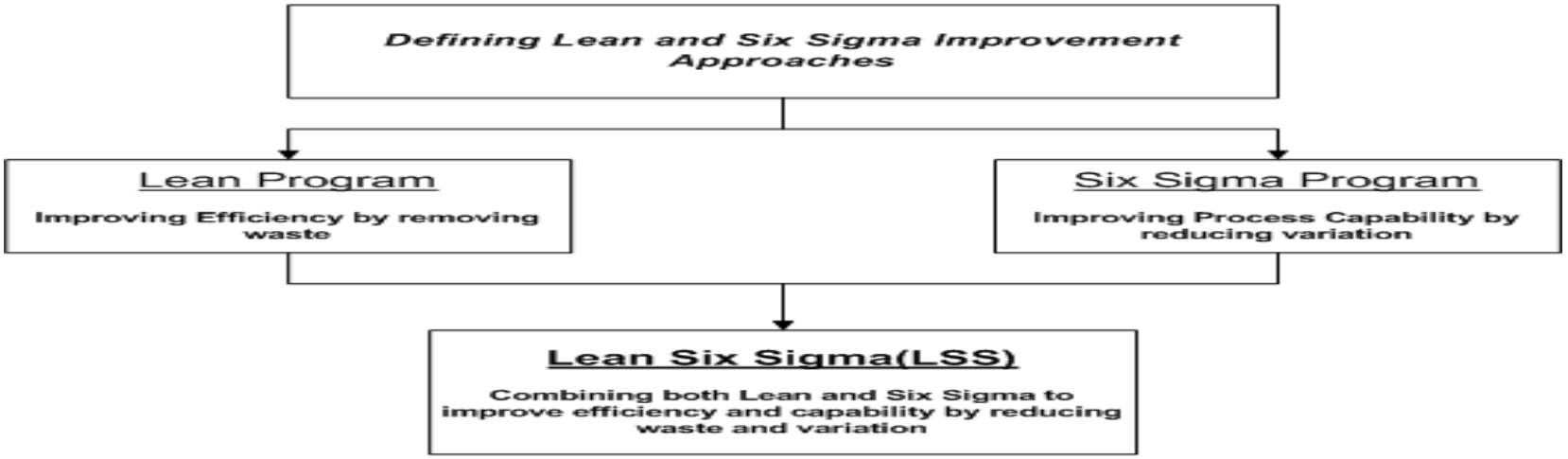
PMPA – Lean Six Sigma Tools and Methods

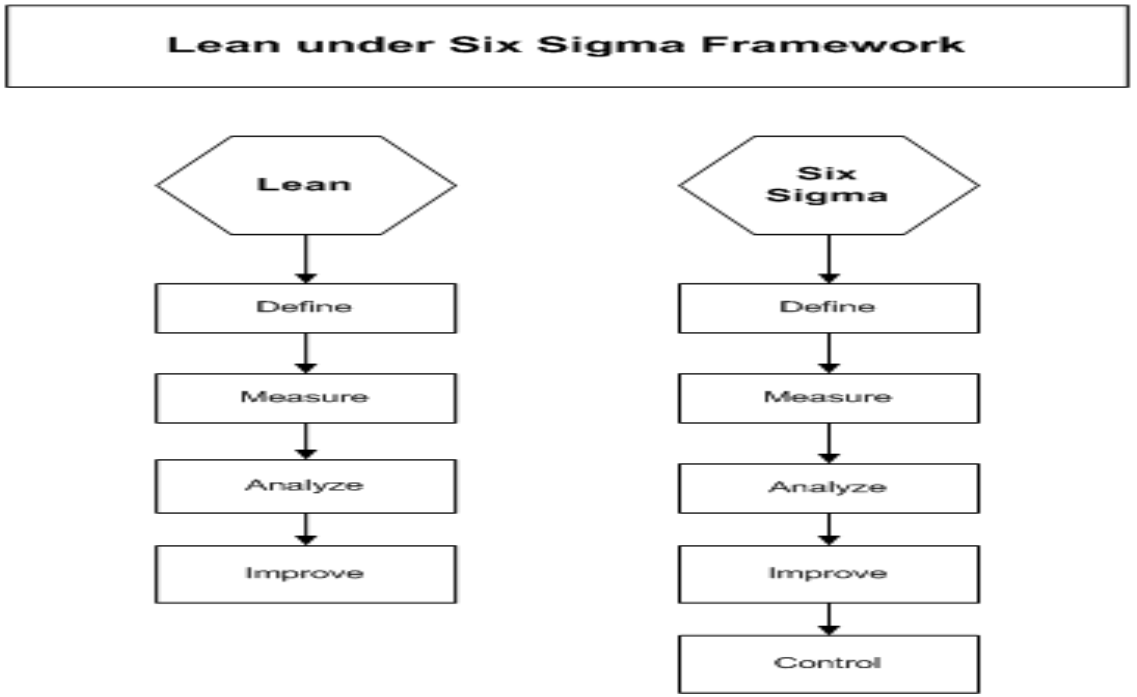
Dan Wilson
Director of Quality
New Dimension Metals
Dayton, OH

Perry Wiltsie
Quality Engineer
Vanamatic Company
Delphos, OH

Lean Six Sigma Outline

- Differences between Lean and 6 Sigma. (Pages 3 -4)
- Basic Lean Tools and Techniques. (Pages 5 to 6)
- Basic 6 Sigma Tools and Techniques. (Pages 7 to 12)
- Lean Six Sigma (LSS). (Page 13)
- Lean Six Sigma DMAIC Tool. (Pages 14 to 22)
- Lean Six Sigma SIPOC Tool. (Pages 23 to 25)
- Lean Six Sigma Value Stream Map. (Page 26)
- Lean Six Sigma A3 Problem Solving Tool. (Pages 27 to 31)


Defining Lean and Six Sigma Improvement Approaches
Lean Program
Improving Efficiency by removing waste
Six Sigma Program
Improving Process Capability by reducing variation
Lean Six Sigma(LSS)
Combining both Lean and Six Sigma to improve efficiency and capability by reducing waste and variation


Lean under Six Sigma Framework
Lean
Define
Measure
Analyze
Improve
Six Sigma
Define
Measure
Analyze
Improve
Control

Differentiation	Lean	Six Sigma
Primary interest	Remove waste.	Reduce variation.
Way they look at the world	Flow and waste.	Problem and detection.
Primary effect	Reduce waste and smooth flow.	Reduce defects by reducing variation.
Secondary effects	Less inventory, fast throughput, better performance, more uniform output, less variation and improved quality.	Improved quality, better performance, less waste, less inventory, fast throughput and uniform process output.
Format	Typically *kaizen* event format; concentrated resources in short timeframe; best for quick and initial gain.	Project format; resources spread over months; suitable for long-term and in-depth study.
Approach	Has selected sets of solutions for selected sets of situations: for example, 5S, visual control, setup reduction, lead time reduction.	All inclusive, generic approach to define, measure, analyze, improve and control; one size fits all.
Efficiency	More efficient in selected sets of situations.	Allows more thorough study and more science, but not as efficient in selected applications.
Limitation	Statistical data analysis not emphasized; relies more on intuition and common sense.	System view limited; may overspend when problems and solutions are simple and apparent.
Signature characteristics	Small, quick, easy and intuitive improvements frequently occur over time; everyone can do it.	Bigger, sophisticated solutions infrequently occur over long-term; star performer, not everyone can do it.
Technical difficulty	Focus on grass-roots, on the spot (*gemba*) and operator level activities and ownership.	Need some science.
Level of competency	Low (for every one).	High (not for everyone).
Tools	Six Sigma tools ~ lean tools + statistics.	

More efficient

Mutually inclusive,

less efficient

Differentiator

Frictions

Conflicts

Frictions

Basic Lean Tools and Techniques

- **Reduce waste and improve process speed for smooth flow**
- **Focus on waste reduction and remove non-value added activities**
- **Identify your constraints or obstacles in the organization**
- **Focus on cycle time reduction**
- **Setup reduction**
- **Single Minute Exchange of Dies (SMED)**
- **Standard operating procedures and documentation**
- **Total Productive Maintenance**
- **Continuous Flow Manufacturing**
- **Value Stream Mapping**
- **Motion Study and Material Handling**
- **Visual Display for work flow & communication**
- **5S – Housekeeping and Organization**
- **Poka Yoke techniques to prevent/detect errors**
- **Just In Time**
- **Kaizen Methods**
- **Respecting People**

Determine the “Muda” or Waste

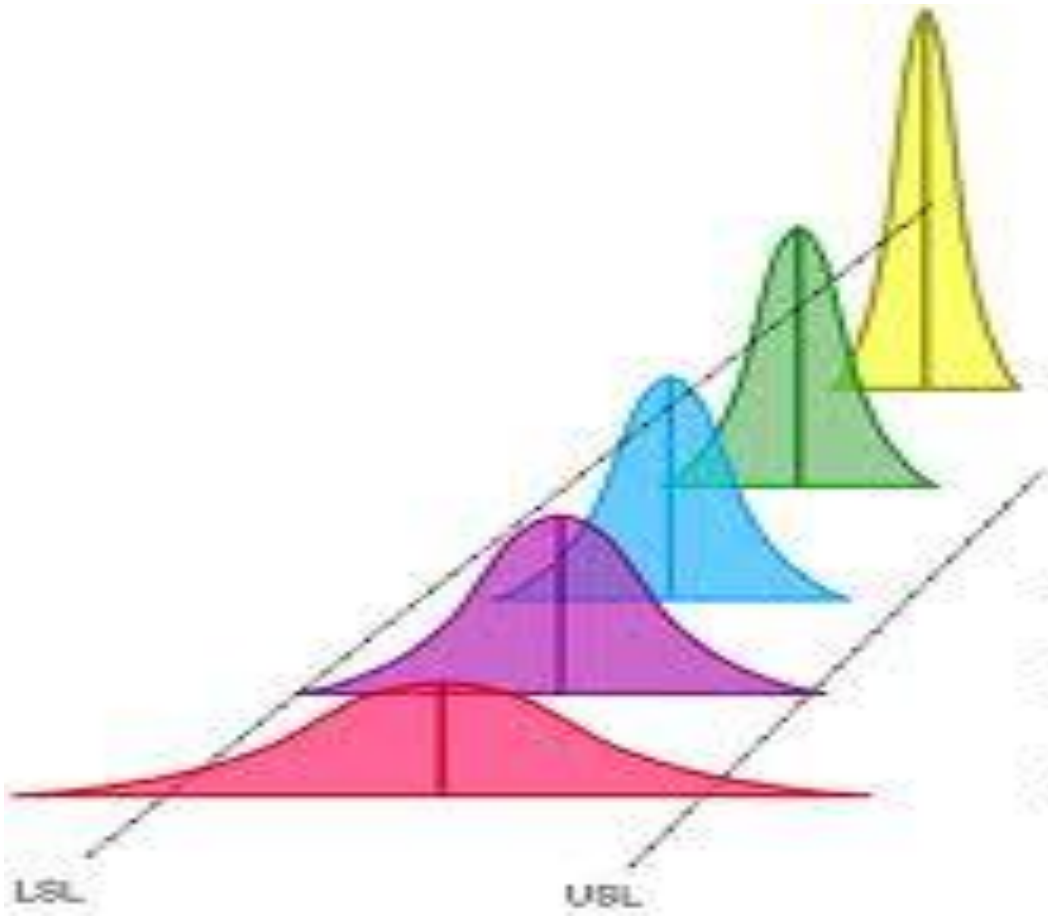
- Categories of Lean Waste:

  Defects – poor quality, maintenance, weak process control
  Overproduction – produce more than demand
  Waiting – long set-up time, unplanned maintenance downtime
  Non-value Added – not necessary to perform
  Transportation – poor plant layout
  Inventory – poor customer/market forecast, unreliable supplier
  Motion waste - walking across plant to retrieve a die, tool, Work Order
  Extra Processing – over engineered, unnecessary rework or inspection

Basic Six Sigma Tools and Techniques

- Reduce defects by reducing variation
- Focused on a disciplined approach for reducing defects and producing measurable financial results
- Provides an organization with a very specific measurable target for quality
- Provide a data-driven methodology focused in driving down process variation so there are no more then 3.4 defects are produced per million opportunities. Its not zero defect, however very close.
- Six sigma refers to the standard deviation of a process that also describes the variation of the process. Standard deviation is the spread of process performance and the dispersion of all data points from the mean (average)

How well is your process performing?



Cp	Sigma	ppm
2.00	6.0	3.4
1.67	5.0	233
1.33	4.0	6,210
1.00	3.0	66,800
0.67	2.0	308,540

D = Number of defects = 15

O = Opportunity = 2

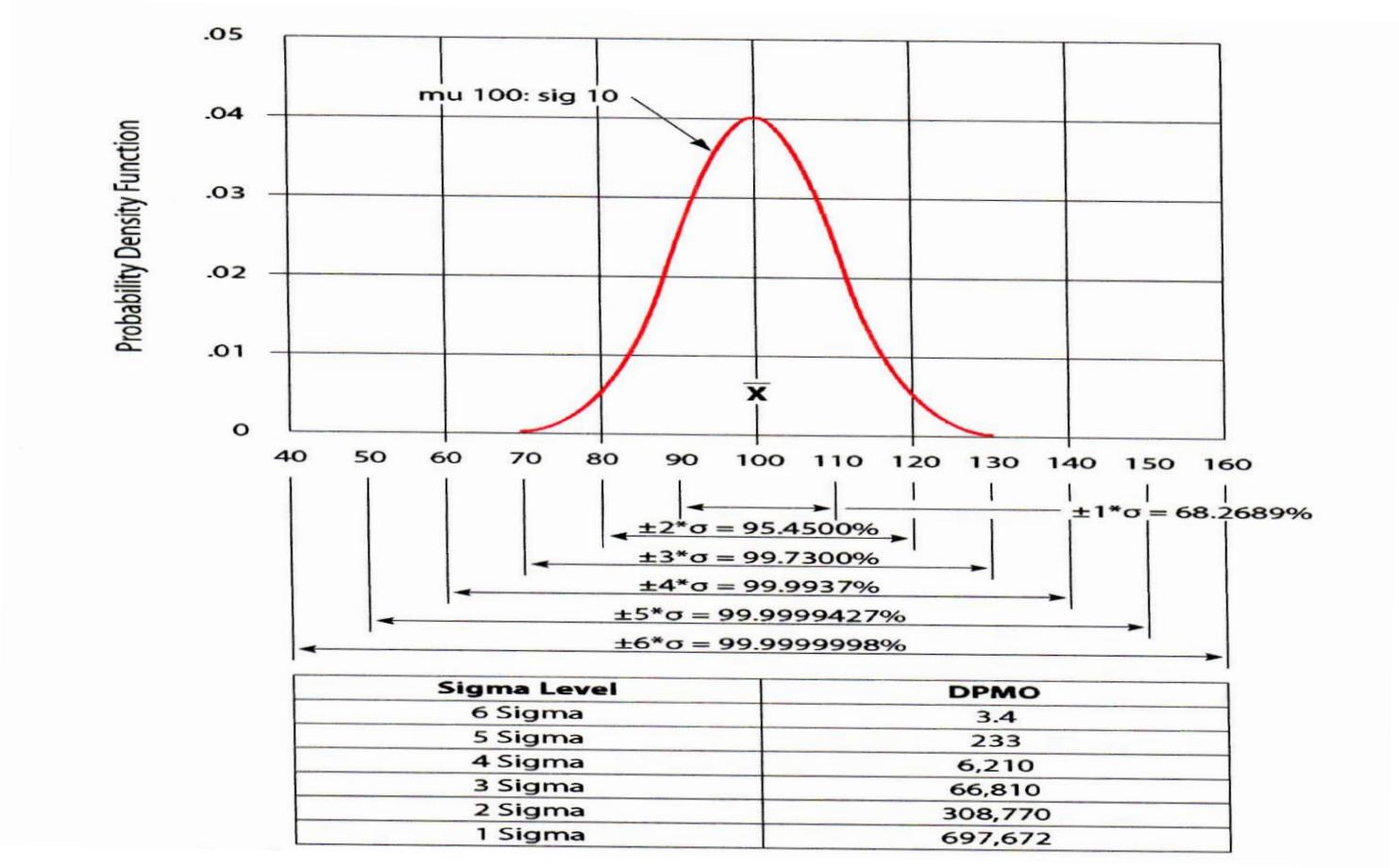
N = Number of units = 25

DPO = D / (N*O) = 15 / (2 * 25) = .30 (Defects per opportunity)

Yield = (1-DPO) x 100 = 70 percent

Sigma = 2.02 (this value is looked up in a process-Sigma conversion table)

DPMO = 300,000



Sigma Level	DPMO
6 Sigma	3.4
5 Sigma	233
4 Sigma	6,210
3 Sigma	66,810
2 Sigma	308,770
1 Sigma	697,672

Process Sigma Level Conversion Table		
Yield %	DPMO	Sigma Level
6.68000	933,200	0.000
8.45500	915,450	0.125
10.56000	894,400	0.250
13.03000	869,700	0.375
15.87000	841,300	0.500
19.08000	809,200	0.625
22.66000	773,400	0.750
26.59500	734,050	0.875
30.85000	**691,500**	**1.000**
35.43500	645,650	1.125
40.13000	598,700	1.250
45.02500	549,750	1.375
50.00000	500,000	1.500
54.97500	450,250	1.625
59.87000	401,300	1.750
64.56500	354,350	1.875
69.15000	**308,500**	**2.000**
73.40500	265,950	2.125
77.34000	226,600	2.250
80.92000	190,800	2.375
84.13000	158,700	2.500
86.97000	130,300	2.625
89.44000	105,600	2.750
91.54500	84,550	2.875
93.32000	**66,800**	**3.000**

Process Sigma Level Conversion Table		
Yield %	DPMO	Sigma Level
94.79000	52,100	3.125
95.99000	40,100	3.250
96.96000	30,400	3.375
97.73000	22,700	3.500
98.32000	16,800	3.625
98.78000	12,200	3.750
99.12000	8,800	3.875
99.38000	**6,200**	**4.000**
99.56500	4,350	4.125
99.70000	3,000	4.250
99.79500	2,050	4.375
99.87000	1,300	4.500
99.91000	900	4.625
99.94000	600	4.750
99.96000	400	4.875
99.97700	**230**	**5.000**
99.98200	180	5.125
99.98700	130	5.250
99.99200	80	5.375
99.99700	30	5.500
99.99767	23	5.625
99.99833	17	5.750
99.99900	10	5.875
99.99966	**3**	**6.000**

What is the difference between a process operating performance of 99% (3.8 Sigma) vs 99.9997% (6 Sigma)?

GOOD	GREAT
If these various processes operated at 99% or 3.8 Sigma, below are the measures of their performance:	**If these various processes operated at 99.9997 % or 6 Sigma, below are the measure of their performance:**
20,000 lost articles of mail per hour	7 lost articles per hour
15 minutes per day of unsafe drinking water	1 minute every 7 months of unsafe drinking water
5,000 incorrect surgical procedures per week	1.7 incorrect surgical procedures per week
2 short or long landings at major airports each day	1 short or long landing at a major airport every 5 years
200,000 wrong drug prescriptions each year	68 wrong drug prescriptions each year
No electricity for almost 7 hours each month	1 hour without power every 34 years

How to perform a 6 Sigma Calculation in Excel.

6 Sigma Rating Calculation. To Measure and Monitor sigma ratings for Continuous Improvement

=NORMSINV((total opportunities - defects)/total opportunities + 1.5)

enter total opp.	enter defects	std sigma shift	=+NORMSINV	6 sigma rating
100000	2	1.5	4.10748	5.60748

Basic Lean Six Sigma (LSS)

- Lean and Six Sigma Methodologies focuses and fixes different areas of a process.
- If you want a process that is fast, defect free, and without waste, then you need LSS.
- LSS has the ability to maximize shareholder value by achieving an extremely fast rate of improvement in he following areas:

1. Cost Reduction
2. Productivity
3. Increased Throughput
4. Defect Reduction
5. Customer Satisfaction and Retention
6. Market Growth

Lean Six Sigma DMAIC Tool & Methodology

- **DMAIC (Define, Measure, Analyze, Improve, Control)** Tool is utilized in Lean Sigma to improve the existing process

- **D**efine: Initiate the project, define the process, determine customer requirements, define key process output measureables, and what are the specific deliverables will be expected as a result of this project
- **M**easure: Understand the process (as is), evaluate risks or process inputs, develop and evaluate measurement systems, measure current performance
- **A**nalyze: Analyze data to prioritize key input variables, and identify waste
- **I**mprove: Verify critical input variables, design improvements, pilot new process
- **C**ontrol: Finalize the control system, verify long term capability

DMAIC – **Define** Phase

- **Objective:** Is to get the project started successfully and headed in the right direction. Get the team organized, determine roles and responsibilities of each team member, establish team goals and milestones. Should be able to answer these questions.
- **Inputs**.

  Need initial draft of the project charter from the Sponsor(s), and initial resources allocated to define the intent and scope of the project
- **Process.**

  Create a SIPOC for the process, High Level Process Map, Project Plan (Schedule, Budget, Milestones), Communication Plan, Validate or Finalize project problem statement and goals, Validate finalized financial benefits, complete final Charter, Prepare for the Define Phase Management Review Presentation
- **Outputs.**

  Completed Project Charter draft (ready for signoff), SIPOC to understand what data elements to collect, Process Map, Project and Communication Plan

D**M**AIC – **Measure** Phase

- **Objective:** Is to thoroughly understand the current state of the process and collect data on the process speed, quality, and costs that can be used to determine the underlying causes of the problem.
- **Inputs**:
  Completed Project Charter draft (ready for signoff), SIPOC to understand what data elements to collect, Process Map, Project and Communication Plan
- **Process**:
  Create Value Stream Process Map to understand current process flow, Identify the input, process and output variables relevant to the project, create a data collection plan (which includes operational definitions for all measures, create a data analysis plan, use measurement system analysis and GRR, collect data to establish baseline measurements, update value stream map with data, collect lead times, perform Cp evaluations, make quick-hit improvements, Prepare for Measure Gate Reviews
- **Outputs**:
  Fully developed current-state value stream map. Reliable data on critical inputs(X's) and critical outputs (Y's) to be used for analyzing defects, variation, process flow and speed. Baseline measures of process Cp, including sigma quality levels and lead time. Refined definitions of improvement goals. A capable measurement system. Revised Project Charter (if additional data gathered shows need for change.

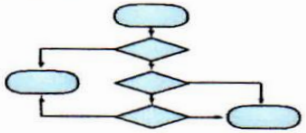
DM**A**IC – **Analyze** Phase

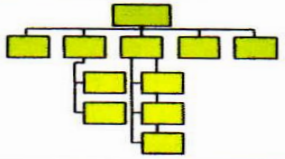
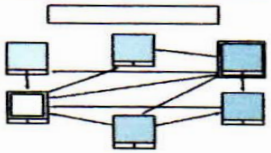
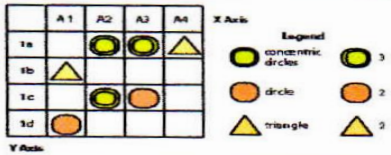
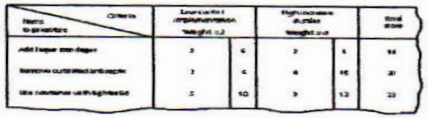
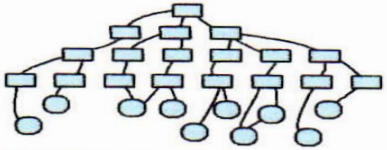
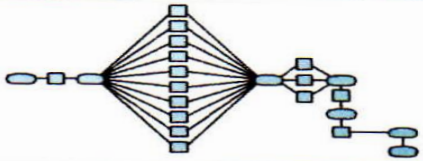
- **Objective**: Is to develop theories of root causes (critical X's), confirm the theories with data, and finally identify the root cause(s) of the problem. The verified cause(s) will then form the basis for the solutions in the "Improve" Phase.
- **Inputs**:

  Fully developed current –state Value Stream Map, Reliable data on critical inputs (X's) and critical outputs (Y's) to be used for analyzing defects, variation, process flow, and speed. Baseline measures of process Cp, including Six Sigma Quality Levels and Lead Time. Re-defined definitions of improvement goals. Capable Measurement System.
- **Process**:

  Conduct Value Analysis, Calculate Process Cycle Efficiency (PCE), Analyze Process flow, Analyzed data collected in the Measure Phase, Generate theories to explain potential causes, Narrow the Search, Collect additional data to verify Root Cause, Prepare for Analyze Gate Review
- **Outputs**:

  Documentation of potential causes considered in Analysis, Data Charts and other Analysis that shows the link between the targeted input and process variables (X) and critical output (Y's), Identification of value added versus non-value added work, Calculation of Process Cycle Efficiencies.

Name	Graphical Representation	Used to:
Check Sheet		• Easily collect data • Make decisions and take actions that are based on the data collected
Pareto Chart		• Define problems and establish their priority • Used to illustrate the problems detected during data collection • Illustrate the frequency of the problems occurring in the process
Histogram		• Show a bar chart of accumulated data • Provide the easiest way to evaluate the distribution of data
Scatter Diagram		• Graphical representation of the data points collected • Show a pattern of correlation between two variables
Flow Chart		• Show a process step-by-step • Graphically understand the process • Identify an unnecessary procedure
Control Chart		• Provide control limits, which are generally three standard deviations above and below average, whether or not our process is in control
Cause and Effect Diagram		• Identify many possible causes for an effect or problem • Sort ideas into useful categories

Name	Graphical Representation	Used to:
Affinity Diagram		• Organize a large set of ideas • Help a team after a brainstorming session • Analyze customer requirements
Tree Diagram		• Break a broad goal into increasing levels of detail • Create a detailed action plan • Graphically communicate information
Inter-Relationship Digraph		• Look for drivers and outcomes • Identify, analyze, and classify cause-and-effect relationships • Identify causes that are key drivers
Matrix Diagram		• Identify and rate the strength of relationships between two or more sets of information
Prioritization Matrices		• Narrow down options through a systematic approach • Compare choices by selecting, weighing, and applying criteria
Process Decision Program Chart (PDPC)		• Improve implementation through contingency planning
Activity Network Diagram		• Schedule sequential and simultaneous tasks • Find the most efficient path and realistic schedule for the completion of a project

DMA**I**C – **Improve** Phase

- **Objective:** Is to generate (and test) possible solutions, select the best solution, and design an implementation plan. You need to demonstrate, with fact and data, that our solutions solve the problem
- **Inputs**:

  Documentation of potential causes considered in analysis, data charts and other analysis that shows the link between the targeted input and process variables (X's) and critical outputs (Y's), Identification of value-add versus non-value-add work, calculation of Process Cycle Efficiency,
- **Process**:

  Generate possible solutions, Evaluate – Select – Optimize the best solutions, Develop "to be" value stream map, Apply LSS Best Practices (Setup Reduction, Line Balancing Defect Prevention, DOE, Layout Improvement, Pull System, Kanban), Develop and Implement pilot solution, Confirm attainment of project goals, Develop and execute full scale implementation plan, Prepare for "Improve" gate review.
- **Output**:

  Business Improvement Project: tested, robust solutions shown to affect the proven causes (X's) that affect the critical output (Y's).

  Lean Projects: Documentation of results of the chosen Lean Best Practice or solution applied.

  An improved process that is stable, predictable, and meets customer requirements

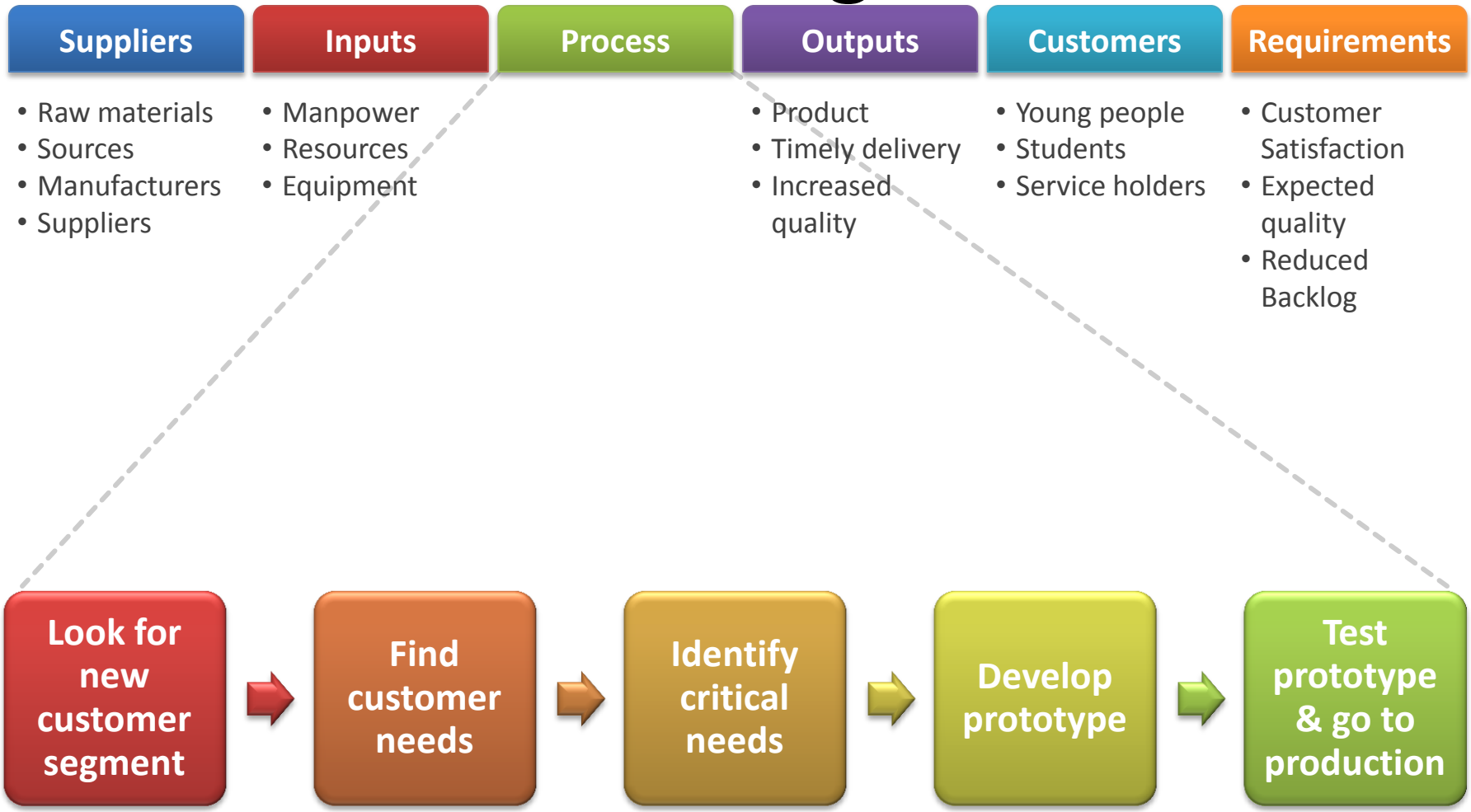
DMAI**C** – **Control** Phase

- **Objective:** Is to create and implement a Monitoring Plan, Standardized Process, Documented Procedures, and Response Plan. The final step is to successfully transfer the ownership of the process back to the process owner, confident in the ability to maintain the gains and manage the new process. The Control Phase is about Standardization. It is the step that enables long-term high quality production of goods and services on a reliable, predictable, and sustainable basis.
- **Inputs**:- Business Improvement Project: tested, robust solutions shown to affect the proven causes (X's) that affect the critical output (Y's).
  - Lean Projects: Documentation of results of the chosen Lean Best Practice or solution applied.
  - An improved process that is stable, predictable, and meets customer requirements
- **Process**:
  - Develop supporting methods and documentation to sustain full scale implementation
  - Launch Implementation
  - Lock in performance gains
  - Monitor Implementation
  - Develop process Control Plans and hand off control to the process owner
  - Audit the results
  - Finalize the project
  - Validate performance and financial results
- **Outputs**:
  - Control System in place
  - Long term improvements validated
  - Continuous improvement opportunities identified
  - New process transferred to the "Process Owner"
  - Team recognition

DMAIC Lean Six Sigma Tools

Define	Measure	Analyze	Improve	Control
• Project Charter • Stakeholder Analysis • SIPOC • Process Map (high level) • Communication Plan, Resistance • Project Plan • Responsibilities Matrix • Items for Resolutions (IFR) • Ground Rules	• Process Map • CTS • Data Collection Plan • Quality Function Deployment (QFD) • Pareto Chart • VOP Matrix • Gauge R&R • Cost of Poor Quality	• Cause & Effect Diagram • Why-Why Diagram • Histograms and Graphical Analysis • Correlation Analysis • Basic Statistics • Sampling • Process Analysis • Failure Mode and Effects Analysis • Gap Analysis • Hypothesis Tests • Summary of Problems • Waste Elimination and Summary of Wastes • 5S • Kaizen	• Recommendations • Improvement Plan • Action Plan • Cost/benefit Analysis • Cost of Poor Quality • Future State Process Map • Design of Experiments • Dashboards • Scoreboards • Weighted Cause and Effect Diagrams	• Hypothesis Testing • Design of Experiments • Basic Statistics • Graphical Analysis • Sampling • Mistake Proofing • FMEA • Control Plan • Process Capability • DPPM / DPMO • Statistical Process Control (SPC) • Standard work • Kaizen • Dashboards • Scoreboards

SIPOC Diagram



Simplified SIPOC to Make Coffee

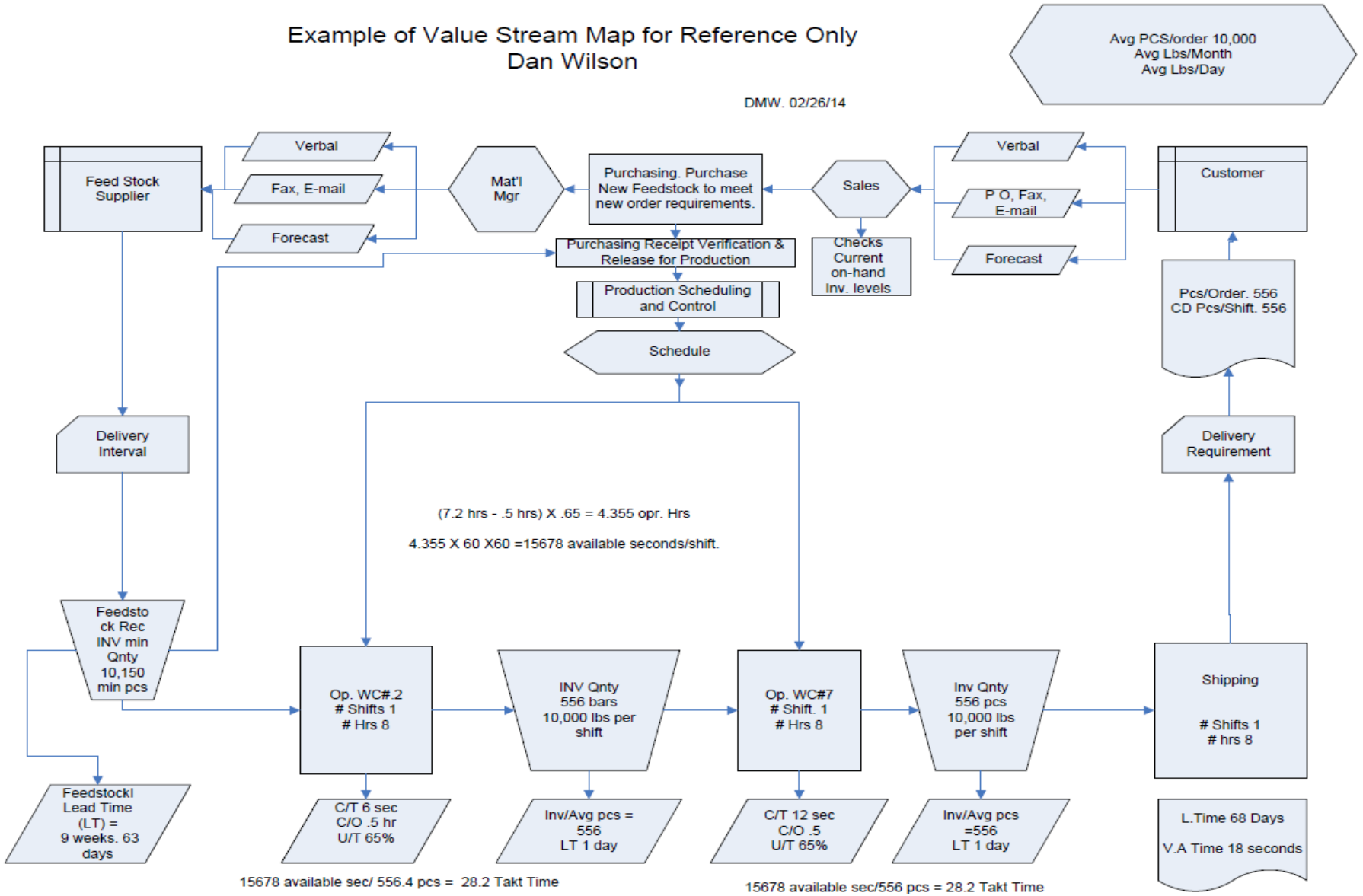
SIPOC					
Suppliers (resource provider)	**Inputs** (process)	**Process** (high level process flow)	**Outputs** (from the process)	**Customers** (receiver an output from the process)	
Coffeemaker purchased - on countertop	>5 cup capacity coffee maker	**Making coffee**	heating to keep coffee warm for 1 hour after brewing	All of us enjoy the same brand of coffee with varying condiments	
		Add water			
city water supply into faucet	water supply		enough coffee to serve all of us within 15 minutes of start time.	1 cup of coffee	wife
purchase from XYZ company	1 filter	Add filter & ground coffee	one filter to prevent overflow	1 teaspoon of french vanilla creamer	
Use ABC brand beans	4 tablespoons of coffee grinds		correct amount of grinds		
Electric company	120V GFCI outlet	Plug-in and turn on		1 cup of coffee	husband
Upper left drawer next to refrigerator	measuring spoons		Source to heat water to temperature	Honey on the table	
			Pump to move water up through filter.	Dash of cinnamon	
Mugs purchased - in upper left cabinet	coffee mugs	Pour into mug	Hot coffee filled near the top of the mug.		
refrigerator and pantry	condiments and containers for sugar, creamer, honey, cinnamon.	Add condiments		1 small cup of coffee for each	
ABC brand for sugar & creamer.			coffee served in spouses favorite mug	1 teaspoon sugar	
XYZ brand for honey and cinnamon		Stir	coffee served in husbands mug	1 tablespoon french vanilla creamer	
pantry	stirrers, lids	Serve	coffee served in personalized kids mugs	Let sit for 5 minutes before serving	2 teenagers

Suppliers, inputs, processes, outputs and customers / TABLE 1

Supplier	Input	Process	Output	Customer	CTQ
Physician Patient	1. Physician. 2. Patient. 3. Ailment. 4. Doctor's office – administration.	Physician schedules surgery appointment.	1. Surgery date established. 2. Instruction booklet is given.	1. Patient 2. CVMC. 3. Scheduler.	1. Date – correct. 2. Instruction – correct and concise. 3. Surgery – correct procedure.
Physician Patient	1. Physician. 2. Patient. 3. Ailment. 4. Physician's office – administration.	OR scheduler schedules PAT appointment.	1. PAT date/time. 2. Process education.	1. Patient. 2. Physician. 3. PAT nurse.	1. Patient knows PAT date/time. 2. Patient knows process.
Patient Scheduler Physician's office	1. Patient. 2. PAT schedule.	Patient arrives at hospital and registers.	1. Patient is pre-registered. 2. Patient pays money. 3. Insurance information is acquired. 4. Patient receives directions.	1. Patient. 2. PAT nurse. 3. Hospital. 4. OB.	1. Patient knows where to go. 2. PAT nurse notified in timely manner. 3. Payment to CVMC. 4. Correct insurance company information.
Physician Patient	1. Patient. 2. Correct physician orders. 3. Consent form.	Patient is assessed (EKG and H&P).	1. History—surgery/patient education completed. 2. EKGs completed. 3. Anesthesia assessment completed.	1. Patient. 2. OPS. 3. OB. 4. Anesthesia.	1. Correct patient history. 2. Correct patient education. 3. Correct chart to OPS.
Physician Patient OR scheduler	1. Patient. 2. Physician orders (via PAT nurse).	Patient is transferred for ordered tests (labs or X-rays).	1. Copy to patient (lab and X-ray). 2. Patient education.	1. Patient. 2. Laboratory. 3. X-ray.	Timely, completed, accurate and obtained/scanned.
Patient OR Scheduler	1. Patient. 2. OR schedule.	Patient leaves discharged with surgery date/time.	1. Schedule surgery date and time. 2. Patient education.	1. Patient 2. OPS and OB.	Correct patient information.

CTQ = critical to quality
CVMC = Church Valley Medical Center
EKG = electrocardiogram
H&P = history and physical
OB = obstetrics
OPS = operations
OR = operating room
PAT = preadmission testing

Value Stream Map. Example



A3 Problem Solving Process

- **What is it?**
- Toyota Motor Corporation is famed for its ability to relentlessly improve operational performance. Central to this ability is the training of engineers, supervisors and managers in a structured problem-solving approach that uses a tool called the A3 Problem-Solving Report. We have adapted the approach by articulating ten steps to proceed from problem identification to resolution in a fashion that fosters learning, collaboration, and personal development. The problem-solver records the results of investigation and planning in a concise, two-page document (the A3 Report, also adapted from Toyota) that facilitates knowledge sharing and collaboration.
- The term "A3" derives from the paper size used for the report, which is the metric equivalent to 11" x 17" (or B-sized) paper. Toyota actually uses several styles of A3 reports--for solving problems, for reporting project status, and for proposing policy changes--each having its own "storyline." We have focused on the problem-solving report simply because it is the most basic style, making it the best starting point.
- **Why use it?**
- Most problems that arise in organizations are addressed in superficial ways, what some call "first-order problem-solving." That is, we work around the problem to accomplish our immediate objective, but do not address the root causes of the problem so as to prevent its recurrence. By not addressing the root cause, we encounter the same problem or same type of problem again and again, and operational performance does not improve.
- The A3 Process helps people engage in collaborative, in-depth problem-solving. It drives problem-solvers to address the root causes of problems which surface in day-to-day work routines. The A3 Process can be used for almost any situation, and our research has found that, when used properly (i.e., all of the steps are followed and completed), the chances of success improve dramatically.

A3 Steps for Problem Solving

- **Steps of the A3 Process**
- The following steps will guide you through the A3 Process. To get a more in-depth explanation of the step, click on the step and a popup window will appear with more information. If you're using Internet Explorer and have popups blocked, you will have to unblock them to see the window.

  · Step 0: Identify a problem or need
  · Step 1: Conduct research to understand the current situation
  · Step 2: Conduct root cause analysis
  · Step 3: Devise countermeasures to address root causes
  · Step 4: Develop a target state
  · Step 5: Create an implementation plan
  · Step 6: Develop a follow-up plan with predicted outcomes

  The results of steps 0-6 can be recorded on an A3 report.

  · Step 7: Discuss plans with all affected parties
  · Step 8: Obtain approval for implementation
  · Step 9: Implement plans
  · Step 10: Evaluate the results
  Note that the A3 process is rooted in the more basic PDCA cycle. Steps 1-8 are the Plan step (with step 5 planning the Do step and step 6 planning the Check step). Step 9 is the Do step, and step 10 is the Check step. Based on the evaluation, another problem may be identified and the A3 process starts again (Act).

A3 Problem Solving Purpose

- **The A3 Report**
- The A3 Report goes hand-in-hand with steps 0-6 of the A3 Process. The purpose of the A3 Report is to:
- Document the learning, decisions, and planning involved with solving a problem,
- Facilitate communication with people in other departments, and
- Provide structure to problem-solving so as to maximize learning.
- The report (template) is designed to be printed on 11x17 inch paper (or two pieces of 8.5x11 inch paper) as shown in the diagram below. For additional explanations of the individual parts of the report, click on the title box for that part. You can also download an A3 Report template in MS Word format; however, remember this is a flexible tool and can be adapted to specific situations--just don't short circuit the process!

THEME: Concise statement of what this A3 report is about.

BACKGROUND:

- Note any contextual or background information necessary to fully understand the issue.
- Indicate how this problem affects the company's goals or is related to its values.

CURRENT CONDITION:

- Insert a diagram that illustrates how the current process works.
- Label the diagram so that anyone knowledgeable about the process can understand.
- Note the major problems (we like to put them in storm bursts to set them apart)
- Include quantified measures of the extent of the problem – graphical representations are best!

Avg. 4 stockouts / wk
(Jun – Aug, 2005)

ROOT CAUSE ANALYSIS:

- List the main problem(s)
- Ask appropriate "why?" questions until you reach the root cause. A rule-of-thumb: you haven't reached the root cause until you've asked "why?" at least 5 times!
- List the answers to each why question

Problem
↳ first immediate cause
↳ cause for the first immediate cause
↳ deeper cause to the preceding cause
↳ etc.

To: _____
By: _____
Date: _____

TARGET CONDITION:

- Insert a diagram that illustrates how the proposed process will work, with labels.
- Note or list the countermeasure(s) that will address the root cause(s) identified.
- Predict the expected improvement in the measure of interest (specifically and quantitatively)

IMPLEMENTATION PLAN:

- List the actions which must be done in order to realize the Target Condition, along with the individual responsible for the action and a due date.
- Add other items, such as cost, that are relevant to the implementation.

Action	Responsibility	Deadline
Action 1	D. Smith	Oct. 1
Action 2	N. Jones	Nov. 5
Action 3	M. Jordan	Nov. 28
Etc.		
COST: no expenditures required		

FOLLOW-UP:

Plan	Actual
• Note the plan to measure the effectiveness of the proposed change. • Indicate when it will be measured, and by whom.	• Leave blank initially • After follow-up, record the results of implementation • Record the date of actual follow-up