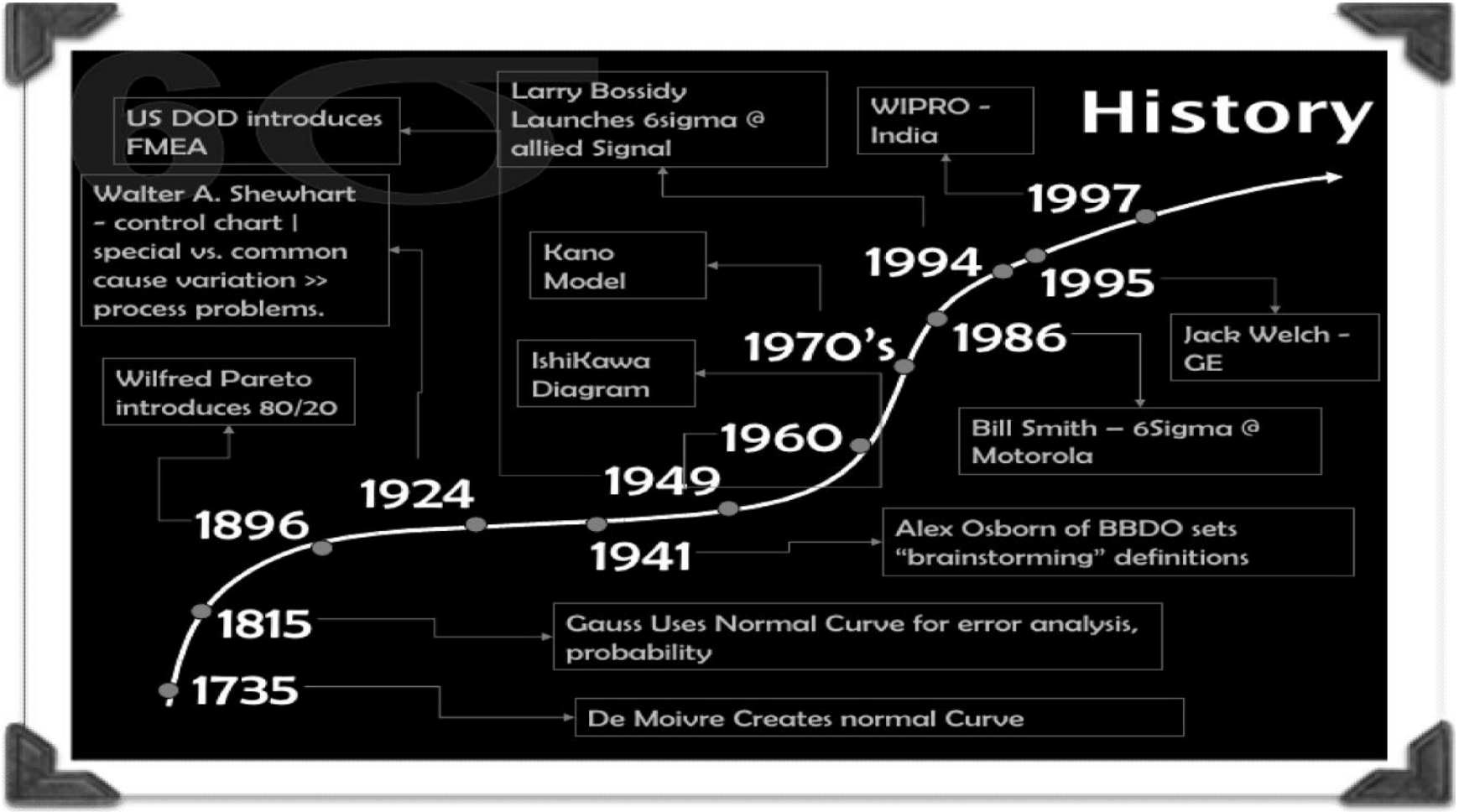
History of Six Sigma



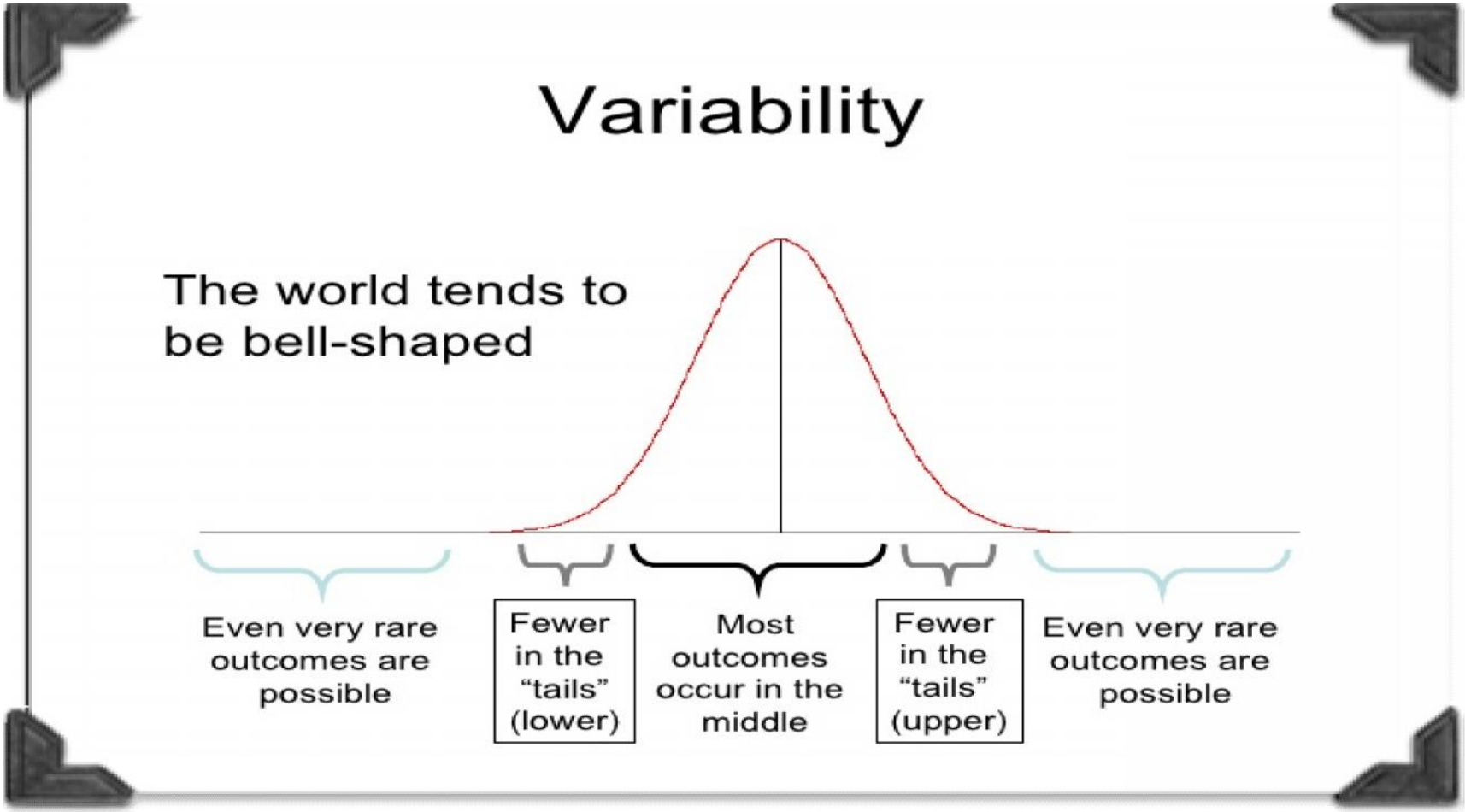
Introduction to Six Sigma

- It is a methodology for continuous improvement
- It is a methodology for creating products and processes that perform at high standards.
- It is a Quality Philosophy & a Management Technique
- It leverages application of statistical tools within a structured methodology
- Repeated application of strategy to individual projects

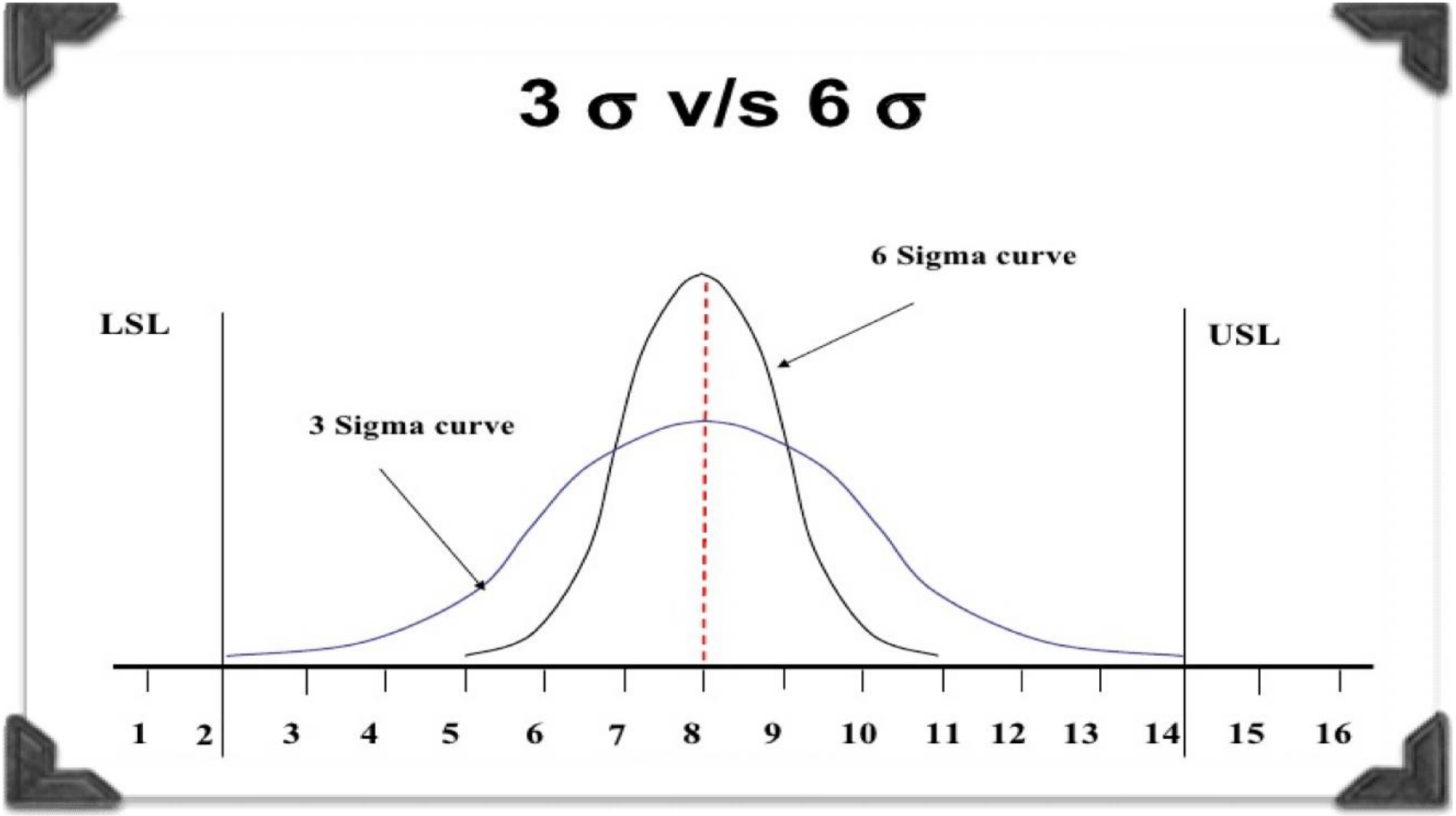
Definition of Six Sigma

- Six Sigma is the measure of quality that strives for near perfection. It is a disciplined, data-driven methodology focused on eliminating defects.
- A Six Sigma defect is defined as anything that falls out of a customer's specifications.

Variability



Difference between 3 Sigma and 6 Sigma



3 Sigma and 6 Sigma : A perspective

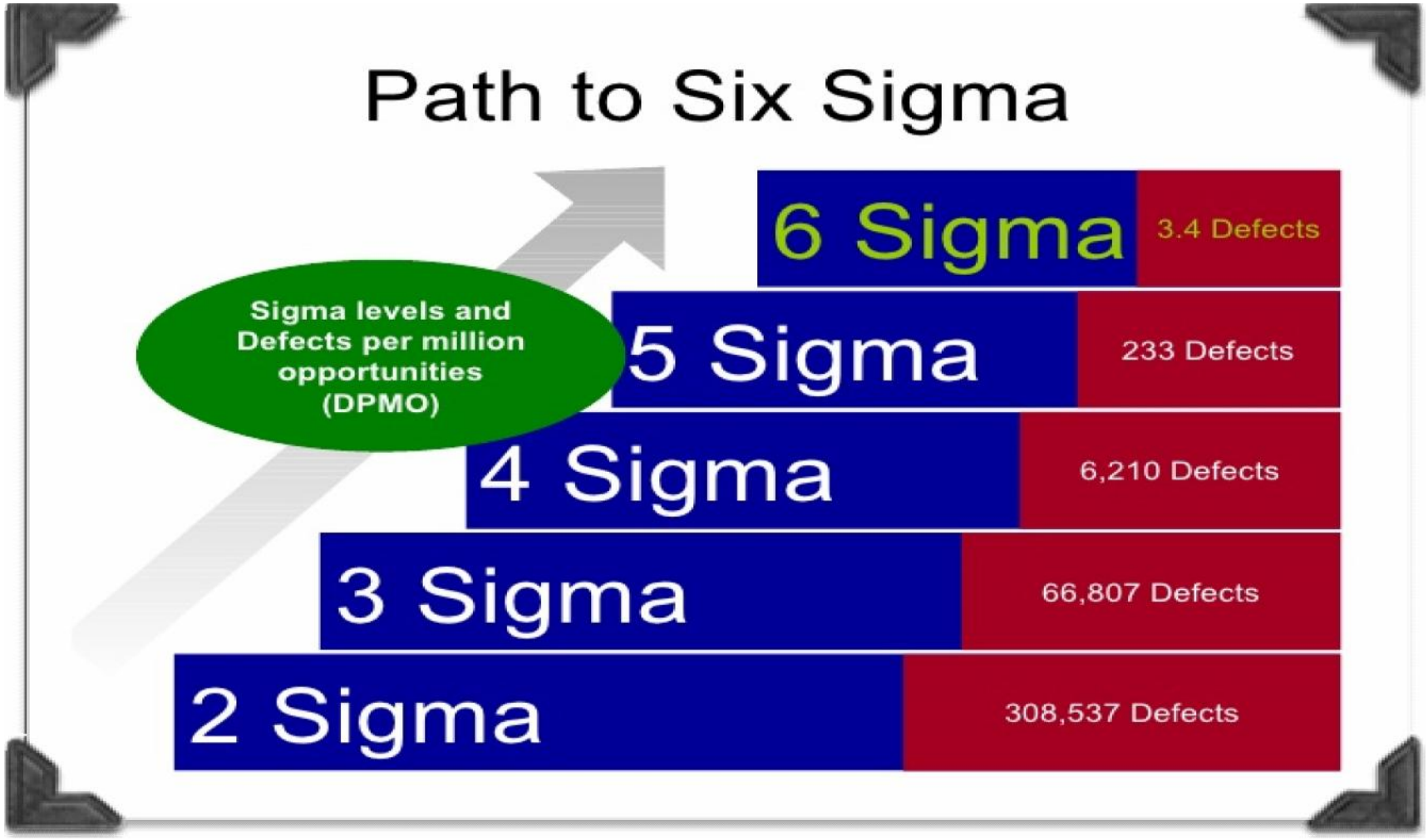
3 SIGMA

1. 20,000 lost mails per hour
2. 200,000 wrong drug prescriptions each year
3. 5000 incorrect surgical operations per week
4. 2 short or long landing at major airports daily.

6 SIGMA

1. 7 lost mails per hour
2. 68 wrong drug prescriptions each year
3. 1.7 incorrect surgical operations per week
4. 1 short or long landing at major airports every five year.

Six Sigma : 3.4 defects per million



Philosophy + Process + Statistics

Philosophy

- Anything less than ideal is an opportunity for improvement
- Defects costs money
- Understanding processes and improving them is the most efficient way to achieve lasting results

Process

- To achieve this level of performance you need to: Define, Measure, Analyze, Improve and Control

Statistics

- Six Sigma processes will produce less than 3.4 defects per million opportunities

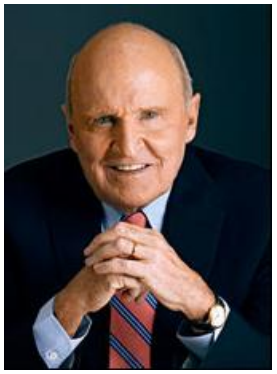
The Growth of Six Sigma

Six Sigma at GE

- Where has GE implemented Six Sigma ?
- Approving a credit card application
- Installing a turbine
- Lending money
- Servicing an aircraft engine
- Answering a service call for an appliance
- Underwriting an insurance policy
- Developing software for a new CAT product
- Overhauling a locomotive

History of Six Sigma at GE

- In 1995 GE mandated each employee to work towards achieving 6 sigma
- The average process at GE was 3 sigma in 1995
- In 1997 the average reached 3.5 sigma
- GE's goal was to reach 6 sigma by 2001
- Investments in 6 sigma training and projects reached 45million US$ in 1998, profits increased by 1.2Billion US$



" The most important initiative GE has ever undertaken".

Jack Welch
Chief Executive Officer
General Electric

Positive quotations

- If you're an average Black Belt, proponents say you'll find ways to save $1 million each year
- Raytheon figures it spends 25% of each sales dollar fixing problems when it operates at four sigma, a lower level of efficiency. But if it raises its quality and efficiency to Six Sigma, it would reduce spending on fixes to 1%
- The plastics business, through rigorous Six Sigma process work , added 300 million pounds of new capacity (equivalent to a 'free plant'), saved $400 million in investment and will save another $400 million by 2000

Negative quotations

- Because managers' bonuses are tied to Six Sigma savings, it causes them to fabricate results and savings turn out to be phantom"
- Marketing will always use the number that makes the company look best …Promises are made to potential customers around capability statistics that are not anchored in reality
- Six Sigma will eventually go the way of the other fads

Barriers to Implementation

- Lack of commitment from leadership.
- Unable to change mindset from event-driven to process-driven.
- Engineers and managers are not interested in mathematical statistics.
- Statisticians have problems communicating with managers and engineers.
- Non-statisticians experience “statistical anxiety” which has to be minimized before learning can take place.
- Statistical methods needs to be matched to management style and organizational culture.

Focus of Six Sigma*

- Customer Focus !
- Accelerating fast breakthrough performance
- Significant financial results in 4-8 months
- Ensuring Six Sigma is an extension of the Corporate culture, not the program of the month
- Results first, then culture change!

*Adapted from Zinkgraf (1999), Sigma Breakthrough Technologies Inc., Austin, TX.

Six Sigma: Critical Success Factors

- Top management leadership & commitment
- A well-implemented customer management system
- The education and training system
- A well-developed strategic planning system
- A well-organized information and analysis system
- A well-implemented process management system
- A well-developed supplier management system
- Availability of tools
- A well-developed human resource management system
- A well-developed competitive benchmarking system

Deep Dive !

1. Key Elements

- Customer
- Process
- Employees

2. Six Sigma Levels

- Master Black Belt
- Black Belt
- Green Belt
- Yellow Belt

3. Key Terminologies

- COPQ : Cost of Poor Quality
- CTQ : Critical to Quality
- DO : Defect Opportunity
- DPO: Defect Per Opportunity
- DPMO: Defect Per Million Opportunity
- CPK : Process Capability

4. Methodologies

- DMAIC
- DMADV

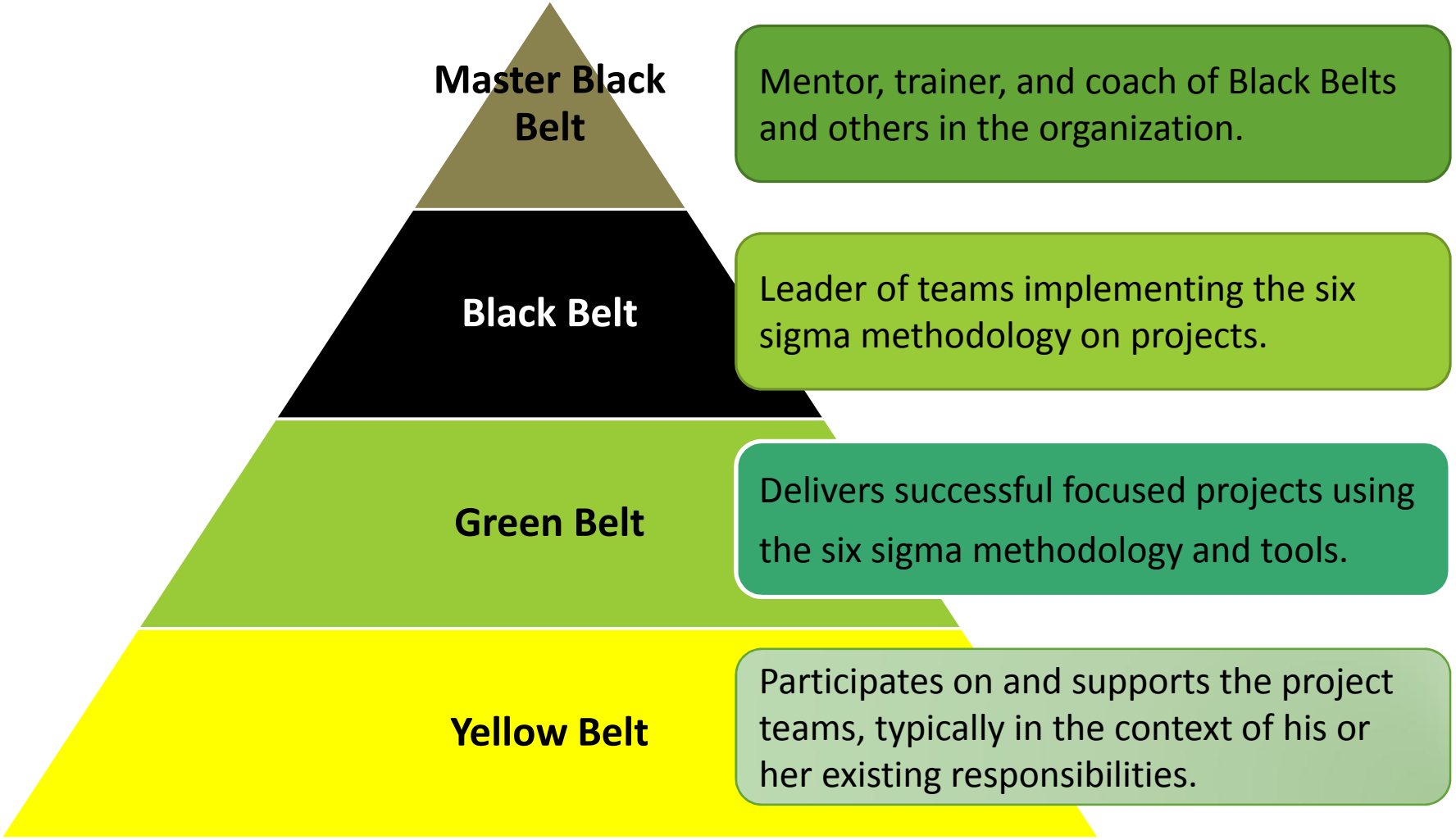
Key Elements

Key Elements

- The Customer: Customers define quality. They expect performance, reliability, competitive prices, on-time delivery, service, clear and correct transaction processing and more. Today, Delighting a customer is a necessity. Because if we don't do it, someone else will!
- The Processes: Defining Processes and defining Metrics and Measures for Processes is the key element of Six Sigma. Quality requires to look at a business from the customer's perspective, In other words, we must look at defined processes from the outside-in. By understanding the transaction lifecycle from the customer's needs and processes, we can discover what they are seeing and feeling. This will give a chance to identify week area with in a process and then we can improve them.
- The Employees: The company must involve all employees in Six Sigma Program. Company must provide opportunities and incentives for employees to focus their talents and ability to satisfy customers. This is important to six sigma that all team members should have a well-defined role with measurable objectives

Six Sigma Levels

Six Sigma Levels



Master Black Belt

- Enterprise Six Sigma expert.
- Permanent full-time change agent.
- Certified Black Belt with additional specialized skills or experience especially useful in deployment of Six Sigma across the enterprise
- Highly proficient in using Six Sigma methodology to achieve tangible business results.
- Technical expert beyond Black Belt level on one or more aspects of process improvement (for example, advanced statistical analysis, project management, communications, program administration, teaching, project coaching)
- Identifies high-leverage opportunities for applying the Six Sigma approach across the enterprise
- Coach / Mentor Black Belts

Black Belt

- Six Sigma technical expert
- Temporary, full-time change agent (will return to other duties after completing a two to three year tour of duty as a Black Belt)
- Leads business process improvement projects where Six Sigma approach is indicated.
- Successfully completes high-impact projects that result in tangible benefits to the enterprise
- Demonstrated mastery of Black Belt bod of knowledge
- Demonstrated proficiency at achieving results through the application of the Six Sigma approach
- Coach / Mentor Green Belts
- Recommends Green Belts for Certification

Green Belt

- Six Sigma Project originator
- Part-time Six Sigma change agent. Continues to perform normal duties while participating on Six Sigma project teams
- Six Sigma champion in local area
- Recommends Six Sigma projects
- Participates on Six Sigma project teams
- Leads Six Sigma teams in local improvement projects

Yellow Belt

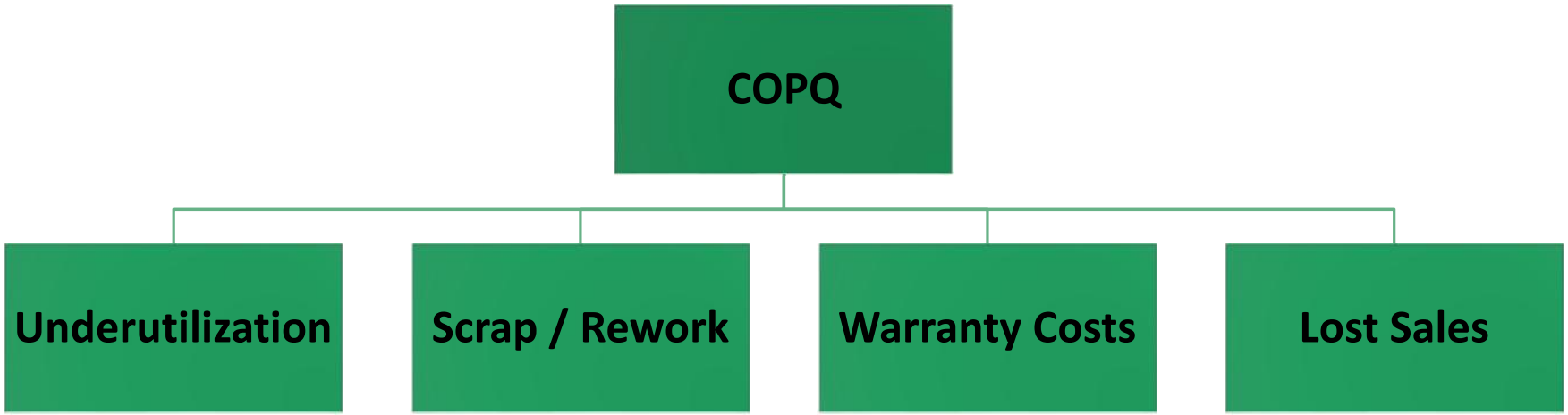
- Learns and applies Six Sigma tools to projects
- Actively participates in team tasks
- Communicates well with other team members
- Demonstrates basic improvement tool knowledge
- Accepts and executes assignments as determined by team

Key Terminologies

List of Terminologies

- COPQ : Cost of Poor Quality
- CTQ : Critical to Quality
- DO : Defect Opportunity
- DPO: Defect Per Opportunity
- DPMO: Defect Per Million Opportunity

COPQ (Cost of Poor Quality)



CTQ (Critical-To-Quality)

- CTQ characteristics for the process, service or process
- Measure of “What is important to Customer”
- Six Sigma projects are designed to improve CTQ
- Examples:
  - Waiting time in clinic
  - Spelling mistakes in letter
  - % of valves leaking in operation

Defect Opportunity

- Number of defect opportunities relate to complexity of unit.
- Complex units – Greater opportunities of defect than simple units
- Examples:
  - A units has 5 part
  - in each part there are 3 opportunities of defects
  - Total defect opportunities are 5 x 3 = 15

DPO (Defect Per Opportunity)

- Number of defects divided by number of defect opportunities
- Examples:
  - In previous case (15 defect opportunities), if 10 units have 2 defects.
  - Defects per unit = 2 / 10 = 0.2
  - DPO = 2 / (15 x 10) = 0.0133333

DPMO (Defect Per Million Opportunities)

- DPO multiplied by one million
- Examples:
  - In previous case (15 defect opportunities), if 10 units have 2 defects.
  - Defects per unit = 2 / 10 = 0.2
  - DPO = 2 / (15 x 10) = 0.0133333
  - DPMO = 0.013333333 x 1,000,000 = 13,333

Methodologies: DMAIC & DMADV

DMAIC Model

DMAIC Method

DEFINE	Determines the scope and purpose of the project
MEASURE	The collection of information on the current situation
ANALYZE	Determines the root causes of defects and explore and organize potential cause
IMPROVE	The development of solution that are implemented to remove the root causes and then measured and evaluated for desired result
CONTROL	Standardizes the improvement process to maintain the gains

Define

DEFINE

- Who wants the project and why ?
- The scope of project / improvement (SMART Objective)
- Key team members / resources for the project
- Critical milestones and stakeholder review
- Budget allocation

MEASURE

ANALYZE

IMPROVE

CONTROL

Measure

DEFINE

MEASURE

- Ensure measurement system reliability
  - - Is tool used to measure the output variable flawed ?
- Prepare data collection plan
  - - How many data points do you need to collect ?
  - How many days do you need to collect data for ?
  - What is the sampling strategy ?
  - Who will collect data and how will data get stored ?
  - What could the potential drivers of variation be ?
- Collect data

ANALYZE

IMPROVE

CONTROL

Analyze

DEFINE

MEASURE

ANALYZE

- How well or poorly processes are working compared with
  - Best possible (Benchmarking)
  - Competitor's
- Shows you maximum possible result
- Don't focus on symptoms, find the root cause

IMPROVE

CONTROL

Improve

DEFINE

MEASURE

ANALYZE

IMPROVE

- Present recommendations to process owner.
- Pilot run
- Formulate Pilot run.
- Test improved process (run pilot).
- Analyze pilot and results.
- Develop implementation plan.
- Prepare final presentation.
- Present final recommendation to Management Team.

CONTROL

Control

DEFINE

MEASURE

ANALYZE

IMPROVE

CONTROL

- Don’t be too hasty to declare victory.
- How will you maintain to gains made?
  - Change policy & procedures
  - Change drawings
  - Change planning
  - Revise budget
  - Training

DMADV Model

DMADV Method

DEFINE	You will define the goals of the project and that of the customers (both internal and external)
MEASURE	Here you will quantify the customer needs as well as the goals of the management
ANALYZE	Analyze the options, existing process to determine the cause of error and evaluate corrective measures
DESIGN	Design a new process or a corrective step to the existing one to eliminate the error.
VERIFY	Verify, by simulation or otherwise, the performance of the design and its ability to meet the target needs.

Define

DEFINE

- Like in DMAIC, the first phase of the DMADV process is the define phase.
- In this phase the goal of the process is designed.
- At the same time, internal goals for the company working on the DMADV are also set up.

MEASURE

ANALYZE

DESIGN

VERIFY

Measure

DEFINE

MEASURE

- The critical to quality aspects are identified and measured.
- The product capabilities and risks are also identified and quantified.
- This helps in better understanding of the goal of the customer.

ANALYZE

DESIGN

VERIFY

Analyze

DEFINE

MEASURE

ANALYZE

- The data gathered and quantified is analyzed.
- This analysis is used for developing and designing alternatives.
- High level design is created with the analysis.
- The capability of the design its stability are tested.
- Using the test results, the best of the alternatives from the design are chosen.

DESIGN

VERIFY

Design

DEFINE

MEASURE

ANALYZE

DESIGN

- The design is optimized further.
- A verification plan is set up which helps in analyzing the design.
- The aim of this phase is to ensure that the right process is chosen.

VERIFY

Verify

DEFINE

MEASURE

ANALYZE

DESIGN

VERIFY

- Once the optimum design has been chosen it is verified.
- Simulation may be used for verifying the design.
- Test runs are carried out to verify that the process works fine and is able to meet the target.
- Once the results are positive, the process is implemented and handed over to the customer.

Similarities of DMAIC & DMADV

- Both the methodologies are used for reducing the number of defects to less than 3.4 per million opportunities available for such defects to occur.
- Both the methodologies use facts and statistical tools for finding solutions to common problems, related to quality.
- Both the methodologies require the services of Green Belts, Black Belts and Master Black Belts during the implementation stage
- Both concentrate on achieving the financial and business objectives of an organization.
- Both the methodologies require support from a Champion and Process Owner during the implementation stage.

DMAIC vs DMADV

DMAIC	DMADV
Associated with defining a business process and its applicability	Helps in defining customer needs in relation to a product or service
Used for measuring the current performance of a business process	Used for measuring the customer needs and specifications
Business process is analyzed to find the root cause of a defect or recurring problem	Business process is analyzed for finding options that will help in satisfying the customer needs and specifications
Improvements are made in the business process for eliminating or reducing defects	An appropriate business model is designed that helps in meeting customer requirements
Control systems are put in place to keep a check on future performance of a business process	The suggested business model is put through simulation tests for verifying efficacy in meeting customer needs and specifications.

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