SIX-SIGMA
GREEN BELT

BODY OF KNOWLEDGE 2019

PRANAMIKA
EDUCATION TRUST

About Us

PET(Pranamika Education Trust, Vadodara, Gujarat, India) is a nonprofit making trust set up specifically for the skill set development of the people who are working in the industries and the students who are about to complete their study and willing to make their career in QA, QC, SCM, Operational Excellence, Manufacturing Excellence and Business Excellence in hospitality, service and manufacturing industries. There is a hard-core Team behind the success of the PET in form of Expert Experience Business Excellence and Engineering People who had served the industries for decades.

Who We Are?

PET's operational strategy consulting institution focusing mainly on Strategy, Innovation, Operational Excellence, Lean Six Sigma, Decision Sciences, Big data analytics and Change Management to individuals working in the industries to excel the industries where they serve .

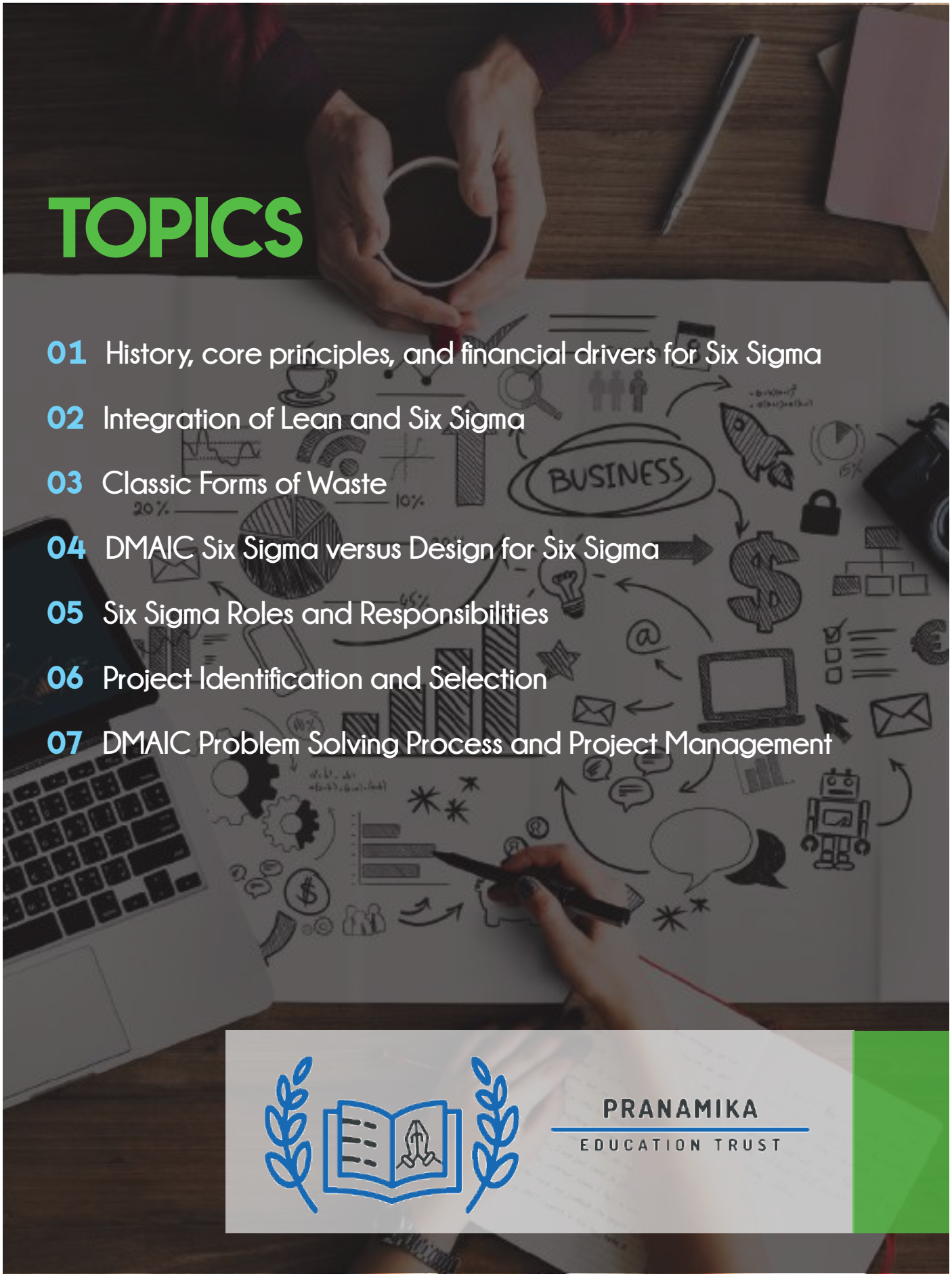
We work with market leading organizations across multiple industry verticals solving high impact business problems in key horizontals such as Manufacturing, Marketing, Risk and Supply Chain. Organizations are challenged with scaling the use of analytics and making it an integral part of all business decisions. The dynamic nature of business requires Decision Sciences, an interdisciplinary approach of business, applied math, technology, design thinking and behavioral sciences, to solve constantly shifting and ill-defined business problems.

What We Do?

Organizations are challenged with scaling the use of analytics and other knowledge areas to make it an integral part of all business decisions. PET addresses this critical need and enables organizations to institutionalize analytics and Decision Sciences in a sustainable manner.

We work with organizations across multiple industry verticals solving high impact business problems in key horizontals such as Marketing, Process/ Product Improvement, Technology, Manufacturing, Risk Management and Supply Chain. Our expertise and experience cut across multiple and disparate verticals such as Retail, BFSI, Pharmaceutical, Healthcare, Technology, and many more. We believe that in a world of blurring value-chain boundaries and continuous transformation, organizations can profit from cross-industry / domain expertise. Over the years, we have leveraged this experience to enable innovation and convergence for our clients.

PET defining Decision Sciences, Big Data analytics and Lean Six Sigma services helps enterprises institutionalize data-driven decision making. Our unique interdisciplinary approach and cross-industry learning drive innovation in solving high impact business problems across marketing, risk management and supply chain.



TOPICS

01 History, core principles, and financial drivers for Six Sigma

02 Integration of Lean and Six Sigma

03 Classic Forms of Waste

04 DMAIC Six Sigma versus Design for Six Sigma

05 Six Sigma Roles and Responsibilities

06 Project Identification and Selection

07 DMAIC Problem Solving Process and Project Management

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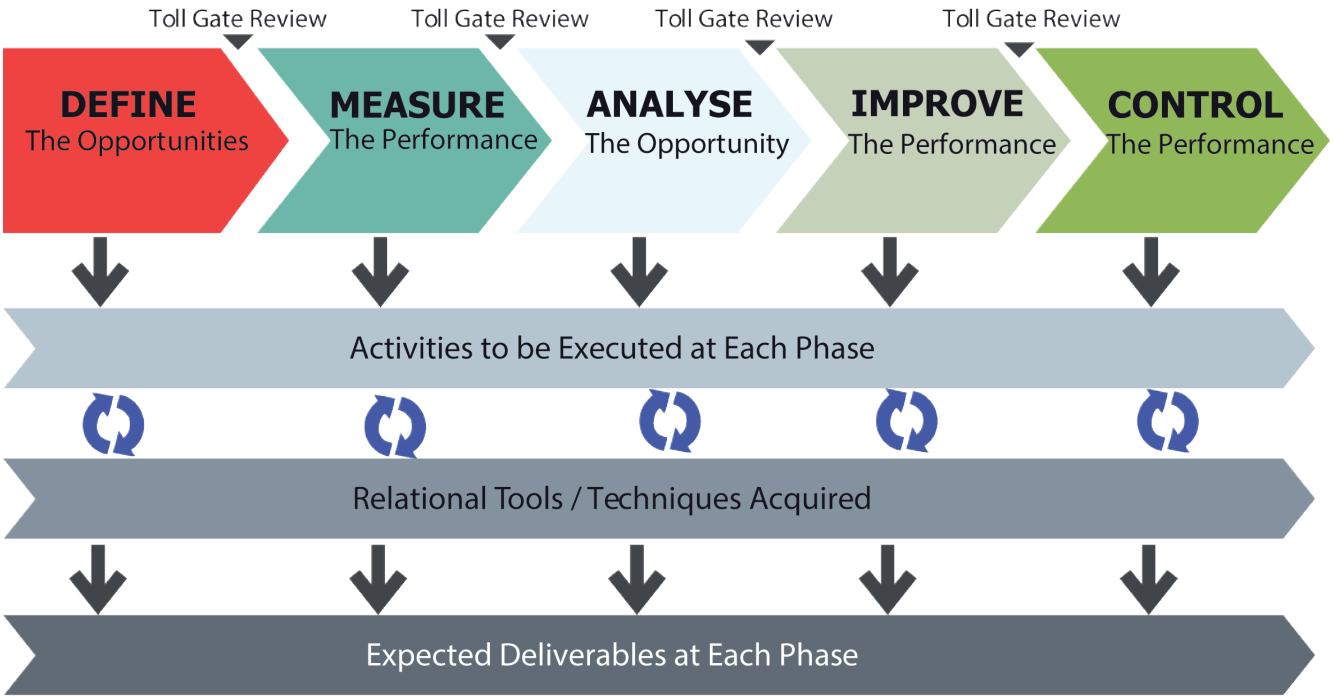
Lean Six-Sigma : DMAIC



Why?

If you're a budding project manager, or interested in becoming one, you should learn Six Sigma and Lean at one point. Preferably now. They're two different but highly complementary approaches to streamlining business processes and eliminating waste. Initially, Six Sigma was used in manufacturing to improve quality and efficiency while bettering business practices.

Lean's focus is to streamline unnecessary steps in the development of a product, so the steps taken to make it only add value. Lean is entirely based on whether the customer would buy the product or not.

Six Sigma believes that the root cause of waste is variance, focusing instead on quality control versus value-add. But both systems have the same eventual goal: to create the most efficient system and the best product possible.

Overview : Six-Sigma

A. Six Sigma and Organizational Goals

1. Value of Six Sigma

Recognize why organizations use Six Sigma, how they apply its philosophy and goals, and the evolution of Six Sigma from quality leaders such as Juran, Deming, Shewhart, Ishikawa, and others.

2. Organizational goals and Six Sigma projects

Identify the linkages and supports that need to be established between a selected Six Sigma project and the organization's goals, and describe how process inputs, outputs, and feedback at all levels can influence the organization as a whole.

3. Organizational drivers and metrics

Recognize key business drivers (profit, market share, customer satisfaction, efficiency, product differentiation) for all types of organizations. Understand how key metrics and scorecards are developed and how they impact the entire organization.

B. Lean Principles in the Organization

1. Lean Concepts

Define and describe lean concepts such as theory of constraints, value chain, flow, and perfection.

2. Value stream mapping

Use value stream mapping to identify value-added processes and steps or processes that produce waste, including excess inventory, unused space, test inspection, rework, transportation, and storage.

C. Design for Six Sigma (DfSS) Methodologies

1. Road maps for DfSS

Distinguish between DMADV (define, measure, analyze, design, verify) and IDOV (identify, design, optimize, verify), and recognize how they align with DMAIC. Describe how these methodologies are used for improving the end product or process during the design (DfSS) phase.

2. Basic failure mode and effects analysis (FMEA)

Use FMEA to evaluate a process or product and determine what might cause it to fail and the effects that failure could have. Identify and use scale criteria, calculate the risk priority number (RPN), and analyze the results.

3. Design FMEA and process FMEA

Define and distinguish between these two uses of FMEA.

Phases

DEFINE : define the problem

A. Project Identification

1. Project Selection

Describe the project selection process and what factors should be considered in deciding whether to use the Six Sigma DMAIC methodology or another problem-solving process.

2. Process Elements

Define and describe process components and boundaries. Recognize how processes cross various functional areas and the challenges that result for process improvement efforts.

3. Benchmarking

Understand various types of benchmarking, including competitive, collaborative, and best practices.

4. Process Inputs and Outputs

Identify process input and output variables and evaluate their relationships using the supplier, input, process, output, customer (SIPOC) model.

5. Owners and Stakeholders

Identify the process owners and other stakeholders in a project.

B. Voice of the Customer (VoC)

1. Customer Identification

Identify the internal and external customers of a project, and what effect the project will have on them.

2. Customer Data

Collect feedback from customers using surveys, focus groups, interviews, and various forms of observation. Identify the key elements that make these tools effective. Review data collection questions to eliminate vagueness, ambiguity, and any unintended bias.

3. Customer Requirements

Use quality function deployment (QFD) to translate customer requirements statements into product features, performance measures, or opportunities for improvement. Use weighting methods as needed to amplify the importance and urgency of different kinds of input; telephone call vs. survey response; product complaint vs. expedited service request.

C. Project Management Basics

1. Project charter

Define and describe elements of a project charter and develop a problem statement that includes baseline data or current status to be improved and the project's goals.

2. Project Scope

Help define the scope of the project using process maps, Pareto charts, and other quality tools.

3. Project Metrics

Help develop primary metrics (reduce defect levels by x-amount) and consequential metrics (the negative effects that making the planned improvement might cause).

4. Project Planning Tools

Use Gantt charts, critical path method (CPM), and program evaluation and review technique (PERT) charts to plan projects and monitor their progress.

5. Project Documentation

Describe the types of data and input needed to document a project. Identify and help develop appropriate presentation tools (storyboards, spreadsheet summary of results) for phase reviews and management updates.

6. Project Risk Analysis

Describe the elements of a project risk analysis, including feasibility, potential impact, and risk priority number (RPN). Identify the potential effect risk can have on project goals and schedule, resources (materials and personnel), costs and other financial measures, and stakeholders.

7. Project Closure

Review with team members and sponsors the project objectives achieved in relation to the charter and ensure that documentation is completed and stored appropriately. Identify lessons learned and inform other parts of the organization about opportunities for improvement.

D. Management and Planning Tools

Define, select, and apply these tools

1) Affinity diagrams
2) Interrelationship Digraphs
3) Tree Diagrams
4) Prioritization Matrices
5) Matrix Diagrams
6) Process Decision Program Charts (PDPC)
7) Activity Network Diagrams

E. Business Results for Projects

1. Process Performance

Calculate process performance metrics such as defects per unit (DPU), rolled throughput yield (RTY), cost of poor quality (CoPQ), defects per million opportunities (DPMO), sigma levels, and process capability indices. Track process performance measures to drive project decisions.

2. Communication

Define and describe communication techniques used in organizations: top-down, bottom-up, and horizonta.

F. Team Dynamics and Performance

1. Team Stages and Dynamics

Define and describe the stages of team evolution, including forming, storming, norming, performing, adjourning, and recognition. Identify and help resolve negative dynamics such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, groupthink, feuding, floundering, the rush to accomplishment, attribution, discounts, digressions, and tangents.

2. Team Roles and Responsibilities

Describe and define the roles and responsibilities of participants on Six Sigma and other teams, including Black Belt, Master Black Belt, Green Belt, champion, executive, coach, facilitator, team member, sponsor, and process owner.

3. Team Stages and Dynamics

Define and apply team tools such as brainstorming, nominal group technique, and multivoting.

4. Team Roles and Responsibilities

Identify and use appropriate communication methods (both within the team and from the team to various stakeholders) to report progress, conduct reviews, and support the overall success

MEASURE : quantify your problem

A. Process Analysis and Documentation

Develop process maps and review written procedures, work instructions, and flowcharts to identify any gaps or areas of the process that are misaligned.

B. Probability and Statistics

1. Basic Probability Concepts

Identify and use basic probability concepts: independent events, mutually exclusive events, multiplication rules, permutations, and combinations.

2. Central Limit Theorem

Define the central limit theorem and describe its significance in relation to confidence intervals, hypothesis testing, and control charts.

C. Statistical Distributions

Define and describe various distributions as they apply to statistical process control and probability: normal, binomial, Poisson, chi square, Student's t, and F.

D. Collecting and Summarizing Data

1. Types of Data and Measurement Scales

Identify and classify continuous (variables) and discrete (attributes) data. Describe and define nominal, ordinal, interval, and ratio measurement scales.

2. Sampling and Data Collection Methods

Define and apply various sampling methods (random and stratified) and data collection methods (check sheets and data coding).

3. Descriptive statistics

Define, calculate, and interpret measures of dispersion and central tendency. Develop and interpret frequency distributions and cumulative frequency distributions.

4. Sampling and Data Collection Methods

Construct and interpret diagrams and charts that are designed to communicate numerical analysis efficiently, including scatter diagrams, normal probability plots, histograms, stem-and-leaf plots, box-and-whisker plots.

E. Measurement System Analysis (MSA)

Calculate, analyze, and interpret measurement system capability using gauge repeatability and reproducibility (GR&R) studies, measurement correlation, bias, linearity, percent agreement, and precision/tolerance (P/T).

F. Process and Performance Capability

1. Process Performance vs. Process Specifications

Define and distinguish between natural process limits and specification limits, and calculate process performance metrics.

2. Process Capability Studies

Define, describe, and conduct process capability studies, including identifying characteristics, specifications, and tolerances, and verifying stability and normality.

3. Process Capability (Cp, Cpk) and Process Performance (Pp, Ppk) Indices

Describe the relationship between these types of indices. Define, select, and calculate process capability and process performance. Describe when Cpm measures can be used. Calculate the sigma level of a process.

4. Short-term vs. Long-term Capability and Sigma Shift

Describe the assumptions and conventions that are appropriate to use when only short-term data are used. Identify and calculate the sigma shift that occurs when long- and short-term data are compared.

ANALYZE : identify the cause of the problem

A. Exploratory Data Analysis

1. Multi-vari Studies

Select appropriate sampling plans to create multi-vari study charts and interpret the results for positional, cyclical, and temporal variation.

2. Correlation and Linear Regression

Describe the difference between correlation and causation. Calculate the correlation coefficient and linear regression and interpret the results in terms of statistical significance (p-value). Use regression models for estimation and prediction

B. Hypothesis Testing

1. Basics

Distinguish between statistical and practical significance. Determine appropriate sample sizes and develop tests for significance level, power, and type I and type II errors.

2. Tests for Means, Variances, and Proportions

Conduct hypothesis tests to compare means, variances, and proportions (paired-comparison t-test, F-test, analysis of variance [ANOVA], chi square) and interpret the results.

IMPROVE : implement and verify the solution

A. Design of Experiments (DoE)

1. Basic Terms

Define and describe terms such as independent and dependent variables, factors and levels, responses, treatments, errors, repetition, blocks, randomization, effects, and replication. (Understand).

2. DoE Graphs and Plots

Interpret main effects analysis and interaction plots.

B. Root Cause Analysis

Use cause and effect diagrams, relational matrices, and other problem-solving tools to identify the true cause of a problem.

D. Lean Tools

1. Waste Elimination

Select and apply tools and techniques for eliminating or preventing waste, including pull systems, kanban, 5S, standard work, and poka-yoke.

2. Cycle-time Reduction

Use various techniques to reduce cycle time (continuous flow, setup reduction).

3. Kaizen and kaizen blitz

Define and distinguish between these two methods and apply them in various situations.

CONTROL : maintain the solution

A. Statistical Process Control (SPC)

1. SPC Basics

Describe the theory and objectives of SPC, including measuring and monitoring process performance for both continuous and discrete data. Define and distinguish between common and special cause variation and how these conditions can be deduced from control chart analysis.

2. Rational Subgrouping

Define and describe how rational subgrouping is used.

3. Control Charts

Identify, select, construct, and use control charts: X-R, X-s, individual and moving range (ImR or XmR), median, p, np, c, and u.

B. Control Plan

Assist in developing and implementing a control plan to document and monitor the process and maintain the improvements.

C. Lean Tools for Process Control

1. Total productive maintenance (TPM)

Define the elements of TPM and describe how it can be used to control the improved process.

2. Visual Factory

Define the elements of a visual factory and describe how it can be used to control the improved process.

Benefits of Six-Sigma

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