Quality Management Approach following

DMAIC Overview

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Problem Solving Failure Points (examples)

Projects: Not aligned with strategy
Defined too broadly (or too narrowly)

Analysis: No clear target metric
Poor data definition (what data to collect)
Measurement system failure
Incorrect conclusions

Control: Changes not locked into business process
Lack of visibility to variation beyond spec.

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Problem Solving: Future State

DMAIC problem solving must consider the path to the lean6sigma Company

Lean6sigma Company

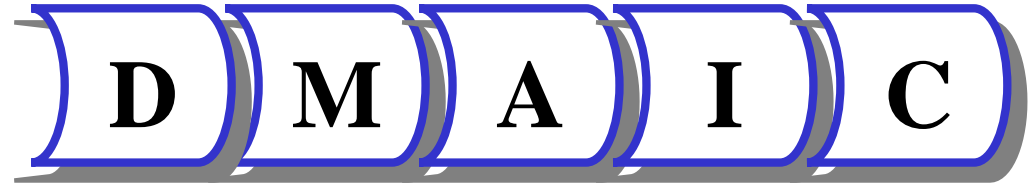| Waste	Goal
Orders	Make to Order*
Lot size	1
Value-add time / total time	1
Variation	6σ
Inventory	$0

DMAIC Overview

- **What is DMAIC?**

- **When, Where, Why to apply?**

- **Overview each phase**
  - *D*efine
  - *M*easure
  - *A*nalyze
  - *I*mprove
  - *C*ontrol

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What is DMAIC?

| D | M | A | I | C |

□ The DMAIC methodology is a structured step-by-step process for problem solving.

□ Five phases:

Define: Define the problem along with key inputs and goals.

Measure: Collect data on the current process.

Analyze: Use data to identify causes of the problem.

Improve: Develop, evaluate, and implement solutions.

Control: Develop processes to ensure sustainability.

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D M A I C

The DMAIC process can be applied to any process that needs improvement

- Core Processes
  - Marketing
  - Sales
  - Product Development
  - Product Manufacturing
  - Customer Service
  - Billing
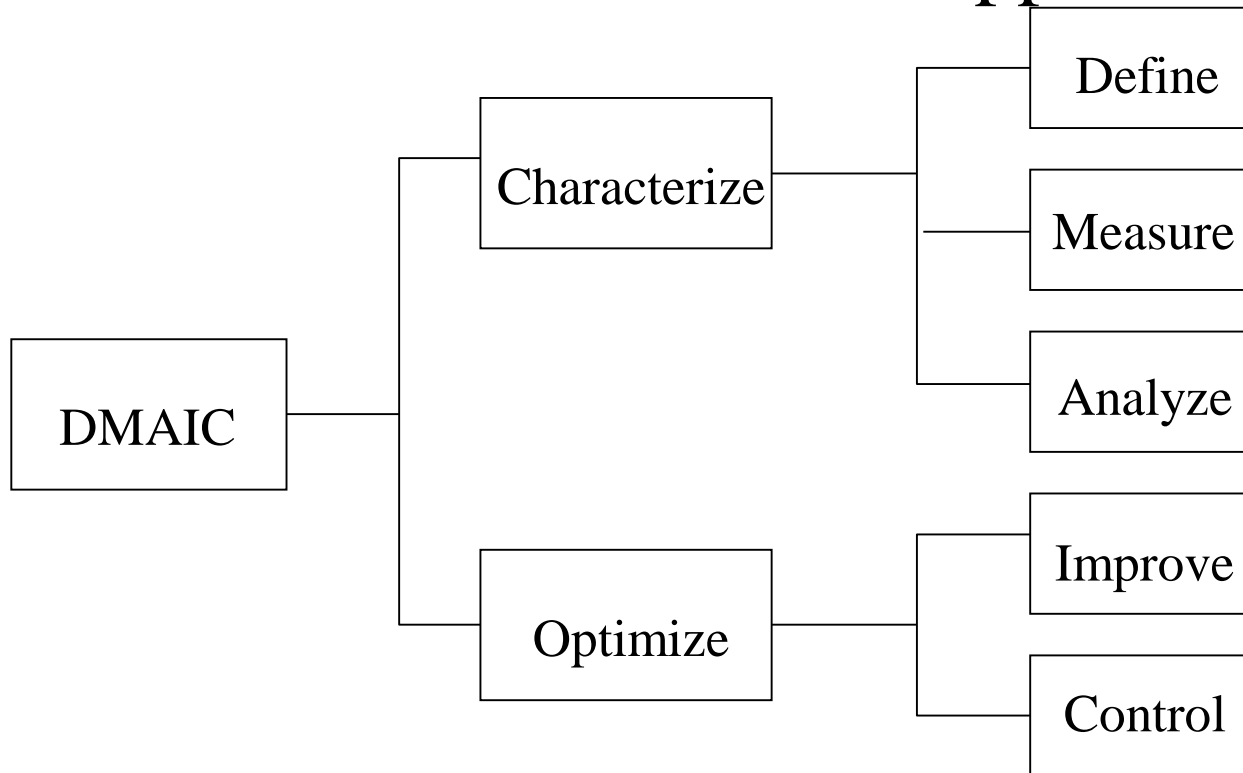 - Accounts Receivable
  - Contracts

- Enabling Processes
  - Hiring
  - Training & Development
  - Information Technology
  - Compensation
  - Legal
  - Administration

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DMAIC

$$\boxed{D} \; \boxed{M} \; \boxed{A} \; \boxed{I} \; \boxed{C}$$

What is different about this approach?

```
                                        ┌─────────┐
                                     ┌──│ Define  │
                      ┌──────────────┐│  └─────────┘
                   ┌──│ Characterize │┤  ┌─────────┐
                   │  └──────────────┘├──│ Measure │
     ┌─────────┐   │                  │  └─────────┘
     │  DMAIC  │───┤                  │  ┌─────────┐
     └─────────┘   │                  └──│ Analyze │
                   │                     └─────────┘
                   │                     ┌─────────┐
                   │  ┌──────────────┐┌──│ Improve │
                   └──│   Optimize   │┤  └─────────┘
                      └──────────────┘│  ┌─────────┐
                                      └──│ Control │
                                         └─────────┘
```

**On the Surface, it is not new!**

What's Different?

- ☐ Rigorous problem solving methodology
  - tied to company goals
  - roadmap to the "end-game"
  - problem structuring, mentoring
  - process control

- ☐ Metrics: strict guidelines on benefits, sign-off, company-wide visibility ("analyst quality" results tracking)

- ☐ Full-time leaders (sufficient & qualified resources)

- ☐ Common language, consistent training program

Define
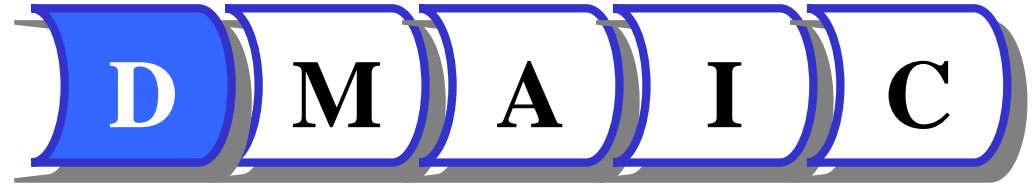
The objectives of Define are to:

- Identify the opportunities for improvement.

- Develop the business process and information.

- Identify the Voice of the Customer (VOC).

- Identify Critical Customer Requirements (CCR).

- Identify Critical To Quality (CTQ) Indicators.

- Assign & Develop an effective team.

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Define

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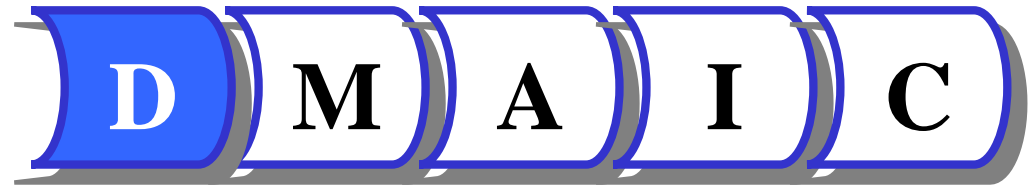
The activities and deliverables of Define are:

- Develop a Team Charter.
- Develop and identify Value Stream Maps, Variation Maps, and Process Maps.
- Identify KPIs, --- including the measures of Results ("Y")
- Identify Product Families, Investment, Manning and Capacity.
- Identify "Quick Win" areas.
- Translate VOC into CCRs(Critical Customer Requirements) and CTQs.(Critical to Quality)
- Develop team guidelines and ground rules for a prepared and effective team.
- Presentation to Stakeholders.

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Key Questions:

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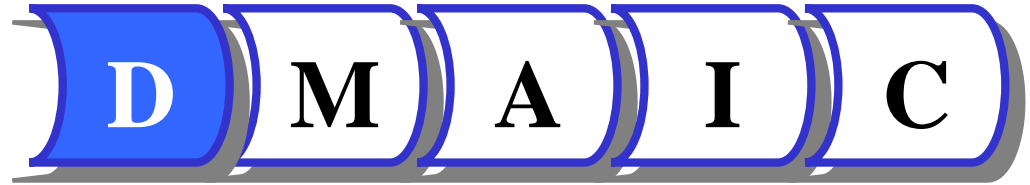
- Team:
  - Has the right team been assigned?
  - Have they all been trained?
- Customers
  - Has the customer been identified (CTQs)?
  - Have customer needs been translated into measurable requirements?
- Critical "Ys"
  - Does this project address a key business goal?
- Problem Statement
  - Has problem been sufficiently defined?
  - Is project scope specific enough?
- Timing / Results:
  - Is completion date reasonable?
  - Does team have sufficiently aggressive goal? Is it fact-based (e.g. with external benchmarks)?
- Lean6sigma Ideal Future State
  - Has team identified lean6sigma vision for process (e.g. lot size = 1)?

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D M A I C

The objectives of Measure are to:

- Develop team brainstorming sessions.
- Identify and develop a measurement system to be able to collect and analyze data pertaining to the CCRs.
- Identify the process variables.
- Develop the baseline sigma level for the process(es).
- Identify and collect the data for the baseline metrics.

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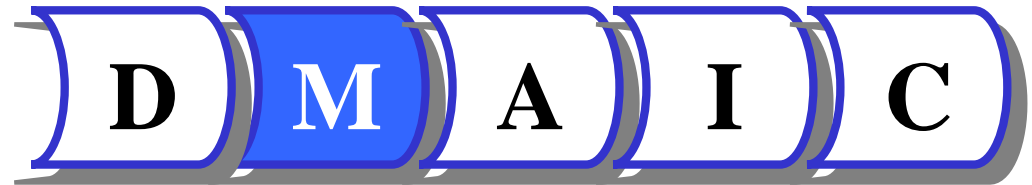
Measure

The activities and deliverables of Measure are:

- Active team meetings, use brainstorming, affinity diagrams, etc.
- Develop and identify the $Y = f(x)$
  - Key Process Input Variables (KPIVs) and Key Process Output Variables (KPOVs).
- Well defined measurement plan for Key Input, Process & Output Indicators.
- Updated Baseline performance levels.
- Plot and analyze data.
- Validate the capability of the Measurement Systems
- Determine if special cause variation is present.
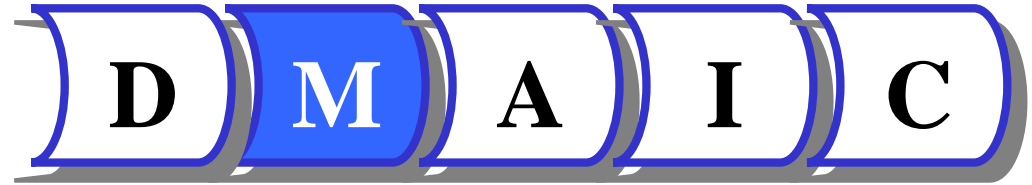- Presentation to Stakeholders, Confirmation of Project Charter

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DMAIC

If we cannot express what we know about a process in numbers, we do not know much about it.

Key Questions:

D M A I C

- ☐ Project Measures:
  - What are the key performance metrics of process (input, process, output)? What will be the measure of success?
  - Are they directly related to project scope and CTQs

- ☐ Data Collection / Data Quality
  - What is the data collection plan?
  - Was a Measurement System Analysis (MSA) conducted?
  - Was Current State Value Stream Map completed? Was product portfolio well defined for the Value Stream?
  - Have other data quality issues been addressed (accuracy, calibration, linearity, and process stability)

- ☐ Performance baseline
  - What is the current process performance?
  - Are there any "low hanging fruit" for improvement?
  - What is process entitlement?

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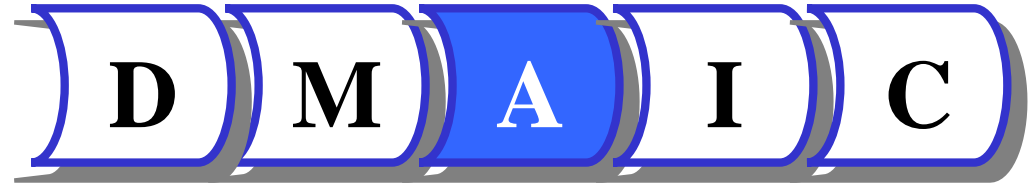Serviceportfolio

15

Analyze

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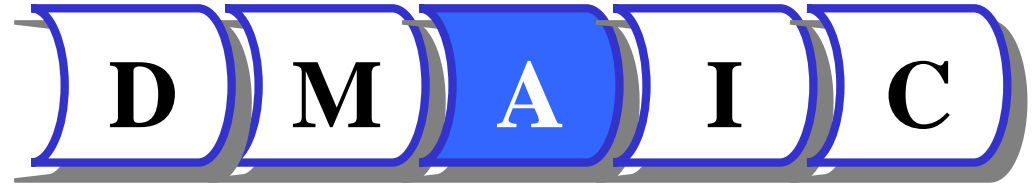
The objectives of Analyze are to:

- Identify and analyze specific variations for improvement.
- Validate actual root cause conditions.
- Identify specific focus areas for team problem solving.
- Hypothesize Future State map

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Analyze

D M A I C

The activities and deliverables of Analyze are:

- Stratify Process Data & Identify Specific Problems
- Develop preliminary FMEAs.
- Develop capability indices.
- Root cause verification analysis.
- Hypothesis testing of collected data
- Clarified Problem Statements
- Screening design of experiments (DOE).
- Definition of Future State Map
- Presentation to Stakeholders.

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Key Questions:

$$\boxed{D} \ \boxed{M} \ \boxed{A} \ \boxed{I} \ \boxed{C}$$
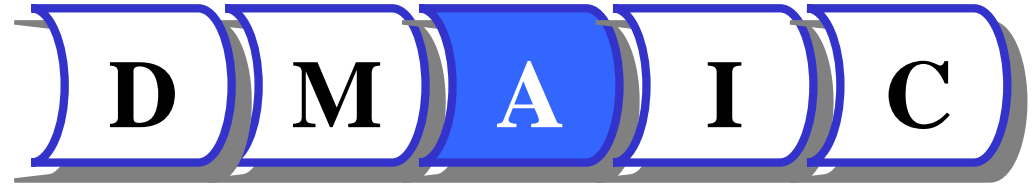
- ◻ **Data Analysis:**
  - Was benchmarking conducted to identify process capability?
  - What are the gaps between process performance and customer requirement (cycle-time, variation, inventory, cost, delivery, etc.)?
    - Was a Future State Value Stream Map developed?
    - Was a flow analysis conducted (takt, balancing, WIP, kanban)?
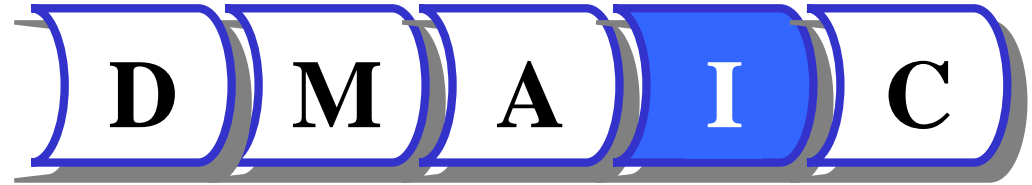   - Were waste & variation clearly identified?

- ◻ **Root Cause**
  - What are the key causes of the performance gap (Pareto, etc.)?
  - Were all likely causes evaluated?

- ◻ **Quantifying Performance Gap**
  - Is original savings opportunity still valid?
  - Are there additional opportunities?
  - Should the project scope be revised?

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Improve
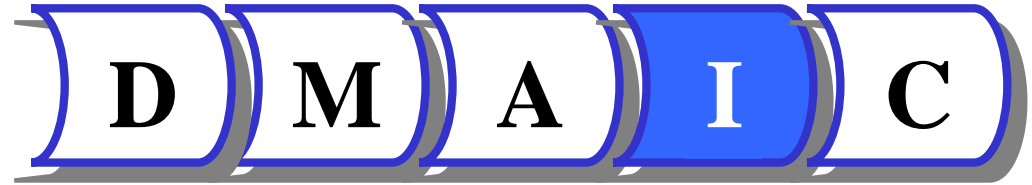
D **M** **A** **I** **C**

The objectives of Improve are to:

- Develop the appropriate improvement solution(s).
- Evaluate if new solutions are necessary.
- Finalize Future State map and new processes
- Develop a culture for change acceptance.
- Implement improvement solutions.

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Improve

D M A **I** C

The activities and deliverables of Improve are:

- Generate robust solution ideas.
- DOE (Design of Experiments) optimization tests.
- FMEA evaluation.
- Design new process maps.
- Intellectual Property (IP) protection of new processes (either manufacturing or business processes)
- Evaluate the benefit of the solutions.
- Presentation to Stakeholders.

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Key Questions:

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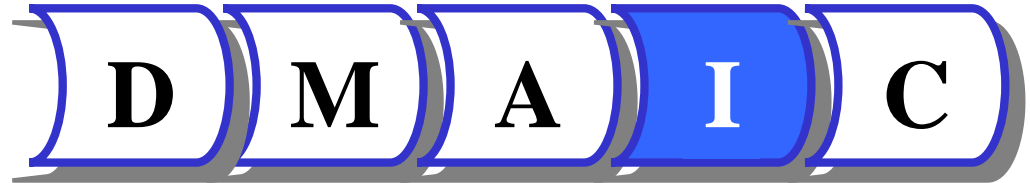
- **Generating Solutions:**
  - Has team generated sufficient list of possible solutions?
  - Was the process creative (finding "out of the box" solutions)?

- **Selecting Solutions**
  - What tools were used to ensure that the best solution was selected?
  - Does the cost/benefit equation look right? Is too much Capital used?
  - Was the solution modeled or piloted for effectiveness?
  - Does the solution meet performance objective? What is the resulting DPM, cost, cycle time, takt time, inventory, etc.?

- **Designing the Implementation Plan**
  - Was Future State Value Stream validated? Is it feasible?
  - Is implementation plan robust? Complete?
  - Has error-proofing (poke-yoke) been utilized?
  - Has communications been included in planning?
  - How will the organization know that the plan has worked
  - (i.e. metrics, visual controls, process changes)?

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21

Control

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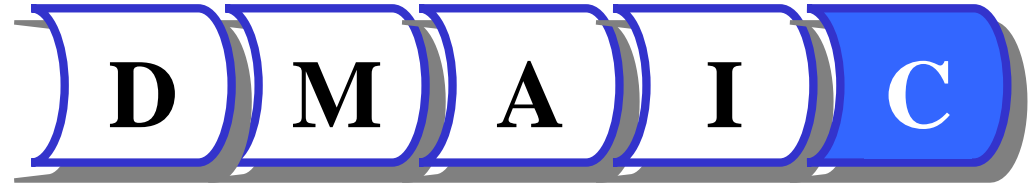
The objectives of Control are to:

- Develop plans, standards, process controls, etc. to sustain the improvements made.

- Disseminate lessons learned and hand off improvements to process owners.

- Train associates to understand and follow new process maps and control plans.

- Build the organizational capabilities to drive toward additional process improvements.

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Control

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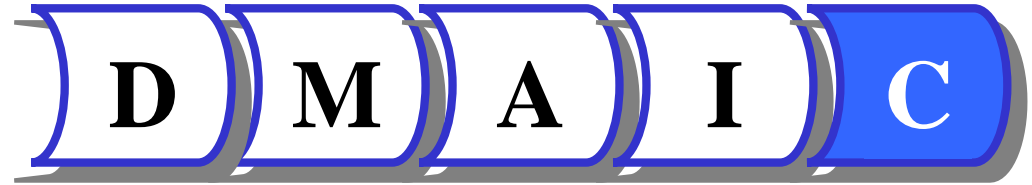
The activities and deliverables of Control are:

- Use Pilot Plan (if necessary)
- Implement process control systems.
- Implement any new standards or procedures.
- Develop and implement training plans.
- Validate solutions & sesults
- Link results to financial statements
- Monitor process and financial KPIs until proces stability has been confirmed (6-12 months).
- Presentation to Stakeholders.
- Evaluate and congratulate the team

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Key Questions:

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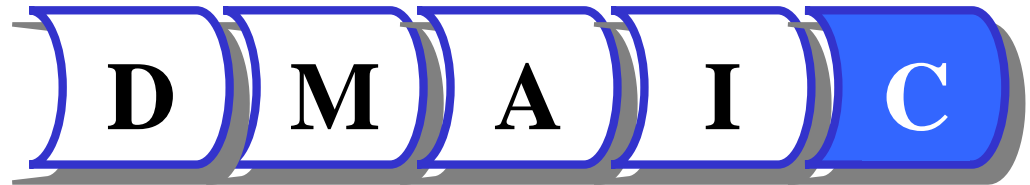
- **Control Strategy:**
  - What specific tools will be used to ensure process control (Poke Yoke, SPC, work procedures, inspection/test, automation)?

- **Process Monitoring**
  - Is a robust monitoring in place? How often? What data? What is the data collection technique? Where in the process?

- **Feedback & Corrective Actions**
  - What is the signal to indicate performance beyond desired level?
  - Is a strong corrective action process in place to ensure results?

- **Transfer of ownership**
  - How will day-to-day responsibilities be transferred to process owner?
  - What is the recommended audit cycle?
  - What is the process-level KPI (e.g. changeover time)? Who, specifically, owns this KPI? What is the review cycle?
  - What is the financial KPI (e.g. cost per transaction, expense-ending cost). Who, specifically, owns this KPI?

    What is the review cycle.

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Leadership of DMAIC

The power of DMAIC is in the _appropriate_ and _rigorous_ use of the methodology.

Conclusions

1. Every business problem can be addressed through the DMAIC process ---do not accept that DMAIC is too complex or too simple.

2. Complex processes may need a multi-generation plan & several DMAIC projects to achieve full potential.

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DMAIC Flow