Process Improvement: Fixing Problems

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Dale Roenigk
School of Government

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Can't we just fix our problems already?

Failure rates of change projects:

30-70%

2

What kinds of problems do you have?

- Defects
  - errors, mistakes, poor quality
- Delays
  - taking too long, lack of timelines met
- Dollars
  - work costing more than we'd like

Alliterated problems from Jay Arthur, www.qimacros.com

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Our old models of management are insufficient to meet our needs.

1st Generation – Just do it yourself
2nd Generation – Management by Direction
3rd Generation – Management by Results

- From Brian Joiner, Fourth Generation Management

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How do we get better results?

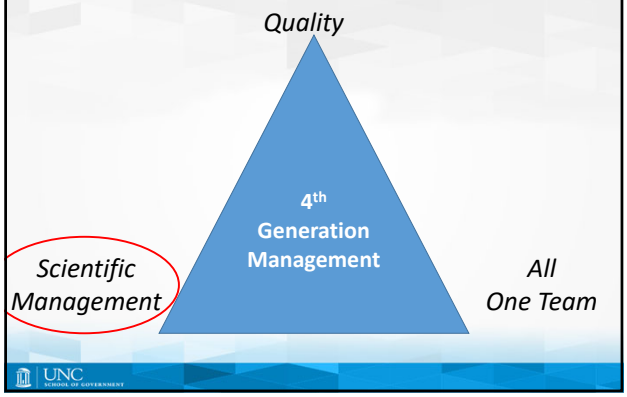
- **Organizations figure out how to improve performance to meet the goal.** *Our Desire*
- People figure out how to game the system to meet the goal. *Unintended Consequences*
- People figure out how to cheat the system. *Unintended Consequences*
- Lower the goal *Failure to improve*
- *Get Lucky*

First three attributed to Brian Joiner, Fourth Generation Management, last two are mine.

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4th Generation – Joiner Triangle



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We're going to cover a few basic tools designed to help us focus our efforts to improve our chance of success.

Focus
- Zeroing in to target our change efforts

Change
- Strategies to effect improvement

- Process Behavior Charts
- Pareto Charts
- Histograms
- Cause and Effect

- Cause and Effect
- Experiments
- Process Mapping
- Learning to look for waste

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Control Charts

Learning to see and understand variation to improve processes

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The number of crimes is going… Up/Down?

- Take a few minutes with others seated nearby to talk about as many possible causes for why crime might be going up/down in a community.

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Monthly Meeting of the Blue Heaven Police Stat Group Key Report

May District Crime Report

	Crimes
District 1	928
District 2	775
District 3	443
District 4	1048

Is this enough?

What more would you want to see for a monthly meeting talking about performance?

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May District Crime Report

	Crimes	Percent Change from Last Month	Percent Change from Same Month Last Year	Performance Score
District 1	928	3.8%	-16.3%	0
District 2	775	-7.7%	43.3%	0
District 3	443	-6.1%	-1.1%	2
District 4	1048	12.2%	36.8%	-2

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Are we confused yet?

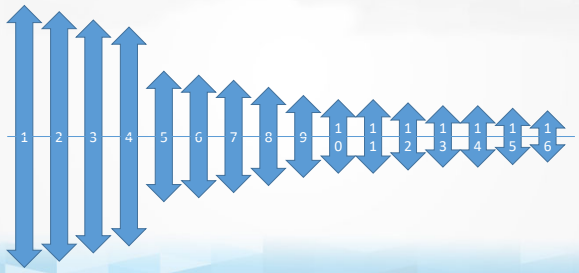
- Who is doing a good job?
- Who's performance is down?
- What actions if any should we be taking?

- Everyone had at least one green mark and everyone had at least one red mark.

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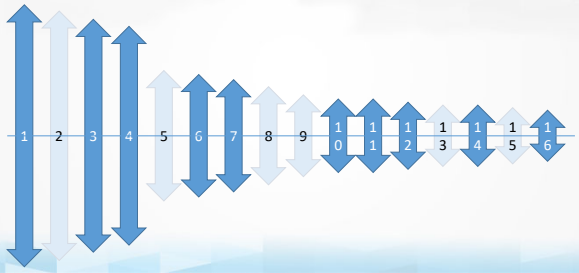
Any process or system has many causes that may be pushing performance up or down.



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But we may not even be identifying all the actual factors driving variation.



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What might explain variation?

- Speculating why numbers vary is usually not hard.
- Figuring out how to find evidence to determine what actually drives variation is key.

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Assessing how we do in traditional tabular reports may lead to misunderstanding and wasted time talking about why the numbers are up or down when common variation is present.

This is likely to be true whether using percentage changes, comparisons to averages, or comparisons to goals or standards.

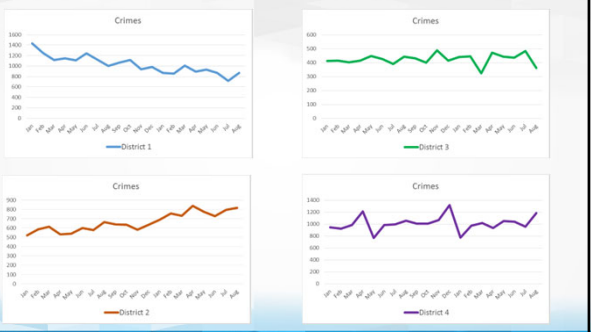
Fails to show variation in context.

May District Crime Report

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District 3	443	-6.1%	-1.1%	2
District 4	1048	12.2%	36.8%	-2

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Is the picture any clearer with simple line graphs?



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- Plotting the dots is the first step to
  - better understanding,
  - better analysis,
  - better discussions about performance, and
  - better decisions about where action is needed and where it may not be.

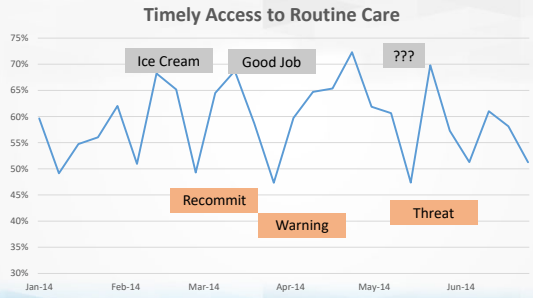
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What does management see as we progress through time?



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But we can go further than line charts and try to decide when the variation calls for change and when it is noise.

District 4's trend appears flat. But there are spikes of variation. Should be we concerned?

How do we understand the variation in evidence?



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Process Behavior or Control Charts were developed as a means to better understand and act on variation.

- Developed by Walter Shewhart in the 1920s at Western Electric later Bell labs.
- Shewhart argued for two types of variation: common cause and special cause.
- Needed a framework to distinguish between normal variation in processes and exceptional causes.



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Understanding the difference between the types of variation helps us understand how to interpret the data and how to make improvements.

Type of Variation	Other names	Character	Cause and Effect	Improvement
Common	Predictable, Routine	Always present, can be used to predict the future	No single assignable cause, can't separate out effects.	Comes from changing the process
Special	Unpredictable, Exceptional	Not always present, can change over time, can't be used to predict	Assignable cause dominates.	Finding and removing assignable causes of the variation

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Common is random or routine variation that is part of the process, special cause is exceptional variation that is likely some signal of change.



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How to calculate the control chart

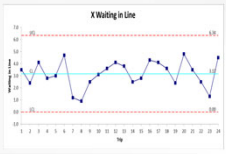
- We will use a particular kind of control well suited for service and administrative measures call the I-MR or X-MR chart.
- Actually two charts together, one for the range which tells us how wide to set the control limits and one for the actual data.

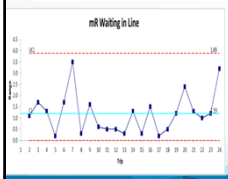
- **Understand this but don't do it manually. Use reliable software so you can focus on the value added of interpreting and using the chart.**

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Imagine some day tracking how long we wait in line for service.





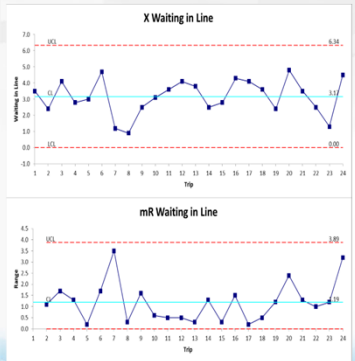
Trip	Waiting in Line	Range
1	3.5	
2	2.4	1.1
3	4.1	1.7
4	2.8	1.3
5	3	0.2
6	4.7	1.7
7	1.2	3.5
8	0.9	0.3
9	2.5	1.6
10	3.1	0.6
11	3.6	0.5
12	4.1	0.5
13	3.8	0.3
14	2.5	1.3
15	2.8	0.3
16	4.3	1.5
17	4.1	0.2
18	3.6	0.5
19	2.4	1.2
20	4.8	2.4
21	3.5	1.3
22	2.5	1
23	1.3	1.2
24	4.5	3.2
Average	3.17	1.19

1. Calculate the range which is the absolute value of the difference between the current point and the previous point.
2. Find the average of the ranges.
3. Create an upper limit for the ranges by multiplying the average by 3.268 and add to the average.
4. Plot the range chart.
5. Find the average for the actual data.
6. Plot upper and lower control limits for the actual data with the formula Average±2.66* AverageRange
7. Plot the data chart.

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How to interpret the range chart.



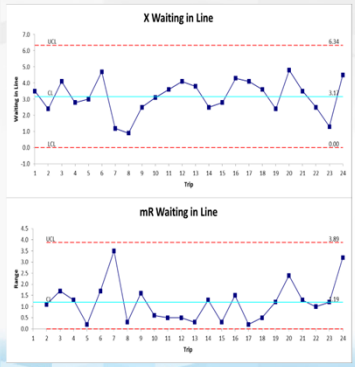
1. The range chart tells us the average movement from period to period is 1.19 minutes and the maximum change in waiting time we should see assuming a predictable process is 3.89 minutes.

2. No points on the range chart are past the 3.89 control limit so there are no points of concern on that chart.

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How to interpret the data chart.



3. On the waiting time data chart, we see that the times while varying all lie within the control limits. We would conclude this is a stable and predictable process.

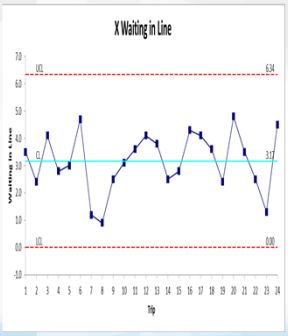
4. The average waiting time is 3.17 minutes and the maximum that would be expected is 6.34 minutes and we might see instances of zero waiting time.

5. Unless changes take place, we can use this for making predictions going forward and checking when we have problems.

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A few things to note about the chart.

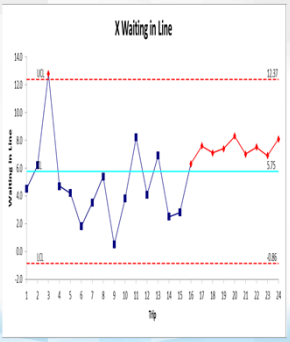


1. The numbers in the graph represent what is actually happening called the "Voice of the Process".
2. We may want something better (lower average times or a lower maximum time) but that is a separate question ("Voice of the Customer"). Don't confuse the two.
3. If we want to make changes we do it by focusing on the process overall and not on fixing specific points. Don't confuse common variation with special variation.

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Imagine instead our wait times had looked as follows.

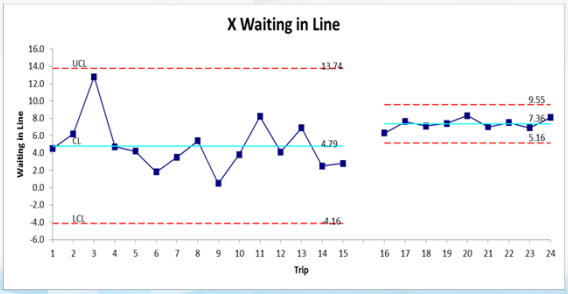


1. We have two places with special variation highlighted.
2. At time 3, we had a wait time of 12.8 minutes, beyond expectations. We should check out what happened at that time and see if an improvement could address it.
3. Starting at time 16, we had a run of nine consecutive measures all above the average which shouldn't happen by chance. Something unfavorable changed in our process and we should determine what it was.

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A revised chart would show that our process has moved to longer times, but a smaller range.



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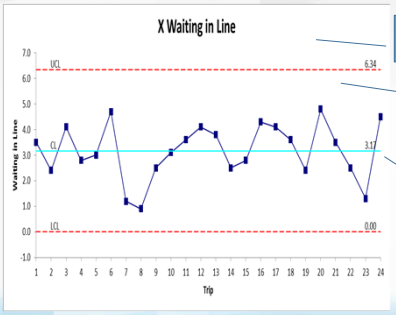
Process behavior or control charts can be used in several ways.

- What does our variation look like, what is average, and what is the predictable range.
- Provide guidance about when to react to variation and when to not react.
- Better discussions about what the varying numbers are telling us.
- Test new experiments or assess whether process changes have made a difference.
- Monitor process over time.

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Assess and understand the variation in place and know how to react.



Points outside the range are likely signals. Investigate and act on if appropriate.

Don't try to fix individual points in the predictable range. Change the whole process.

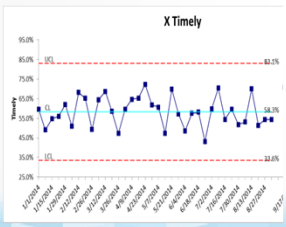
The average and limits provide you with a predictable set of numbers to use until the process changes.

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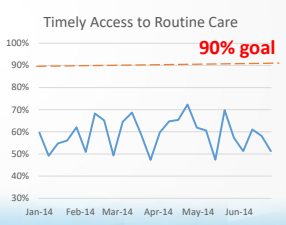
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We need to keep separate the "Voice of the Process" and the "Voice of the Customer"

Voice of the Process



Voice of the Customer



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The Voice of the Process tells us what is. If we want more, we need more than a goal we need a plan.

Voice of the Process

How will we know there is achievement or improvement

What do you want to accomplish

Voice of Customer

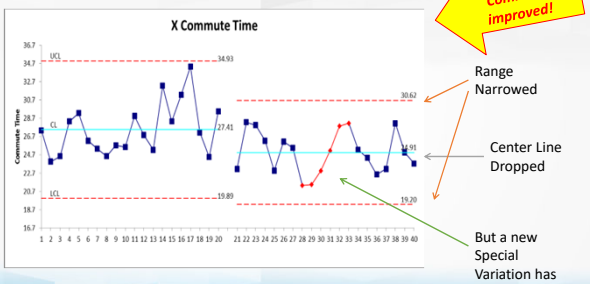
How will you do it

A plan to effect change

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Use other quality improvement tools to identify fixes or set up trials, then monitor if a difference was made.



Commute improved!

Range Narrowed

Center Line Dropped

But a new Special Variation has popped up

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What do you do with this headline?

The News & Observer

Wake Motor Vehicle Deaths up 18% in 2016

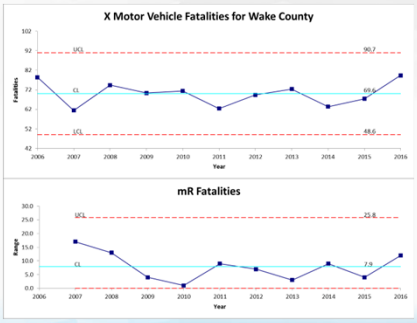
- *Wake County Motor Vehicle Fatalities up from 67 in 2015 to 79 in 2016, 18% increase!*
- *NC Fatalities up by just 4% over same period.*
- *Data Source: North Carolina 2016 Traffic Crash Facts, NC Division of Motor Vehicles*

Actual data, no such headline to my knowledge

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The control chart for motor vehicle fatalities in Wake County doesn't suggest the process has changed.



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Should we be celebrating progress with this headline?

Greensboro News and Record

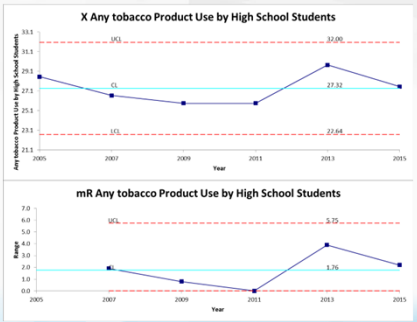
Use of Tobacco Products Down by NC High School Students

- *Survey data shows use of any type of tobacco products by NC high school students was down from 29.7 percent of students in 2013 to 27.5 percent in 2015.*
- *Data Source:* NORTH CAROLINA YOUTH TOBACCO SURVEY (NC YTS) for Middle & High Schools Factsheet, NC Division of Public Health

Actual data, no such headline to my knowledge

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The control chart for tobacco use shows that the decline in the most recent year while positive doesn't suggest the process has changed.

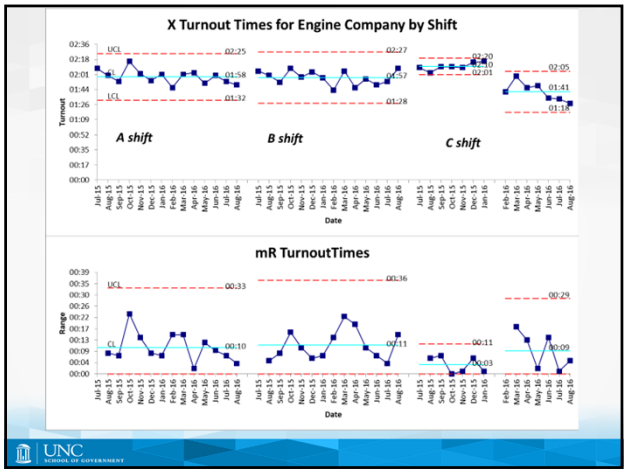


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Turnout Times for Fire Station

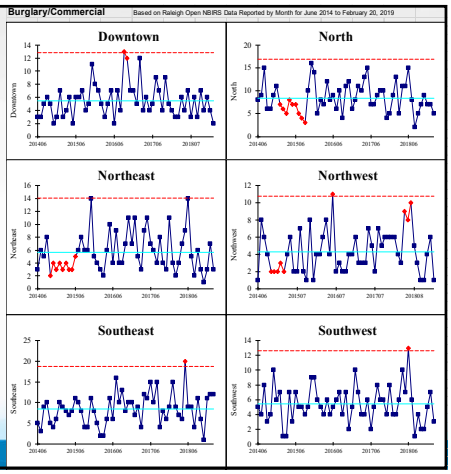
Engine Company 1	Shift		
Date	A-Turnout	B-Turnout	C-Turnout
Jul-15	02:08	02:05	02:09
Aug-15	02:00	02:00	02:03
Sep-15	01:53	01:52	02:10
Oct-15	02:16	02:08	02:10
Nov-15	02:02	01:58	02:09
Dec-15	01:54	02:04	02:15
Jan-16	02:01	01:57	02:16
Feb-16	01:46	01:43	01:41
Mar-16	02:01	02:05	01:59
Apr-16	02:03	01:46	01:46
May-16	01:51	01:56	01:48
Jun-16	02:00	01:49	01:34
Jul-16	01:53	01:53	01:33
Aug-16	01:49	02:08	01:28

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Control Chart Dashboard for Commercial Burglaries in Raleigh



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If you go forward with this technique, you may want to shift your terminology to better represent and communicate what you are doing.

Traditional	Better terminology
Control Chart	Process behavior chart
In-control process	Predictable process
Out-of-control process	Unpredictable process
Control limits	Natural process limit
Statistical process control	Continual improvement

If you intend to search for additional information in books or online, the terms on the left are the traditional phrasing. However, the terms on the right are likely to carry less baggage (for example the word "control").

Suggested by Donald Wheeler http://www.spcpress.com/pdf/DJW129.pdf

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XmR or ImR – The Swiss Army Knife of Process Behavior Charts



- It is the best chart for management and service processes.
- It is based on empirical data whereas some other models assume reliance on particular probability models.
- It is robust and will work in most situations. It is flexible and sensitive to actual change.

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A number of rules have been developed to highlight variation that is likely to be outside the bounds or random noise or common cause variation.

- The rules are effectively decision rules
- "Pay attention to what happened here" or just as importantly "These changing numbers need not be investigated"
- "***Don't just do something, stand there***".
- The rules don't guarantee that you can find the cause or even that there was a real difference. They focus our attention where it is most likely to be fruitful.

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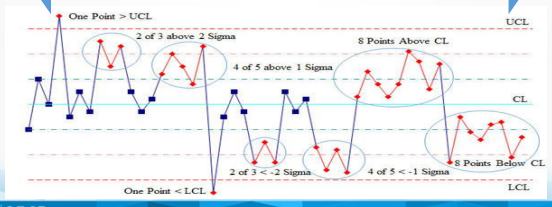
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These first set of rules basically represent a continuum between "spikes" and "shifts" in process behavior

"Spikes" Short-term deviations

At the right edge of a chart we will not know if a "spike" will transform into a "shift". Both are signals.

"Shifts" Changes in Process



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How much data do I need?

- At least three data points. But be careful and tentative.
- 10-20 is OK but still should be used cautiously.
- 20-30 is desirable
- 30+ is good

- The key to understanding is that your confidence goes up as your sample gets larger.

- As your sample gets much larger you may start to see more points of either spikes or shifts and you should be prepared for changes in the process

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Control charts can also be used to make comparisons across individuals or organizational units.

- Who should we fire?
- Who should get a bonus?

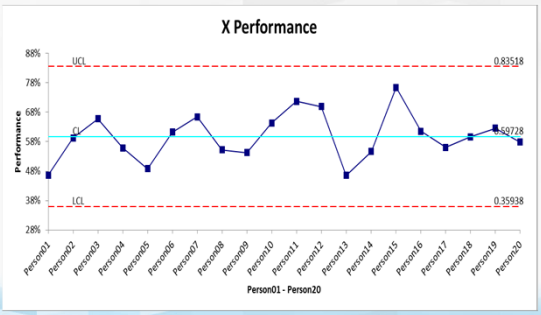
- What causes this variation by individual?

Person	Timely Access to Routine Care for Last Quarter
Person 01	57%
Person 02	66%
Person 03	62%
Person 04	70%
Person 05	58%
Person 06	62%
Person 07	62%
Person 08	60%
Person 09	69%
Person 10	70%
Person 11	62%
Person 12	60%
Person 13	66%
Person 14	47%
Person 15	62%
Person 16	52%
Person 17	64%
Person 18	62%
Person 19	61%
Person 20	82%

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The XmR chart can also be used to compare variability across people or units as long as the data is not sorted by the measure's values.



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If using the XmR chart to assess variation across people or units be careful of a few limitations.

- Don't sort the data by measure being analyzed. This would effectively reduce the actual variation and lead to overly tight limits.
- Instead sort the data by something unrelated to the measure. For example, name of the individual or unit, ID #, randomly assigned number.
- The only detection rule that matters is observations completely outside the bounds. Ignore the other rule violations.
- Anyone within in the limits can be said based on the data used to be the same as the others. Only those outside the bounds would be true outliers (high or low).

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A better control chart for analyzing differences among individuals or groups is the ANOM (Analysis of Means) control chart.

- This chart requires two or more observations for each person or unit being measured.
- The chart then uses the variation observed across the group to determine what is unusual variation or what is common cause.
- Only those individuals or units outside the limits should be determined to be different.

- Excel Example

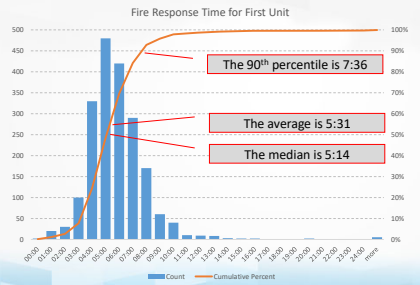
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Histograms

Another tool for seeing variation

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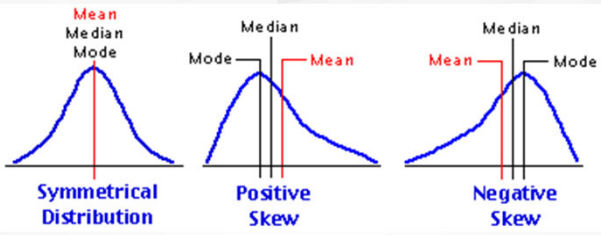
Histograms as another way to see variation but outside of the time ordered pattern.



- You need to group your data into categories if your variable is continuous.
- By adding a cumulative percent line you can find percentiles or fractiles.

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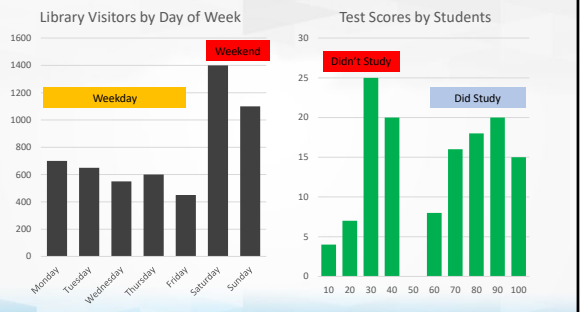
Mean or Median or Mode



http://analystnotes.com

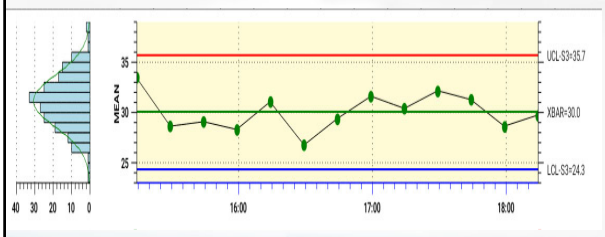
65

Histograms with multiple groupings suggest you have multiple processes.



66

A histogram and a control chart are both about displaying variation. Both have advantages but the control chart helps you see the process through time.



67

Pareto Analysis

68

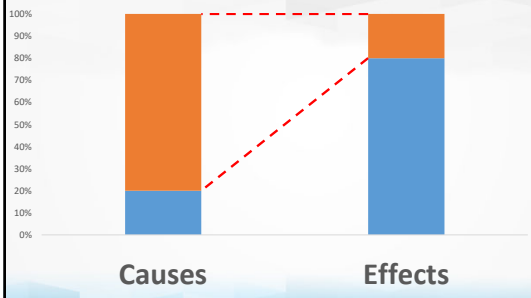
If we're not happy with our results, what do we do?

- We can't do nothing
- We can't fix everything
- We want to make a difference

The Pareto Principle or 80/20 Rule is a simple analytical technique to help us focus on actions that are most likely to make a difference.

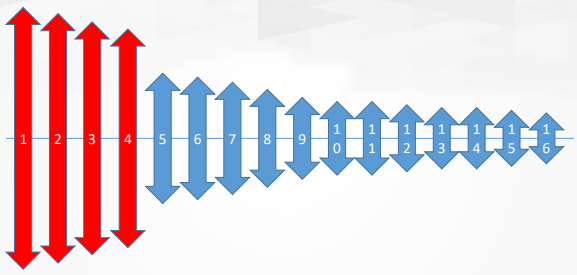
69

A small fraction of items will produce a large fraction of effects.



70

Focus on the vital few that are the biggest cause of problems.



71

Possible examples of the Pareto Principle in government.

- A large portion of crime is committed by a small number of people.
- Most of the financial issues come from a small number of bills or payors.
- Most of the breaks in a water system will come from a small portion of the system.
- Most of our service costs are for a small number of clients.

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It's useful to consider how you count "effect" to focus on where you can gain the most impact.

- Cases/Incidents
- Dollars associated with cases
- Severity Measure

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What do you do when you have data?

- Slice and dice data by subcategories
  - Time
  - Cause Type
  - Geography
  - Organizational Unit
  - Other?
- Look at data by different measures of effect.
  - Cases/Incidents
  - Dollars
  - Severity

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Practice creating a Pareto

The Town of Blue Heaven is worried about the numbers of serious employee accidents that have been happening, 90 in the last year. The problem seems complex.

- All departments have had some accidents.
- There are 27 different types of accidents that have occurred.
- Our employee safety program follows a national model but our numbers haven't improved.

Accident Data for Organization, By
90 Accidents for 2015

Accident	Date	Type	Dept
1	1/6/2015	T-26	Dept E
2	1/7/2015	T-10	Dept D
3	1/14/2015	T-09	Dept D
4	2/4/2015	T-01	Dept C
5	2/6/2015	T-14	Dept D
6	2/12/2015	T-02	Dept C
7	2/17/2015	T-04	Dept B
8	2/18/2015	T-02	Dept C
9	2/22/2015	T-02	Dept C
10	2/24/2015	T-11	Dept D
11	3/3/2015	T-13	Dept E
12	3/10/2015	T-02	Dept C
13	3/14/2015	T-01	Dept D
14	3/15/2015	T-05	Dept E
15	3/28/2015	T-06	Dept D

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Accidents Grouped by Type and Department

A Focussed Work Plan

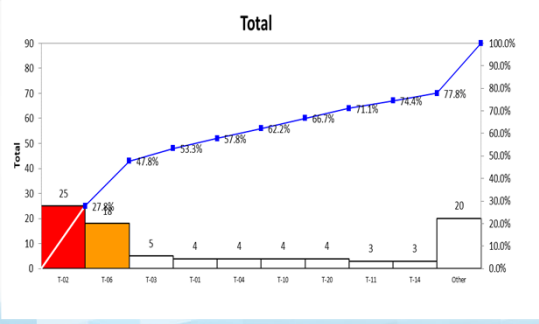
1. Dept C, Accident type 2
2. Dept D, General Accident Prevention
3. Accident Type 6, across all Depts.

	Dept A	Dept B	Dept C	Dept D	Dept E	Total
T-01	0	1	1	2	0	4
T-02	1	0	23	1	0	25
T-03	0	1	0	3	1	5
T-04	1	1	0	2	0	4
T-05	0	0	1	0	1	2
T-06	3	1	4	6	4	18
T-07	0	0	1	0	0	1
T-08	0	0	0	0	0	0
T-09	0	0	0	1	1	2
T-10	0	0	2	1	1	4
T-11	1	0	0	2	0	3
T-12	0	0	0	0	1	1
T-13	0	0	0	1	1	2
T-14	0	0	0	3	0	3
T-15	0	0	0	0	0	0
T-16	0	0	0	0	0	0
T-17	1	0	0	1	0	2
T-18	0	0	1	0	0	1
T-19	2	1	0	0	0	3
T-20	0	1	0	2	1	4
T-21	0	0	0	0	0	0
T-22	0	0	0	1	0	1
T-23	0	0	0	0	0	0
T-24	0	0	0	0	0	0
T-25	0	0	0	2	0	2
T-26	0	0	0	0	1	1
T-27	0	0	0	1	1	2
TOTAL	9	6	33	29	13	90

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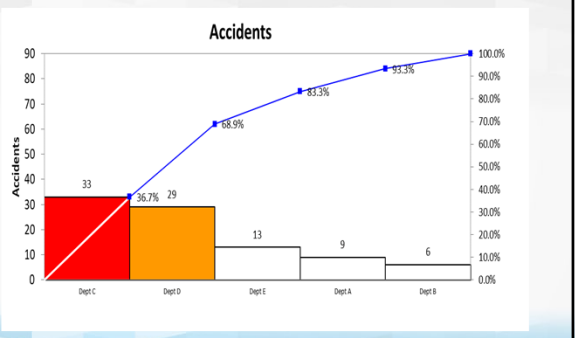
Accidents by Type



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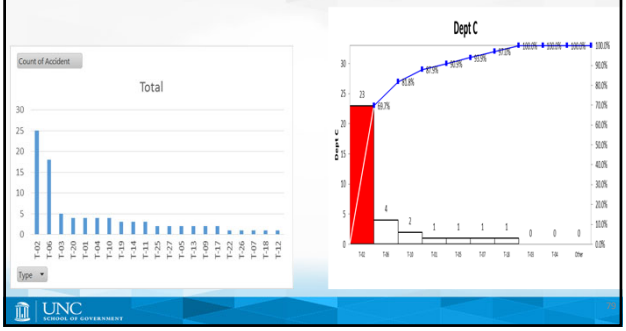
77

Accidents by Department



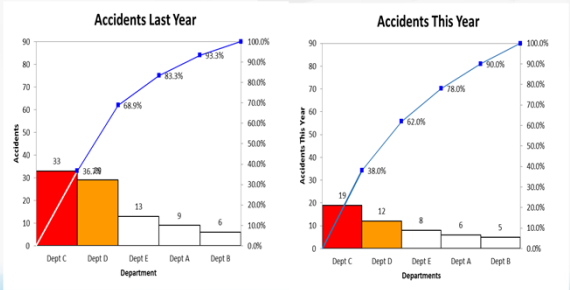
78

Pareto Charts can be created with simple pivot tables or with add-in software for Excel.



79

Chart the changes, celebrate the progress, and start again.



80

Use the Pareto Principle to focus your improvement efforts.

- Find the "Vital Few" that cause the most problems.
  - Base this on actual data whenever possible.
- Make and implement a plan to address these vital few.
- Monitor to see if you have fixed them.
- Repeat again and again for continual improvement.

81

Data Issues

What if you don't have all the data you need?

83

You probably have more data than you think. Start from where you are and what is important to you.

But what do you do when you don't have the data you need to use the tools or answer your questions?

- *Don't punt the challenge and say you can't do anything.*
- *Don't insist you need to spend lots of money or effort setting up systems to collect data (at least initially).*

84

Collecting new data is a challenge.

- It requires new effort to define, collect and use.
- Before you start on big efforts look to simple strategies.
  - Simple data collection tools (check sheets, defect tracking, time tracking – the software has templates you can use)
  - Go back to your process and do a sample of 30-50 cases to measure what you can from your historical data. Might be paper files or other tracking systems not available to analyze in Excel. Determine if the information was worthwhile.
  - Set up tracking initially to be done manually for a limited defined time going forward. Assess whether the information is helpful.

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Look for additional data to stratify your current data collection into what you believe are possible key causes.

- What additional ways might you slice and dice your data as with Pareto charts to find the "Vital Few"
  - Geography, time, organizational unit, error type, client characteristics, etc.
- Create the possible list of causes to add by first doing a cause and effect analysis.

Stratification

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Look for additional data to segment your current data collection into sub-steps in your process.

Total fire response time for the first unit is driven by three separate steps. But relative performance is not the same and differences are missed without segmenting the process.

Segmentation

15. Response Times-1st Arriving Unit	(a) Avg Dispatch Time	(b) Avg Turnout Time	(c) Avg Travel Time	Sum of Average Times
APEX	1.48	1.12	3.93	6.53
ASHEVILLE	1.40	1.02	3.72	6.13
CHAPEL HILL	1.97	1.02	3.38	6.37
CHARLOTTE	0.35	0.80	3.40	4.55
CONCORD	0.87	0.82	4.10	5.78
GOLDSBORO	0.57	2.08	3.58	6.23
GREENSBORO	1.28	1.47	2.62	5.37
GREENVILLE	1.52	1.57	4.25	7.33
HICKORY	1.98	1.28	2.88	6.15
HIGH POINT	0.37	0.93	3.65	4.95
SALISBURY	0.87	1.73	5.15	7.75
WILSON	0.68	0.92	3.43	5.03
WINSTON-SALEM	0.73	1.18	3.52	5.43
Average	1.08	1.23	3.66	5.97

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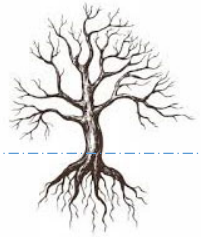
87

Cause and Effect Analysis

Further focusing your attention but starting to fix problems

88

Getting to the Root Problem Cause and Effect Analysis



Symptom

Cause

89

Cause and effect analysis is simple but powerful tool that can improve our problem solving.

- Can help us push beyond the usual suspects
- Provides structure to our thinking
- Press us to consider broad and balanced approach to problem identification
- Helps groups keep focus and facilitate participation.

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Conducting a cause and effect analysis is straightforward.

Investigate
- **Identify the problem to be examined. Be specific. Base on data.**
- Choose major categories of cause.
- Brainstorm for causes. Drill down with the 5 whys to get at the root
- Review diagram for missing items or weak categories. Add as needed.

Prioritize
- Identify most likely targets for investigation
- Seek to confirm causes with data or prioritize based on risk.

Act and Confirm
- Create action plans to fix or prevent.
- Monitor to see if solution was successful.

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Select major categories of causes

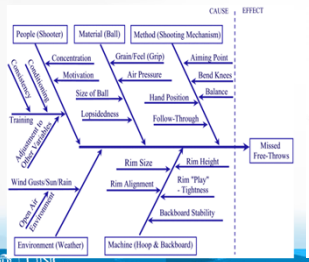
- Starting off with major categories helps focus our attention but also prompts us to cover all the bases.
- Typical categories for services
  - People
  - Processes/Methods
  - Policies
  - Resources
  - Other

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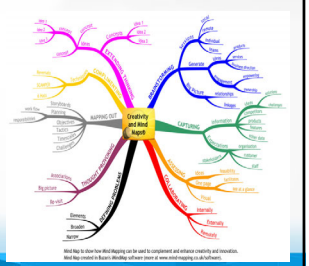
93

Two types of cause and effect diagrams

Fishbone



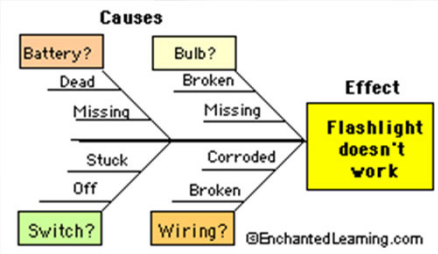
Radial



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94

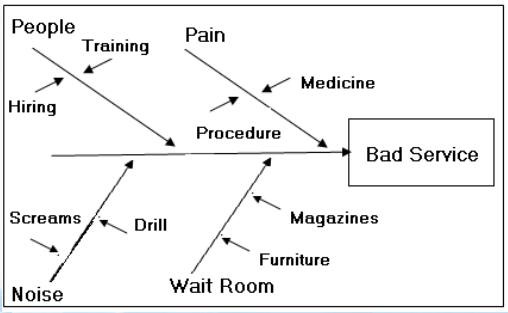
Causes of a flashlight not working.



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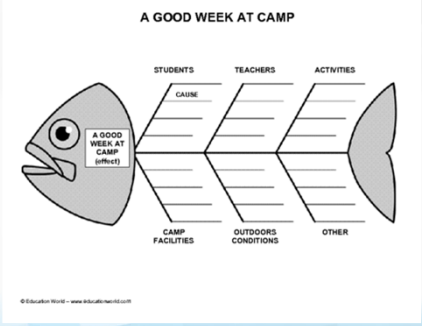
Cause of bad service in a dentist office



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Causes of a good week at summer camp



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The five whys is a way of drilling down in a causal chain to get at the true root of the problem.

- Car stopped
  - Why did the car stop – It ran out of gas
    - Why did it run out of gas – didn't buy gas last night
      - Why didn't you buy gas – no money and credit card is topped out
        - Why didn't you have money .....
          - Why
            - Why
- Don't need to go down five levels but don't stop before you get to what feels like the root of the cause-effect chain.

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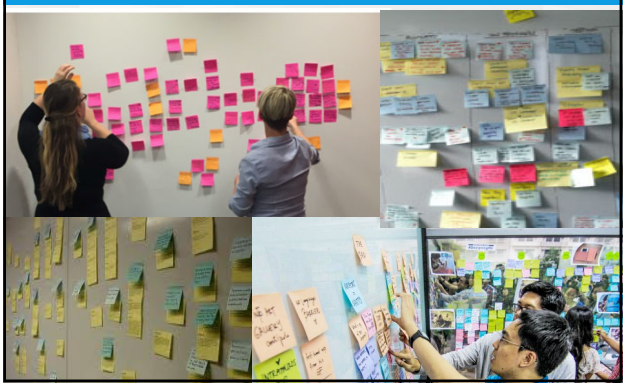
Illustration of the 5 Whys

	The Problem	Solution
	Oil on Fleet Shop Floor	Clean up the oil
WHY?	Because the oil tank gasket is leaking	Fix the leak
WHY?	The tank gasket has deteriorated	Replace gasket
WHY?	Because we have inferior gaskets	Change gasket specifications
WHY?	Bought a good deal on cheap gaskets	Change purchase policy
WHY?	Purchasing gets rewarded for short-term cost savings	Change evaluation rules for purchasing office

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Post-its are a the tool for cause and effect analysis at the start.



101

Why are post-its so useful?

- Sized for a chunk of information
- Easily stuck to a surface and stays put.
- But they can also be easily moved and reattached.
- Writing it down helps get it out of our head, makes it stick in our memory, and separates it from our ego.



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A few simple key principles

- Each post-it is a single "chunk" of information.
  - A word or just a few but not an essay.
- Arrange the chunks.
  - Lists
  - Trees
  - Maps
- We set up a few guides to focus a session.
  - Objectives
  - Criteria
  - Constraints
  - Questions



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Brainstorm for ideas of causes by category.

- Post-it Notes allow for flexibility and easy idea generation.
- Go randomly or work through categories sequentially.
- Silent method: Let individuals start by putting out ideas separately without talking
- Open brainstorming: talk it through out loud building the ideas as you go.

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Practice Exercise for Cause and Effect

- **What causes fire companies to have long turnout times?**
- **Alternatively we can select you own topic.**

1. Do a post-up problem solving
   a) Individually and quietly list out all the causes you can
   b) Post up causes on a common board without talking
   c) Add causes that you notice individually
2. Working as a group, aloud, create the cause-effect diagram
   a) Eliminate duplicates
   b) Drill down with five whys
   c) Work until you get to where you are satisfied

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Cause and effect diagrams offer several values not obvious.

- By identifying many causes, the process can reduce the chances of overlooking causes or missing more promising options.
- Kept over time, the cause and effect diagram can be revisited for further improvements or when new problems arise.
- The cause and effect diagram can support dialogue across functional areas.
- Diagrams can be used for training new employees.
- Cause and effect diagrams can be used proactively to prevent problems.

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Cause and effect analysis should be a participatory sport. Get everyone involved as part a broader culture shift to improve quality.



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We've done a cause and effect analysis so now what?

- Identify most likely candidate causes, use data when possible.
- Identify fixes such as countermeasures, checklists, error proofing
- Prioritize actions.

- Not sure? Consider experiments to test out different ideas for cause and see if they fix the problem. If not, repeat the process as needed.

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Prioritize causes for action and figure out countermeasures or fixes.

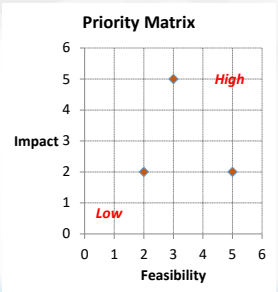
- For root cause analysis directed at special cause variation, identify the key root cause (or possibly multiple ones) and design countermeasures (fixes).
- The countermeasure matrix template in the software can help you prioritize based on impact and feasibility.
- Consider the use of checklists as a means to standardize your process, prevent errors, and promote best practices.
- Consider how you might "error proof" your process.
- The FMEA template may help you also consider risk for future oriented problem prevention.

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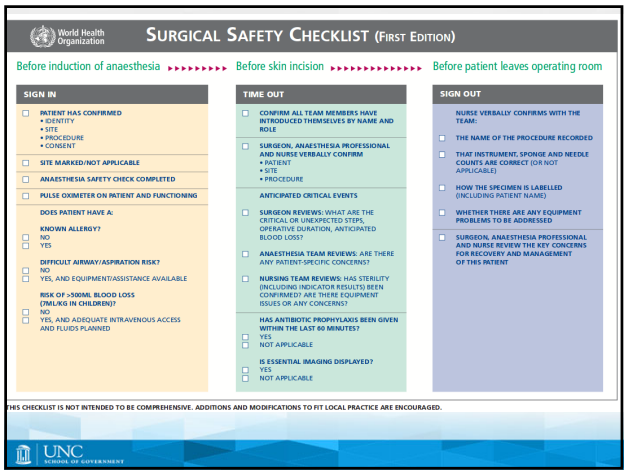
Priority Action Matrix

Action	Feasibility or Cost (1-5)	Impact (1-5)
Act 1	3	5
Act 2	5	2
Act 3	2	2

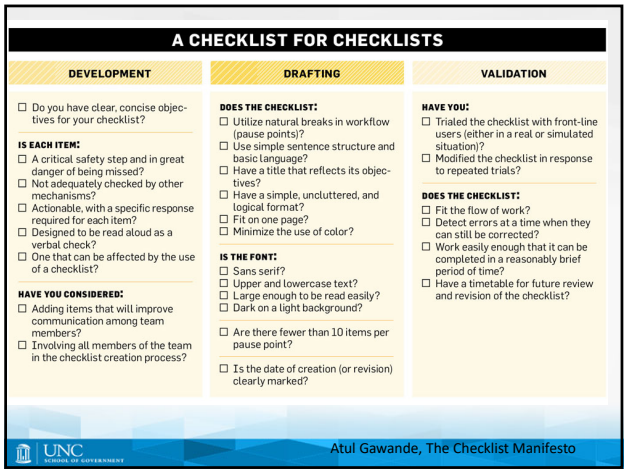


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World Health Organization
SURGICAL SAFETY CHECKLIST (FIRST EDITION)
Before induction of anaesthesia
Before skin incision
Before patient leaves operating room
SIGN IN
PATIENT HAS CONFIRMED
• IDENTITY
• SITE
• PROCEDURE
• CONSENT
SITE MARKED/NOT APPLICABLE
ANAESTHESIA SAFETY CHECK COMPLETED
PULSE OXIMETER ON PATIENT AND FUNCTIONING
DOES PATIENT HAVE A:
KNOWN ALLERGY?
NO
YES
DIFFICULT AIRWAY/ASPIRATION RISK?
NO
YES, AND EQUIPMENT/ASSISTANCE AVAILABLE
RISK OF >500ML BLOOD LOSS (7ML/KG IN CHILDREN)?
NO
YES, AND ADEQUATE INTRAVENOUS ACCESS AND FLUIDS PLANNED
TIME OUT
CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE
SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE VERBALLY CONFIRM
• PATIENT
• SITE
• PROCEDURE
ANTICIPATED CRITICAL EVENTS
SURGEON REVIEWS: WHAT ARE THE CRITICAL OR UNEXPECTED STEPS, OPERATIVE DURATION, ANTICIPATED BLOOD LOSS?
ANAESTHESIA TEAM REVIEWS: ARE THERE ANY PATIENT-SPECIFIC CONCERNS?
NURSING TEAM REVIEWS: HAS STERILITY (INCLUDING INDICATOR RESULTS) BEEN CONFIRMED? ARE THERE EQUIPMENT ISSUES OR ANY CONCERNS?
HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES?
YES
NOT APPLICABLE
IS ESSENTIAL IMAGING DISPLAYED?
YES
NOT APPLICABLE
SIGN OUT
NURSE VERBALLY CONFIRMS WITH THE TEAM:
THE NAME OF THE PROCEDURE RECORDED
THAT INSTRUMENT, SPONGE AND NEEDLE COUNTS ARE CORRECT (OR NOT APPLICABLE)
HOW THE SPECIMEN IS LABELLED (INCLUDING PATIENT NAME)
WHETHER THERE ARE ANY EQUIPMENT PROBLEMS TO BE ADDRESSED
SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT
THIS CHECKLIST IS NOT INTENDED TO BE COMPREHENSIVE. ADDITIONS AND MODIFICATIONS TO FIT LOCAL PRACTICE ARE ENCOURAGED.
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A CHECKLIST FOR CHECKLISTS
DEVELOPMENT
Do you have clear, concise objectives for your checklist?
IS EACH ITEM:
A critical safety step and in great danger of being missed?
Not adequately checked by other mechanisms?
Actionable, with a specific response required for each item?
Designed to be read aloud as a verbal check?
One that can be affected by the use of a checklist?
HAVE YOU CONSIDERED:
Adding items that will improve communication among team members?
Involving all members of the team in the checklist creation process?
DRAFTING
DOES THE CHECKLIST:
Utilize natural breaks in workflow (pause points)?
Use simple sentence structure and basic language?
Have a title that reflects its objectives?
Have a simple, uncluttered, and logical format?
Fit on one page?
Minimize the use of color?
IS THE FONT:
Sans serif?
Upper and lowercase text?
Large enough to be read easily?
Dark on a light background?
Are there fewer than 10 items per pause point?
Is the date of creation (or revision) clearly marked?
VALIDATION
HAVE YOU:
Trialed the checklist with front-line users (either in a real or simulated situation)?
Modified the checklist in response to repeated trials?
DOES THE CHECKLIST:
Fit the flow of work?
Detect errors at a time when they can still be corrected?
Work easily enough that it can be completed in a reasonably brief period of time?
Have a timetable for future review and revision of the checklist?
Atul Gawande, The Checklist Manifesto
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Error proofing or "Poke-Yoke" is about trying to prevent mistakes before they happen.
Disk Cleanup
Are you sure you want to permanently delete these files?
Delete Files
Cancel
1 2 3 4 5 6 7 8 9
COMPOST
LANDFILL
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Experiments are another natural tool to use with cause and effect analysis.

- Using what you devise from cause and effect analysis, design small experiments to test relationships.
- This is most important when you don't have data pointing to relationships or when the costs of a change may be large and you want to make sure it is likely to work.
- Even fairly simple experiments may be possible by controlling one or two items and using random assignment. For example, test over a short period whether one type of notification generates more citizen participation over another. Do emailed bills get paid faster than paper bills?
- There are a number of tools to do process improvement experimentation more efficiently and effectively such as DOE (design of experiements) and MVT (multivariable testing) but they are more advanced and you might want assistance or further develop these skills.

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Cause and effect analysis is flexible tool that can be used for special cause, common cause, or future prevention efforts.

- Special Cause – reactive focused on special cause (what happened that day in that place)
- Common Cause – reactive but focused on common cause (what are the primary factors driving the underlying process)
- Failure Modes and Effect Analysis FMEA – proactive focused on preventing problems in the future (what could go wrong).

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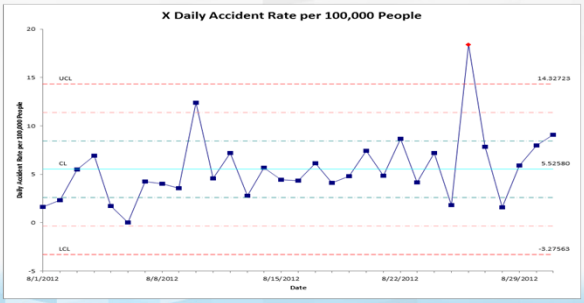
Special cause and effect analysis is meant to address special cause variation.

- It is reactive in that it is focused on a specific occurrence.
- What caused the issue at that date, time, place?
- Beyond just looking at the usual suspects, root cause asks us to determine what was the actual cause.
- We need to rule out alternative causes and only accept causes with evidence or a strong case.

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Control charts help us see special cause and unusual events separate from the common cause variation.



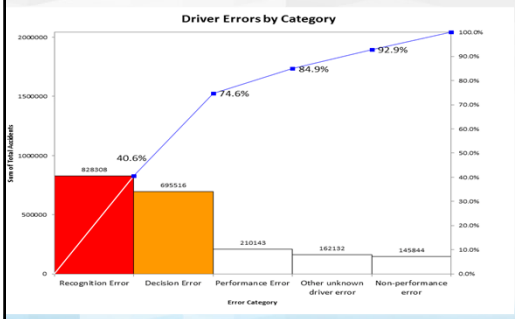
119

Common cause analysis is meant to address common cause variation.

- It is reactive in that it is looking backwards but focused on the underlying general levels.
- We are looking for causes hidden in the noise.
- The key tool here to help choose what cause to look at is the pareto chart so we are looking at data based evidence of the drivers of the process.
- Typically we select some threshold to mark out those cases that are of concern (cases that are too long, above average defects, etc.) and then see what is common to those cases.

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Pareto charts help us focus on key problems rather than everything.



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Failure Modes and Effect Analysis is cause and effect analysis applied to what hasn't happened yet.

- FMEA is proactive, looking to prevent future problems.
- We don't have data about the future but we can use evidence like pareto charts for the past or other data about the likelihood and risks of possible problems.
- The key task for FMEA is to select a problem of concern and identify its likely drivers and design appropriate preventative measures.

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Improving Processes

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A process map of a turn in Monopoly

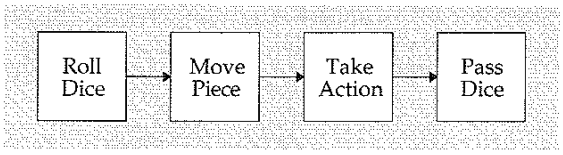


Figure 2.1: Block Diagram for a Turn in Monopoly

Source: Donald J. Wheeler and Sheila R. Poling
Guide to Process Improvement, 1998.

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A more complex view of a turn in Monopoly.

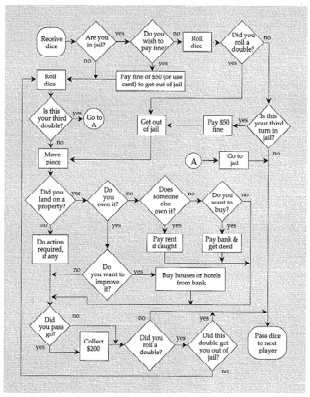


Figure 2.2: Flowchart for a Turn in the Game of Monopoly

Source: Donald L Wheeler and Sheila R. Poling, Quality Improvement, 1998

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A good process map requires work. Why do it?

- Visually document important process.
- Clarify and reach agreement on actual and desired process among participants.
- Communicate the process outside and to future employees.

Simply clarifying and reaching agreement on your processes may eliminate some errors.

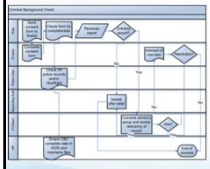
- **Identify opportunities for improvement by eliminating or reducing delays and errors.**

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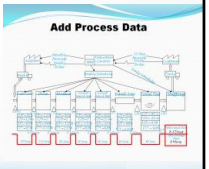
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Process diagrams help us look at how the what, where, and when of our processes that might be fixed.

Process Flow ***Spaghetti Diagram*** ***Value Added Map***







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Spaghetti Diagram: Mapping in Spatial terms

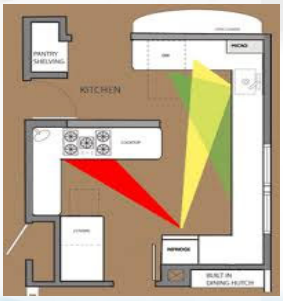
- Used to look at the movement of people or materials in physical space.
- Concern is to find where the paths are unnecessarily long, overlapping, and inefficient.

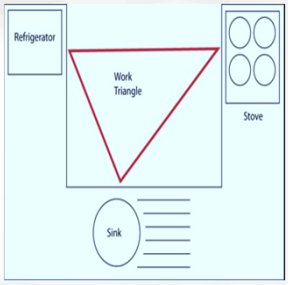
- Do with post-its to start.
- Try step-counters for tracking movement of people.
- Follow the path an item takes through your organization.

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Kitchen work triangle is a simple example of the idea of a spaghetti map.

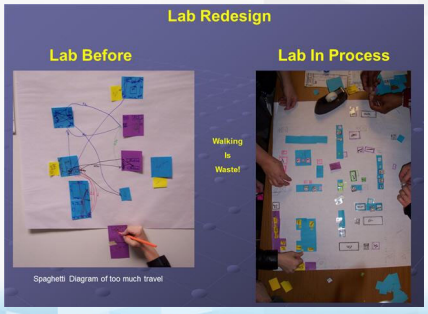




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Example of a hospital lab change



- Reduce lab staff walking by 54%
- Reduced floor space by 17%
- Reduced tech travel by 40%
- Reduced sample travel by 55%

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Places this might work

- Fleet Shop
- Parks and Recreation
- Public Works
- Library

Less obvious places
- Planning, permitting, licensing
- Bill paying

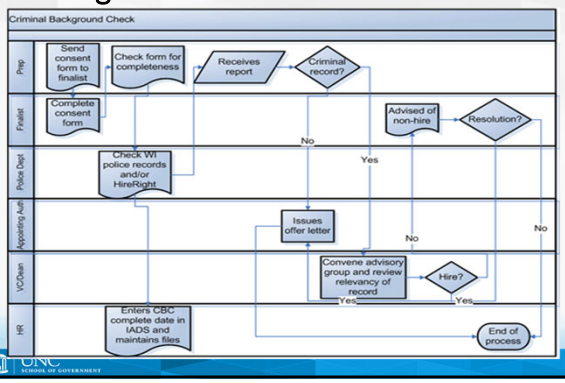
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Process Flow: Getting the steps lined up

- How a process moves from start to finish
- Key concerns are:
  - Setting the boundaries for the process (start to finish)
  - What level of detail to map
  - Getting the right people in the room. Make sure to include not just the top-level people but the people who actually carry out the steps.
- Objectives for process mapping
  - Eliminate unnecessary steps
  - Simplify process flow
  - Standardize work

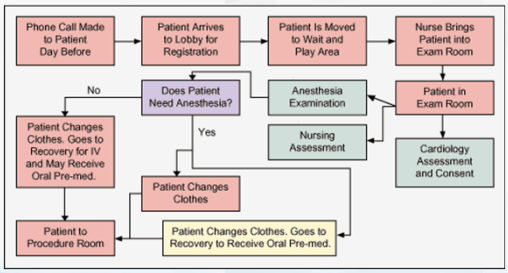
134

Example of a process flow for criminal background check.



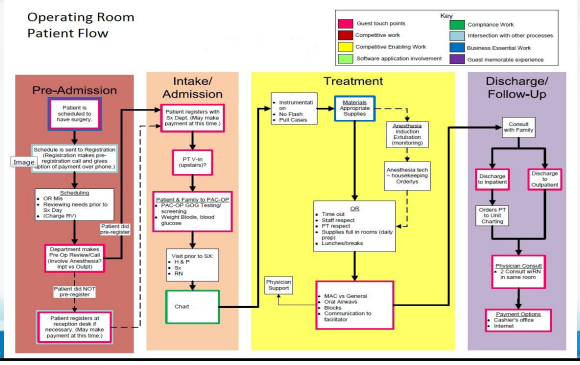
135

Process flow for outpatient surgery



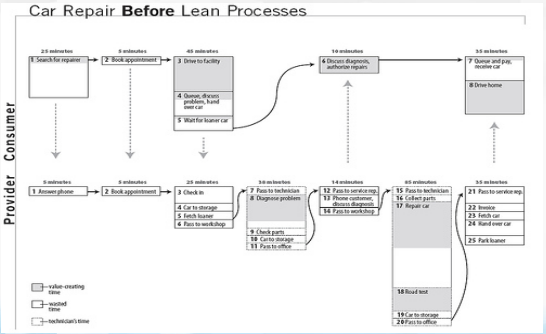
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Operating process flow



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Process Map for Car Repair



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Example of a process flow with post-it notes. You don't need software.



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Exercise

- Map the process for hiring a new employee.
  - Start with position posted to hiring
- Use Post-its
  - Square/Rectangle is process
  - Diamond is decision
  - Get all the steps on the table
  - Get the steps in the right order
  - Add/modify as you move along

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Clean up Process Map

- Turn post-it notes or drawing into computer drawing.
  - basic shapes in Excel to create chart or
  - specialized software to get a clean chart
- Add "swim lanes" to show who has responsibility for step.
- Create checklists to help people remember or keep on top of process.
- See process maps as part of your standard procedures documents
- Use process maps to train new people.

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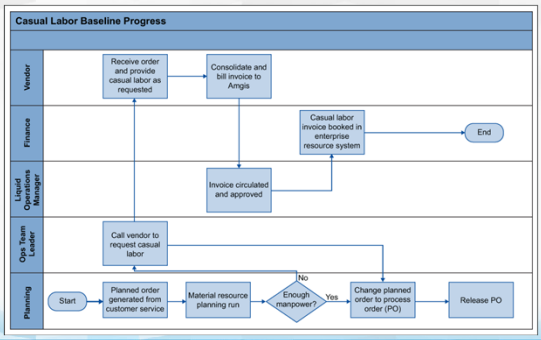
Basic Language

Elements in Process Map	Purpose	Object
Start/End	Used to show beginning and ending of process.	
Process Step	Describes a task step	
Decision Step	A choice has to be made, paths diverge.	? YES NO
Jump Point	Used to keep the process map less cluttered with lines. Jump from point A to B	
Connector Lines	Lines to show ordering of steps in process	

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Process for hiring of casual labor



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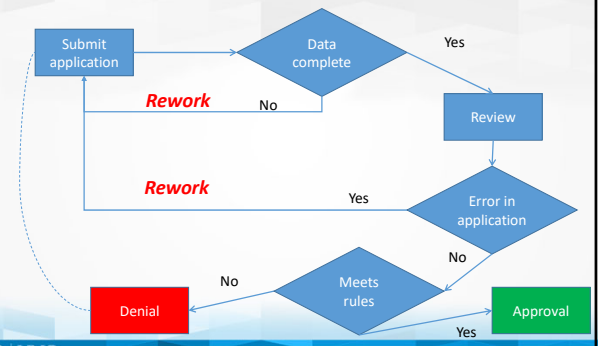
Particular leverage points for improvement from basic process maps

- Rework loops to clean up mistakes
- Choke points with multiple steps feeding
- Backtracking
- Non-value added steps
- Physical movement of people or materials

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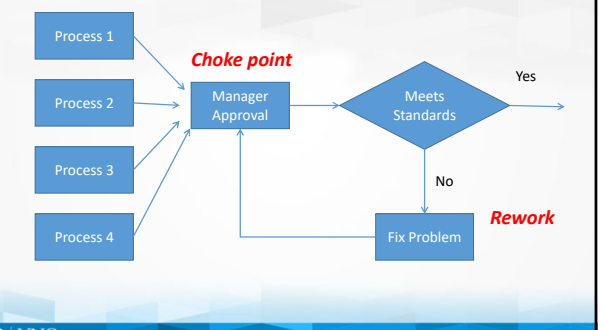
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Rework or incomplete data



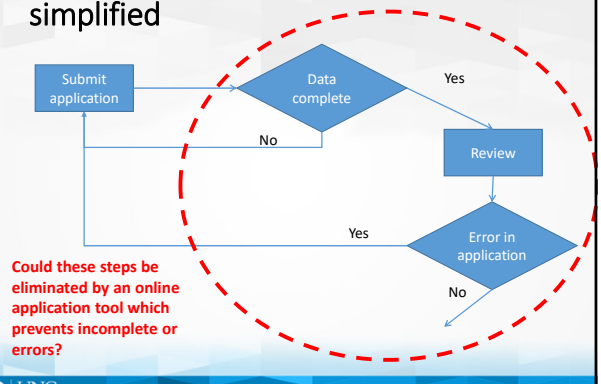
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Choke points and backtracking can slow key processes



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Does step add value or could it be simplified



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Identify key time delays

How long does your medical appointment take?



31 minutes for actual process

40 minutes waiting (idle time)



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What steps truly add value

- Does the customer/end user care if a given step is done?
- Federal tax processing as an example
  - Return times of several months
  - Now with e-file it can often be only days.

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Some hints to making the most or process mapping

- The process map is a tool, not an end goal itself.
- Actually observe the process to confirm how it is being done.
- Decide on level of detail needed (high level or specific).
- Keep boundaries around the process based on your purpose. Don't try to include everything.
- Include a mix of people affected by the process to get all points of view. Don't forget "customer" or end user.
- May need two process maps: current process versus new future improved process.

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Why bother with process diagrams?

- Explicit understanding of the steps
- Contrast between what you do and what you are supposed to do
- Seek agreement among multiple parties about what you do
- Find ways to improve the process
  - Eliminate unnecessary steps
  - Streamline process (parallel processing, better sequencing, fewer actors)
  - **Look to eliminate the delays between steps and the rework from errors. Speeds up the process without employees working harder. Work smarter not faster.**

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Look for Waste – 8 Types

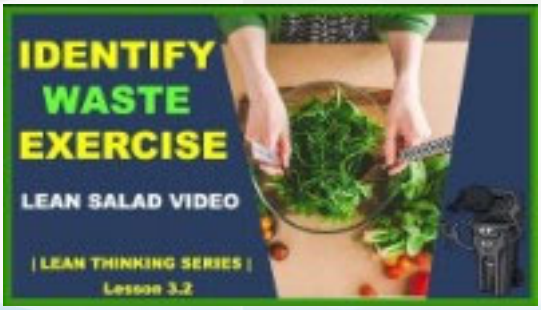
- Defects
- Overproduction
- Waiting
- Non-utilitized talent
- Transportation
- Inventory
- Motion
- Excess Processing

- Key foundational idea in Lean Thinking.
- Get rid of that which doesn't add value.
- DOWNTIME to remember
- See handouts for detail and practice sheets.

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The key idea is to look for waste in your organization. But you have to train yourself to do this because we are often blind to it.



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Looking for waste takes practice. Try using the handouts when you get back to your organization or in your own home.

- This approach to change is often small and incremental in nature. That makes it easier to implement in some ways but may not be as dramatic in the short term.
- Don't do this to someone else. Use it on your part of the organization or be invited in to help someone. No one wants to have you come in and tell them how wasteful they are.
- See the nice GFOA article at the link for a case study in the City of Bloomington.
- http://www.gfoa.org/sites/default/files/GFR_DEC_11_18.pdf

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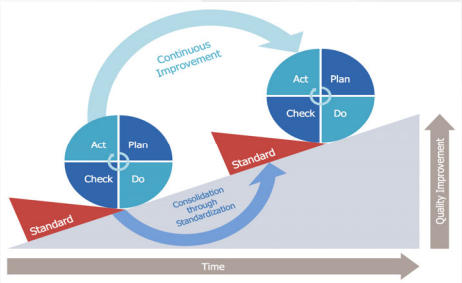
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Key Takeaways

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Improvement is a cycle climbing to higher levels.



http://studioy.us/continuous-improvement-cycle-diagram/plan-do-check-act-pdca-solution-conceptdraw-intended-for-continuous-improvement-cycle-diagram

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Understand the principle of variation.

- Track the measures you care about (defects, delays, dollars) and create a process behavior chart.
  - Is the variation common or special?
  - What is typical performance? What is the variation? Acceptable?
  - Does the process behavior change?
- Even without data to analyze, recognize that processes vary. Ask yourself if the variation is special or common cause. Could it happen again?
- Don't blame workers for the failures caused by variation in your processes. Fix the system.

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Look for ways to focus your efforts

- Process behavior charts
  - Common or special cause, when, how much
- Pareto Charts
  - What are the primary causes of our common cause variation
- Root and common cause analysis to get at the causes and not the symptoms.

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Look for fixes in your root causes and in your processes. Look to get rid of waste in all its forms.

- When root causes can be directly fixed, make the changes without overthrowing your current processes.
- Use tools like checklists and error-proofing to fight against errors or promote best practices.
- Study your processes to reach understanding and look for opportunities to improve by cutting out unneeded steps, complex paths, error rates in early steps, and in particular lengthy times between steps. You can be much faster without needing employees to work faster.
- Look for waste and eliminate the non-value added work.

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Feel free to reach out to me if you have follow up questions.

Dale Roenigk
Roenigk@sog.unc.edu
919-843-8927

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Some resources

Books

- Understanding Variation by Donald Wheeler
- Twenty Things You Need to Know by Donald Wheeler
- Making Sense of Data by Donald Wheeler
- Data Sanity by Davis Balestracci
- Fourth Generation Management by Brian Joiner
- The Toyota Kata Practice Guide by Mike Rother

Websites

- www.qimacros.com
- www.spcpress.com/djw_articles.php
- www.davisdatasanity.com/newsletter-archives/

Software

- www.qimacros.com for Excel control chart add-in and training materials on Lean Six Sigma
- http://www.mercerqualityconsulting.com/statistical-thinking.html for a less expensive add-in but it just does control charts.
- Google other software by using search terms like “SPC software” or “Excel add-ins for control charts”.
- See Excel template I created and shared which has limited features but can be used as a start.

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