



Satisfying customers with engaged employees, higher quality and quicker responses

City of Gresham
1/14/2020

Brion Hurley

- Born and raised in Iowa City, Iowa
- Living in Portland, Oregon since 2013
- Improvement consultant since 1999
- Experience:
 - BS in Statistics
 - MS in Quality Management and Productivity
 - Lean Master certified
 - Six Sigma Master Black Belt



Agenda

- What is Lean?
- Pillars of Lean
- 5 Lean Principles
- Simulation
- Examples
- What is Six Sigma?
- DMAIC
- SPC
- Examples
- Struggles
- Summary
- Q&A



Audience Poll

What do you know about Lean and Six Sigma?

- Expert, Knowledgeable or Limited



What is Lean (TPS)?



Lean History

- Lean = Toyota Production System
- Toyota evolved from small struggling company to most successful automaker
- Combined approach of self-developed techniques and learning from others
 - Taiichi Ohno and Shigeo Shingo
 - Ford assembly line
 - Industrial engineering methods from Frederick Taylor and Gilbreth's
 - Quality gurus: Dr W. Edwards Deming and Joseph Juran
 - US Military – Training Within Industry (TWI)
- Japanese books translated into English in 1970's and 1980's
- MIT study mission research in 1980's brought more attention
- Methods validated with US workers
- Spread into many industries in last few decades

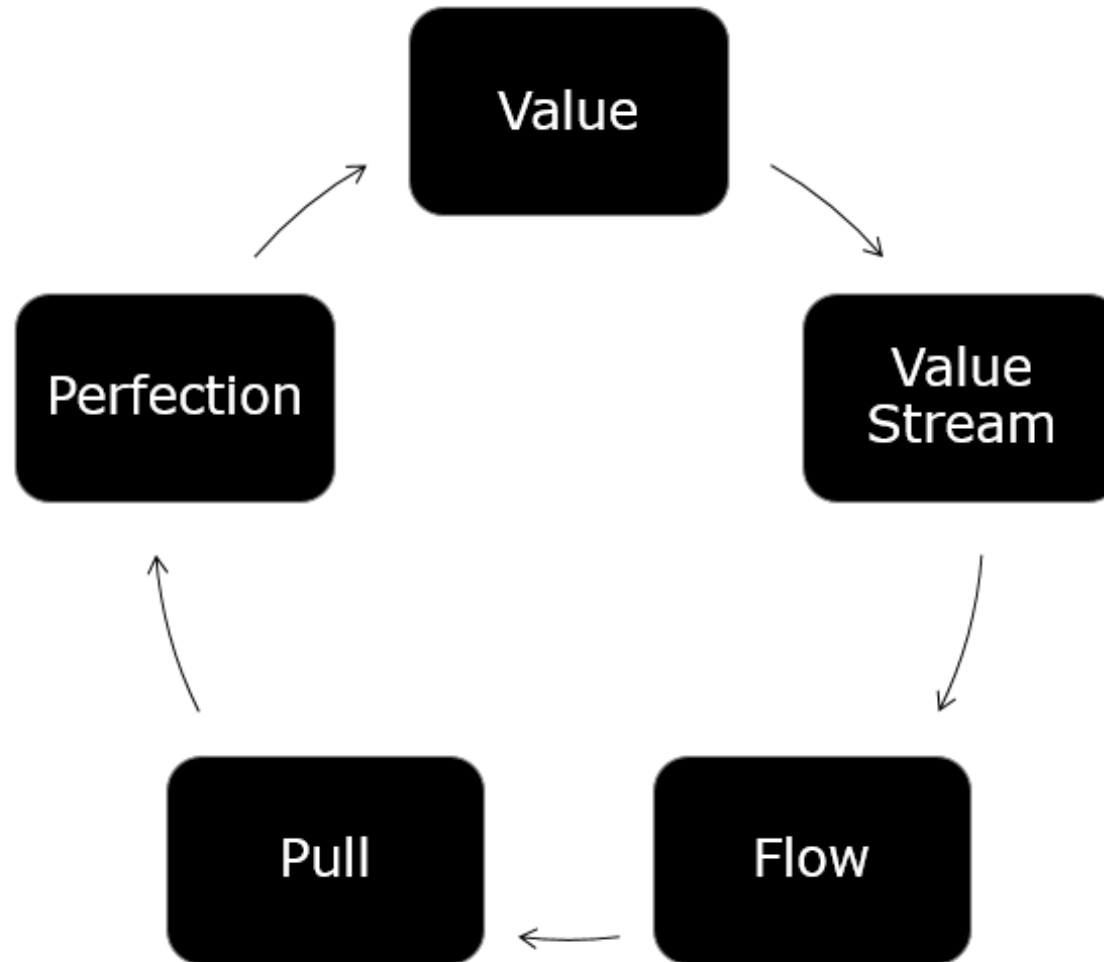
Pillars of Lean

- **Continuous Improvement**
 - Challenge
 - Kaizen
 - Genchi Genbutsu (go and see)
- **Respect for People**
 - Respect
 - Teamwork



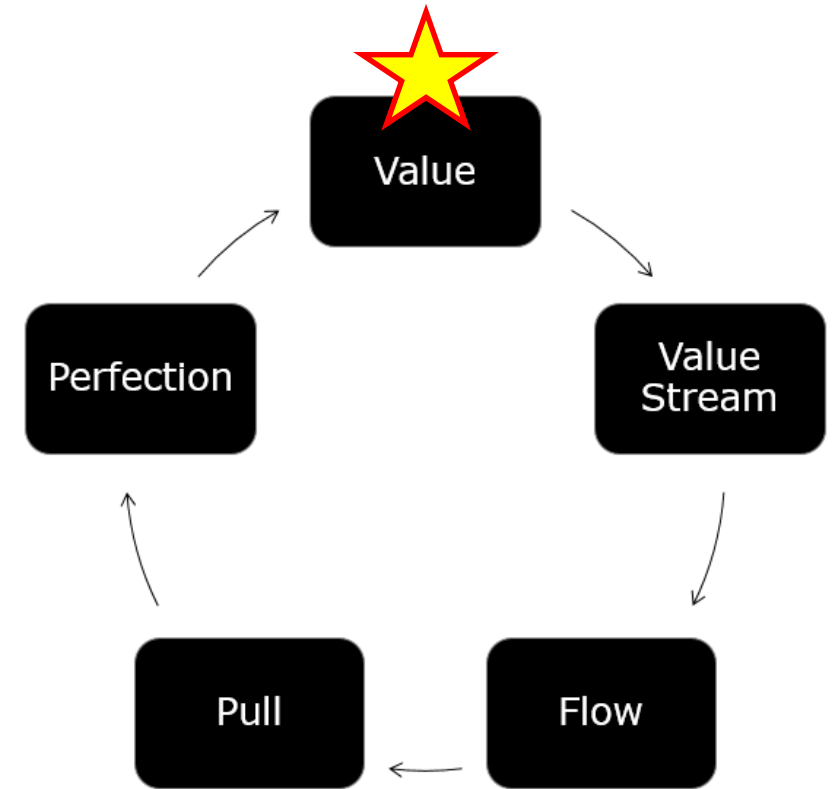
<https://theleadershipnetwork.com/article/lean-manufacturing/developing-lean-leaders-the-toyota-kata-way>

5 Lean Principles



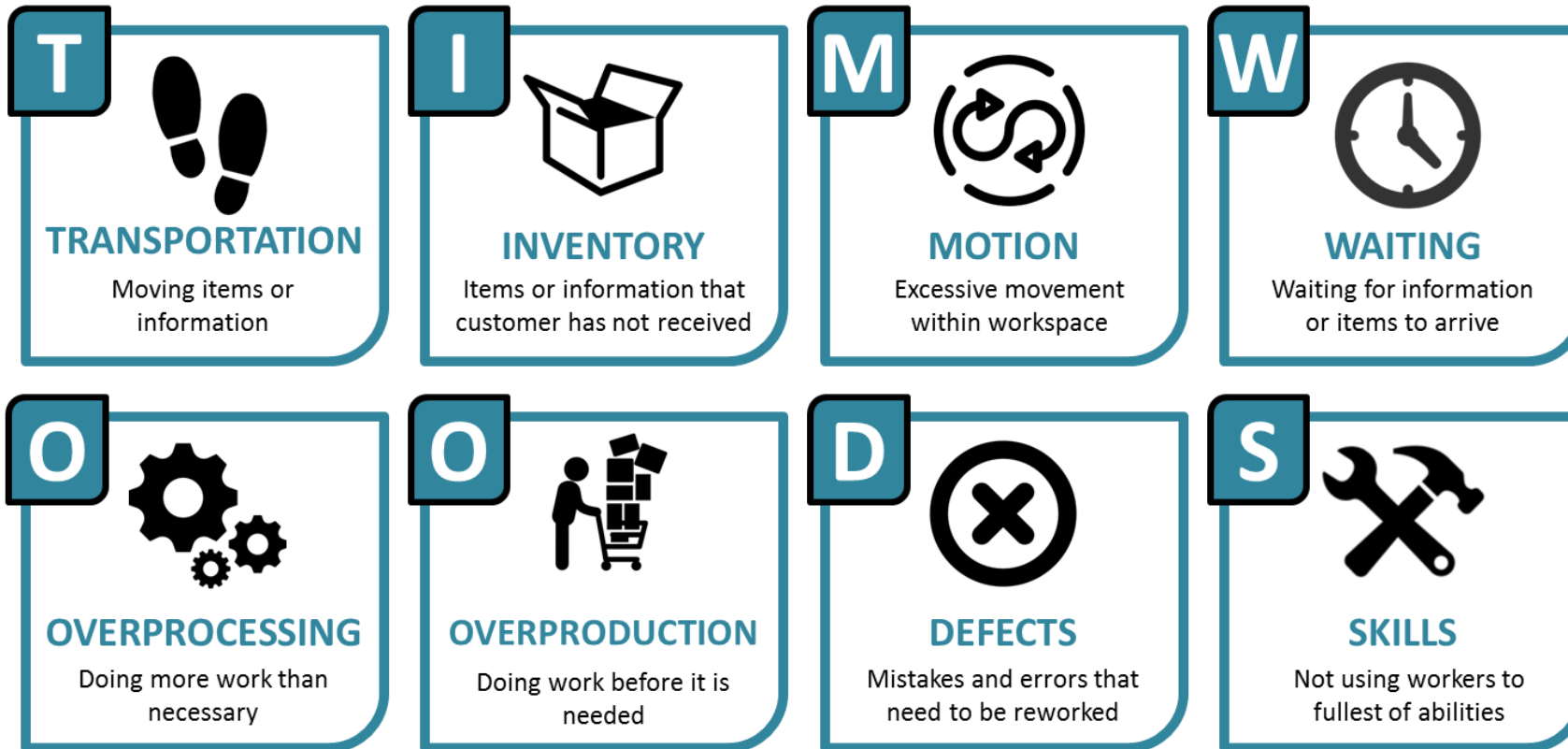
Value

- Always defined by the customer
- “Would the customer be willing to pay for that step or task in the process?”
- “Would the customer be less satisfied if the step or task was removed?”
- Don’t assume, talk to your customers and stakeholders!



TIM WOODS (8 Wastes)

- Waste = Non-value added
- Find and eliminate these 8 forms of waste in your processes



Waste = Environmental Impacts

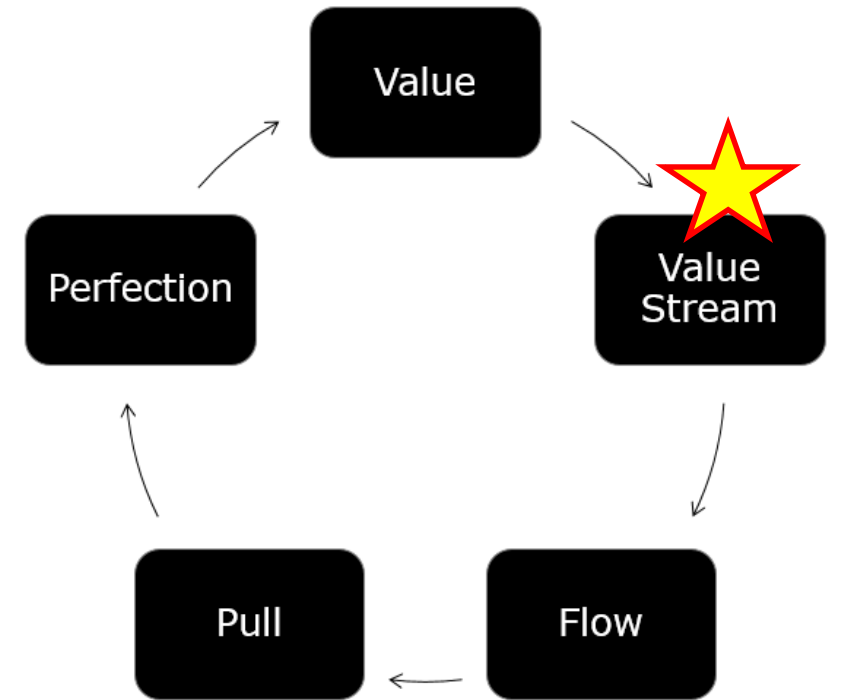
	Waste Type	Environmental Impacts
O	Overproduction	<ul style="list-style-type: none"> • More raw materials consumed in making the unneeded products • Extra products may spoil or become obsolete requiring disposal • Extra hazardous materials used result in extra emissions, waste disposal, worker exposure, etc.
I	Inventory	<ul style="list-style-type: none"> • More packaging to store work-in-process • Waste from deterioration or damage to stored WIP • More materials needed to replace damaged WIP • More energy used to heat, cool, and light inventory space
T	Transportation and Excessive Motion	<ul style="list-style-type: none"> • More energy use for transport • Emissions from transport • More space required for WIP movement, increasing lighting, heating, and cooling demand and energy consumption • More packaging required to protect components during movement • Damage and spills during transport • Transportation of hazardous materials requires special shipping and packaging to prevent risk during accidents
M		
D	Defects	<ul style="list-style-type: none"> • Raw materials consumed in making defective products • Defective components require recycling or disposal • More space required for rework and repair, increasing energy use for heating, cooling, and lighting
O	Over Processing	<ul style="list-style-type: none"> • More parts and raw materials consumed per unit of production • Unnecessary processing increases wastes, energy use, and emissions
W	Waiting	<ul style="list-style-type: none"> • Potential material spoilage or component damage causing waste • Wasted energy from heating, cooling, and lighting during production downtime

Value Stream

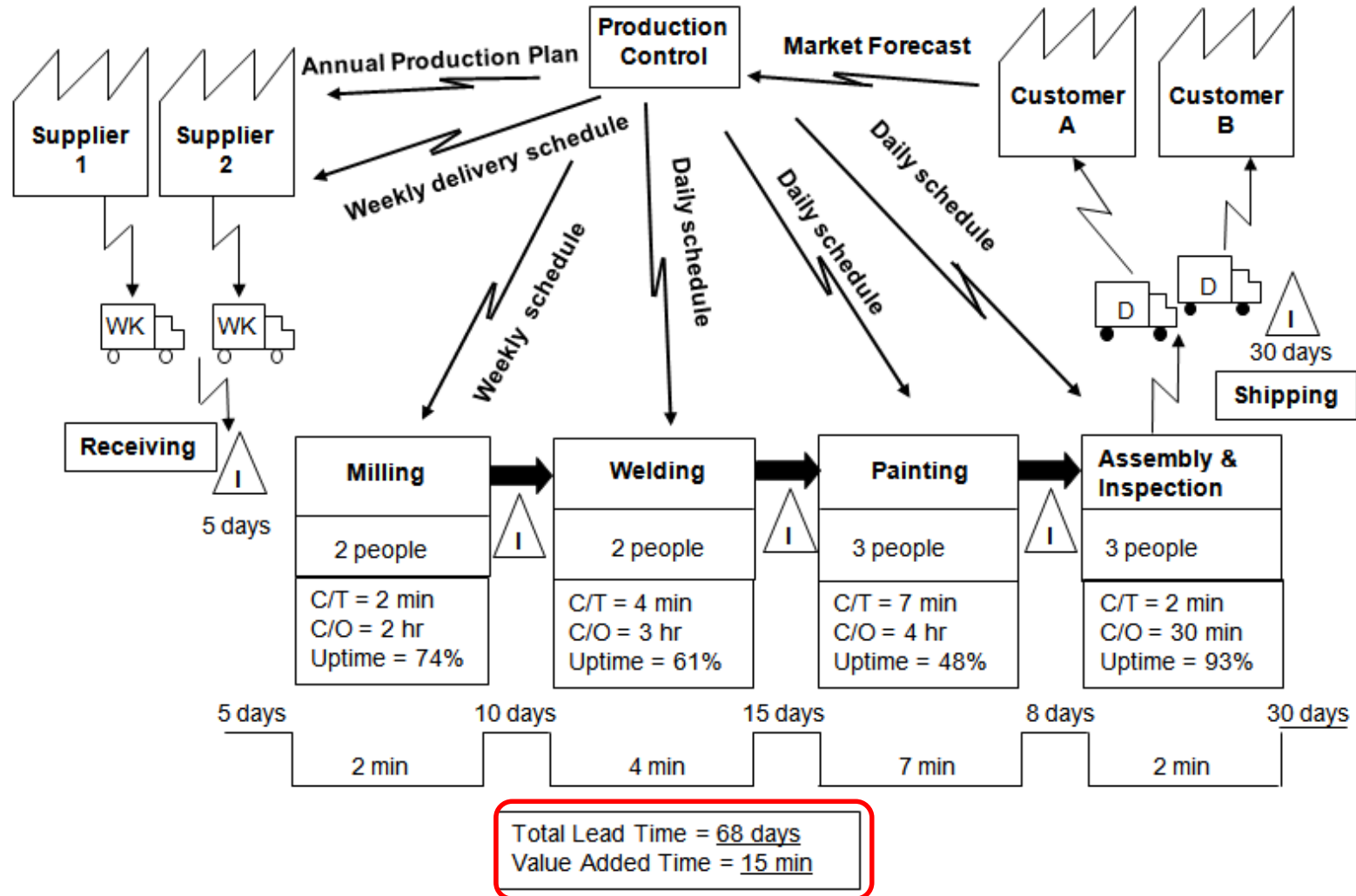
“All we are doing is looking at the time line, from the moment the customer gives us an order to the point when we collect the cash. And we are reducing the time line by reducing the non-value adding wastes.”



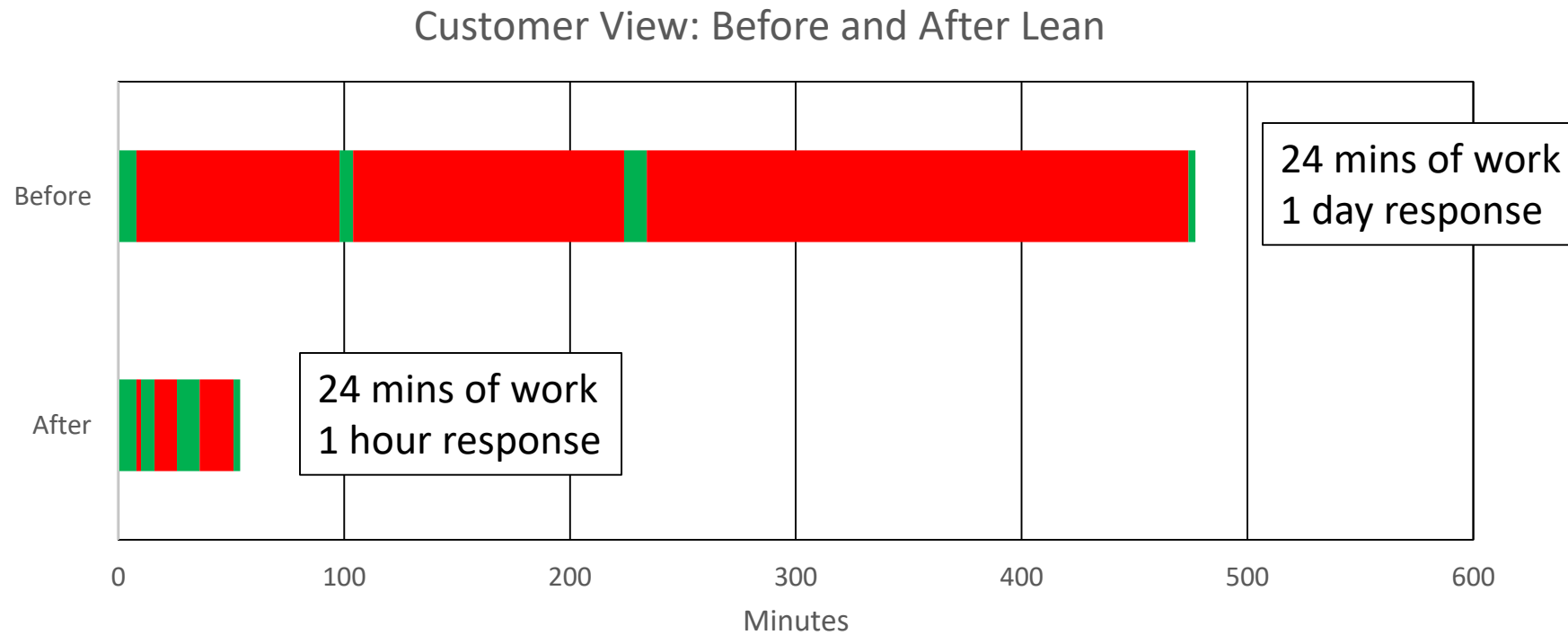
- Taiichi Ohno



Value Stream Map



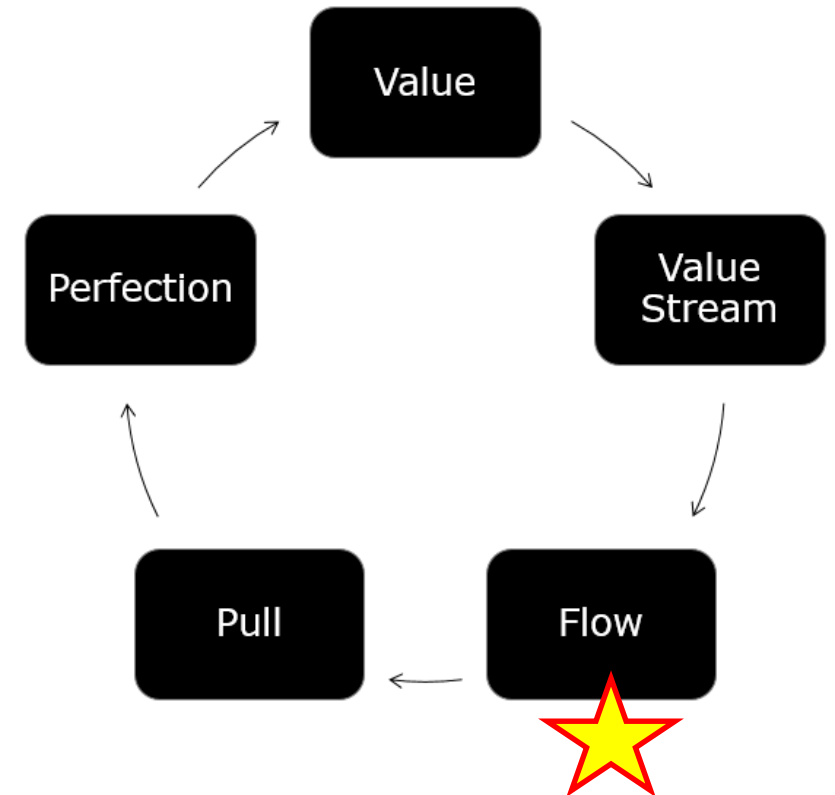
Value vs non-value added



Remove delays (red) first, before reducing value time (green)

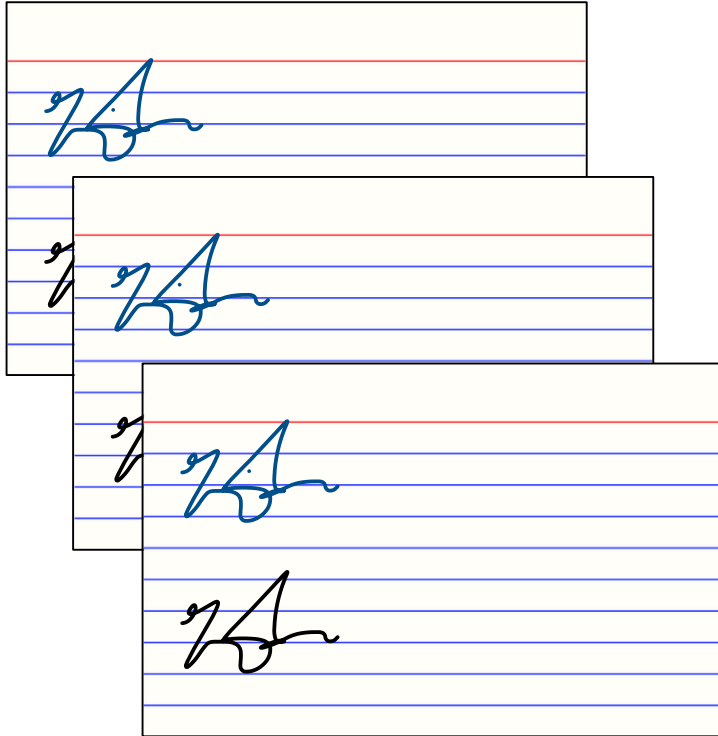
Flow

- Once the work starts, should continue through all processes until finished
- Stops and starts cause delays to the customer
- Often caused by batching or personal efficiency

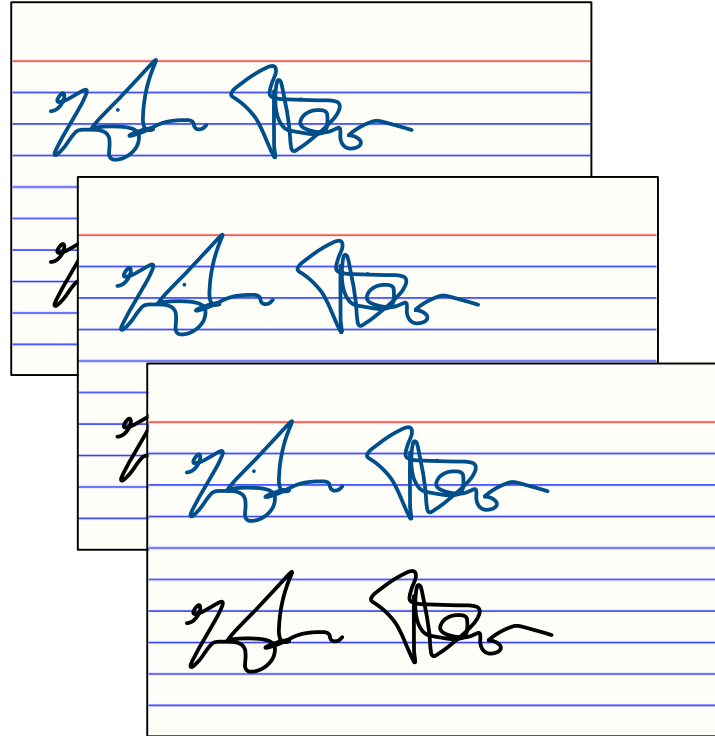


SIMULATION

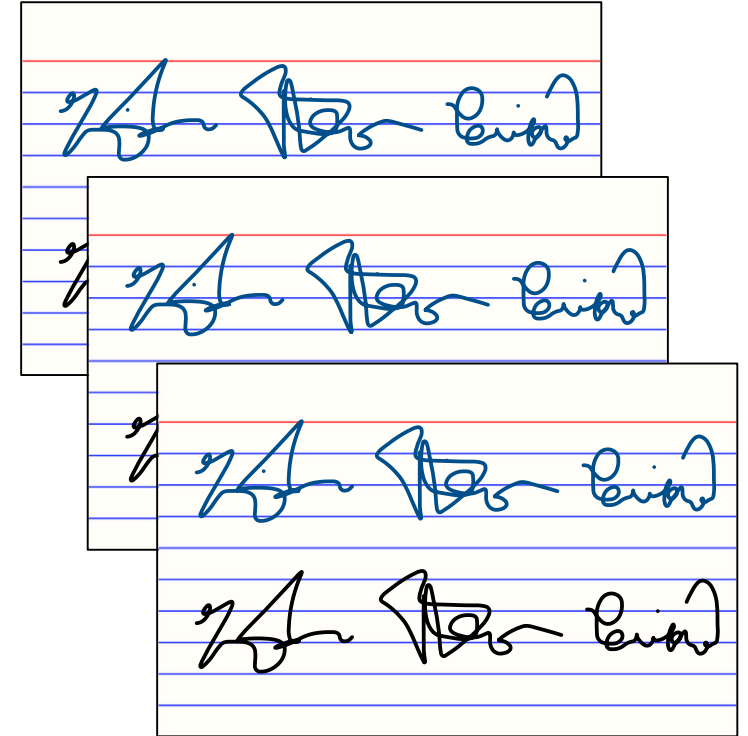
Simulation Rules – Round 1 – Batch of 3



1st Person

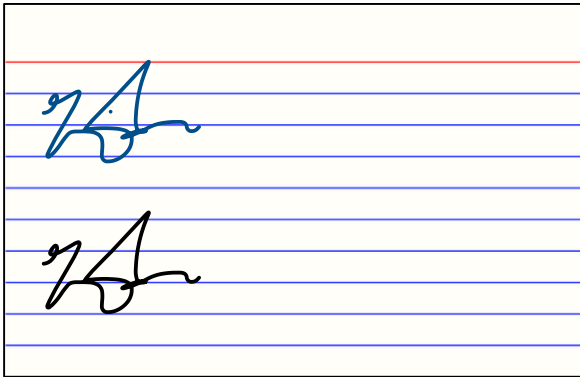


2nd Person

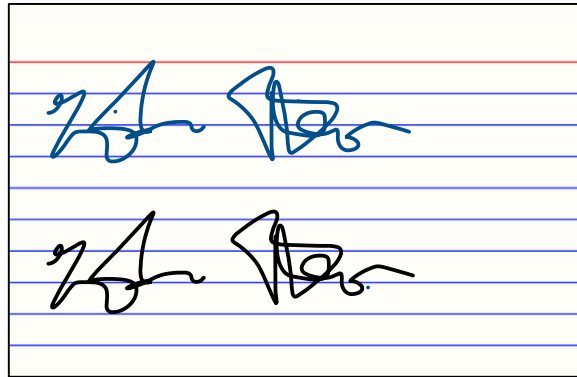


3rd Person

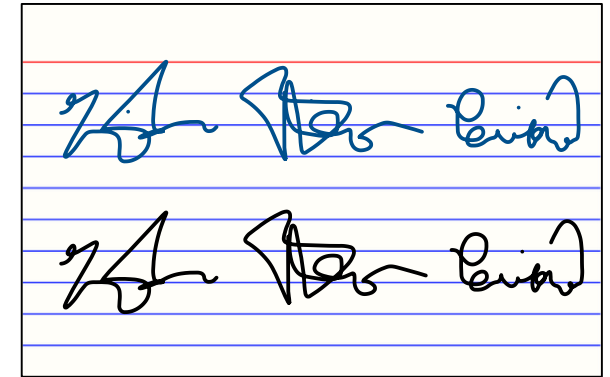
Simulation Rules – Round 2 – Batch of 1



1st Person

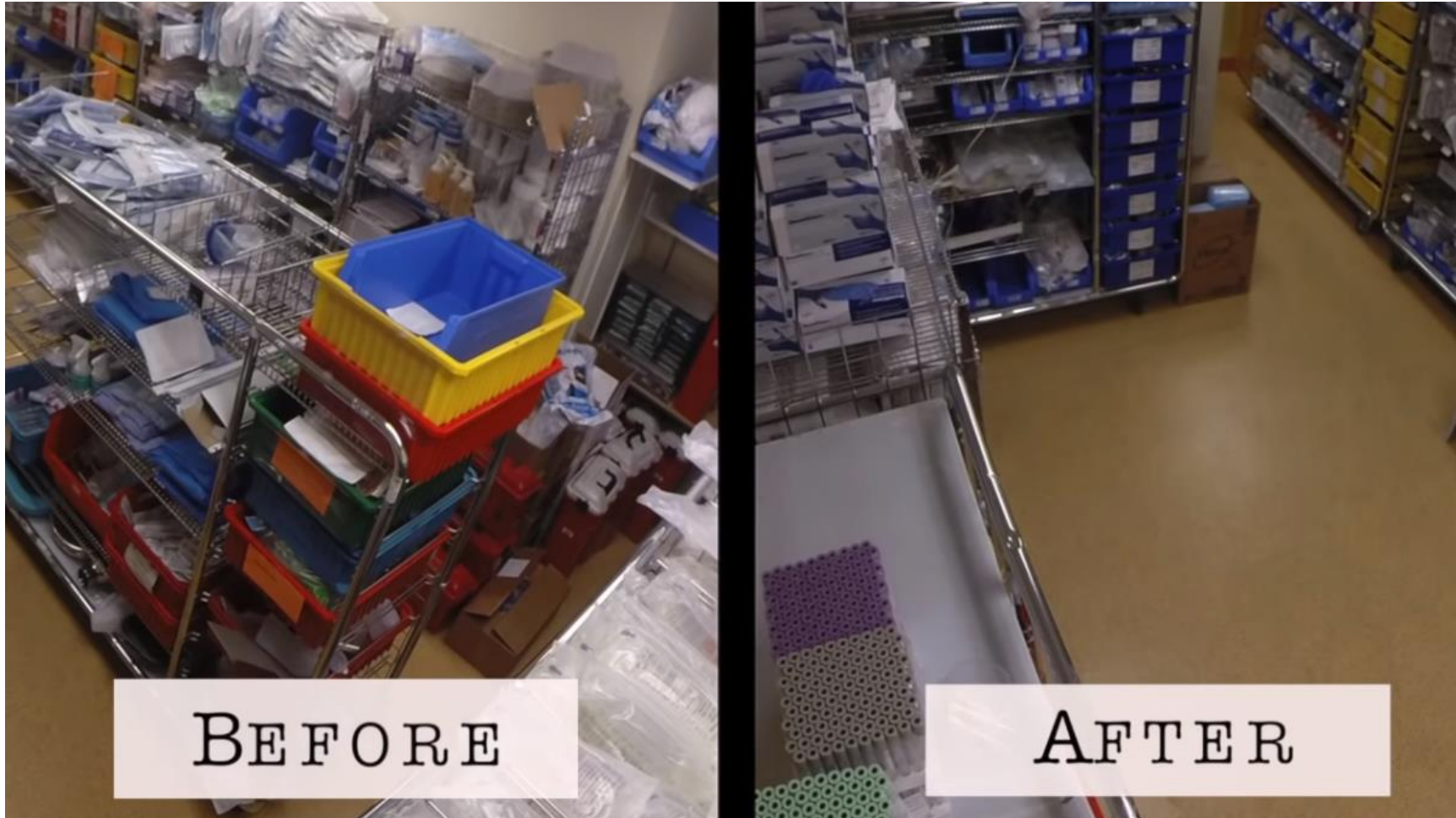


2nd Person



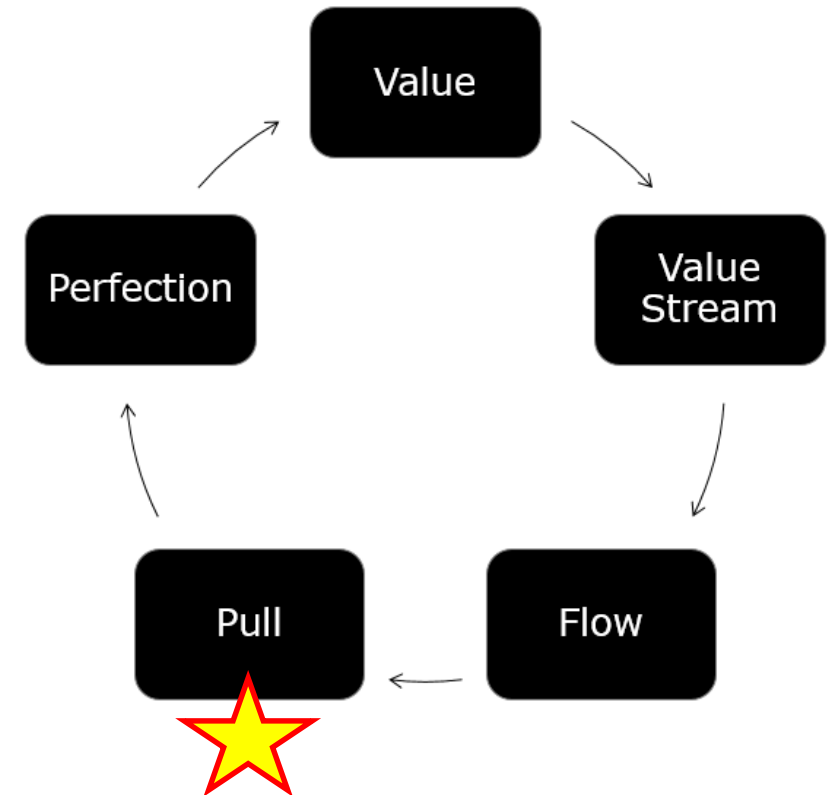
3rd Person

5S Workplace Organization



Pull

- Once the process is flowing smoothly, time to complete is understood
- Pull means waiting for a signal or trigger from next step that they are ready
- Push means you continue working regardless if next process is ready



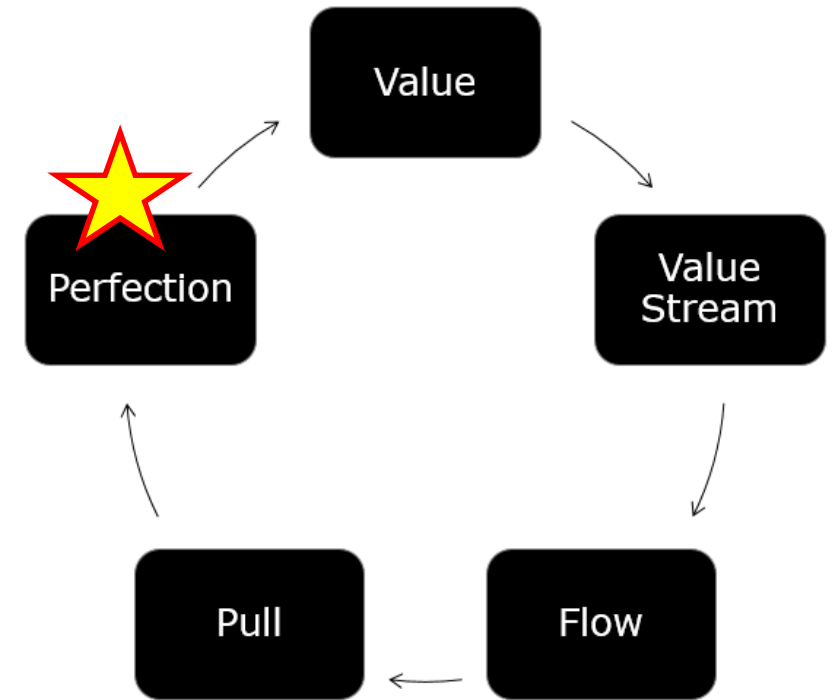
Kanban Example - Business

- Yellow boxes are trigger for process
- Send boxes back to supplier when empty
- Supplier only sends back that quantity
- Removes need for predicting accurately
- Also more “green,” reuses packaging

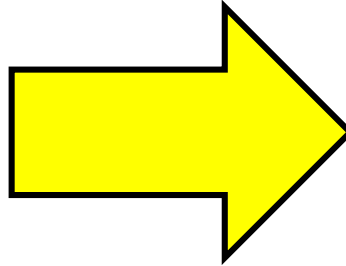


Perfection

- Continuous improvement (CI) is always looking for the next problem
- Lean forces CI to take place, instead of being complacent
- No problem is a problem



Lean Example - Business



BEFORE

AFTER

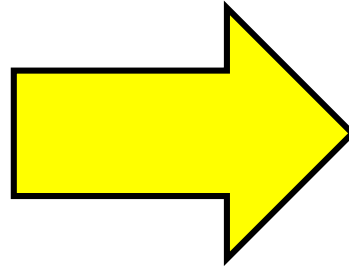
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Lean Example - Home



BEFORE

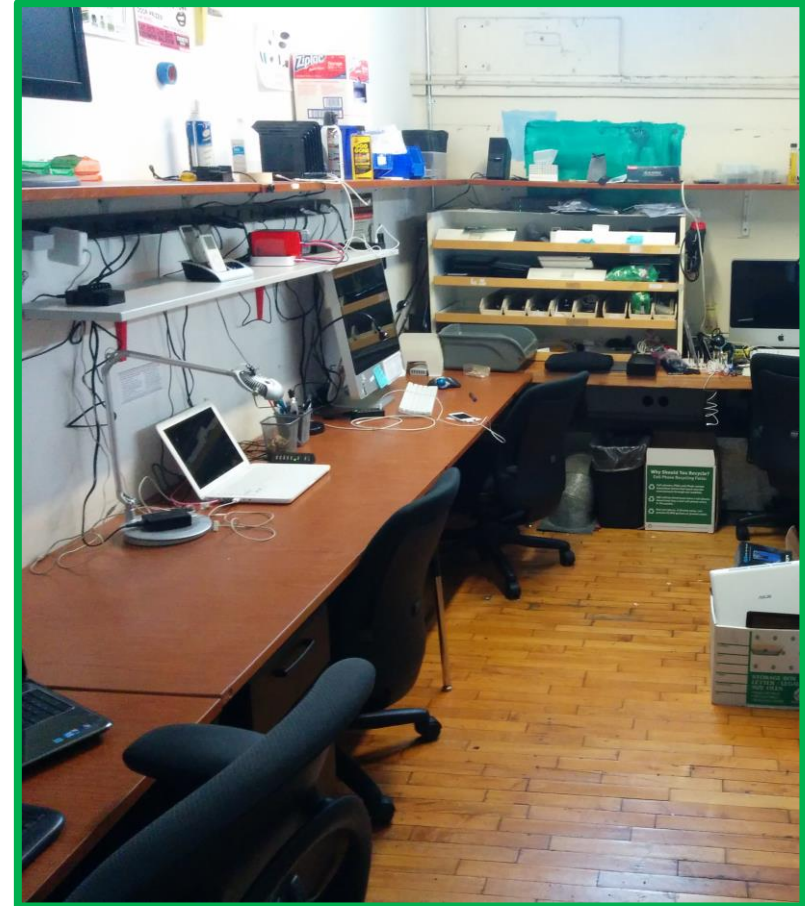
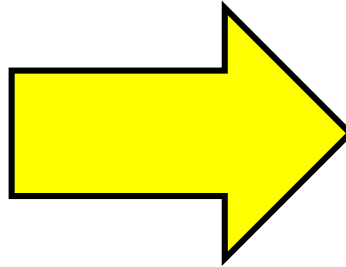
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AFTER

Lean Example - Community



BEFORE



AFTER

Group Discussion

- What takeaways did you have about Lean?

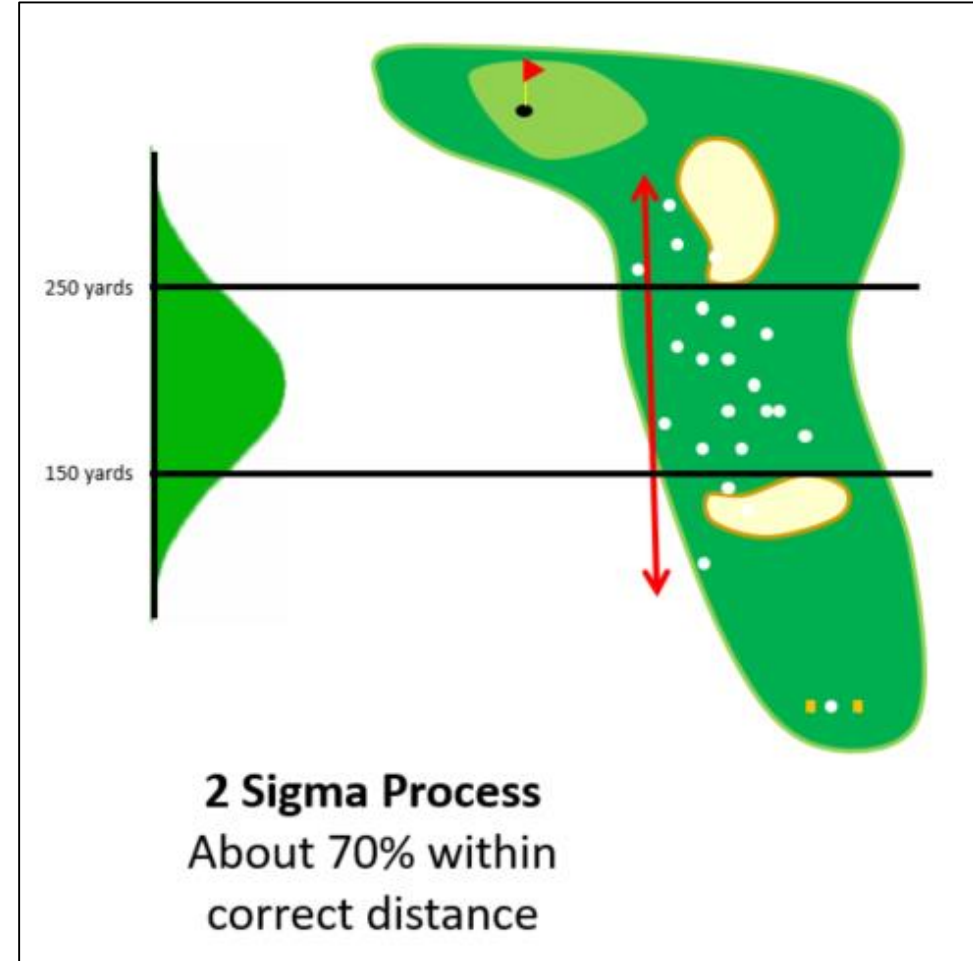
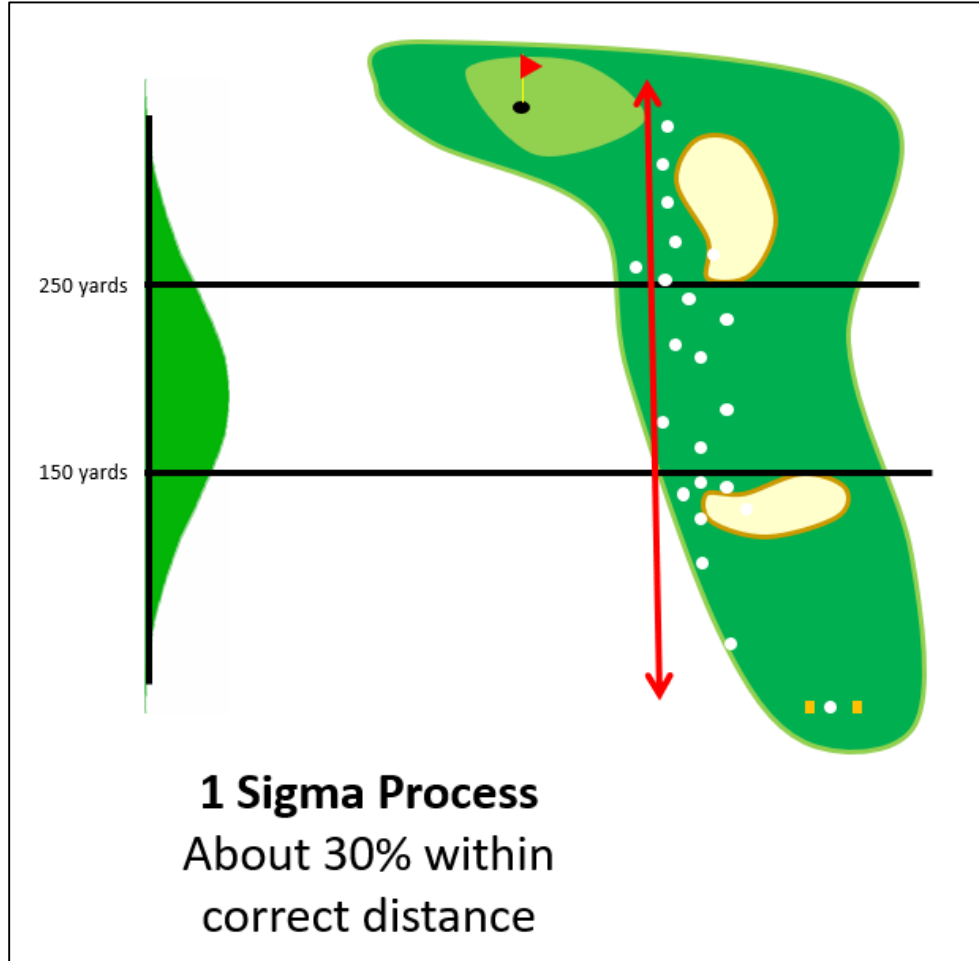


Six Sigma

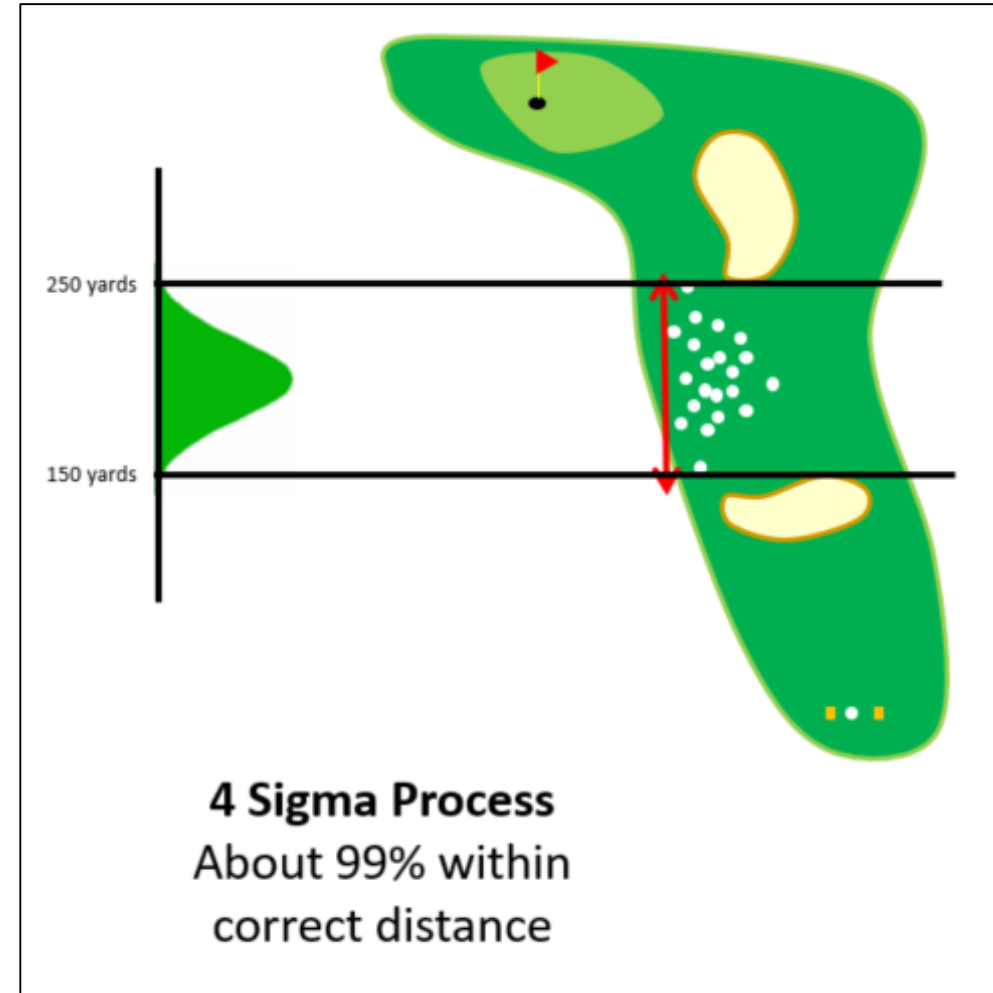
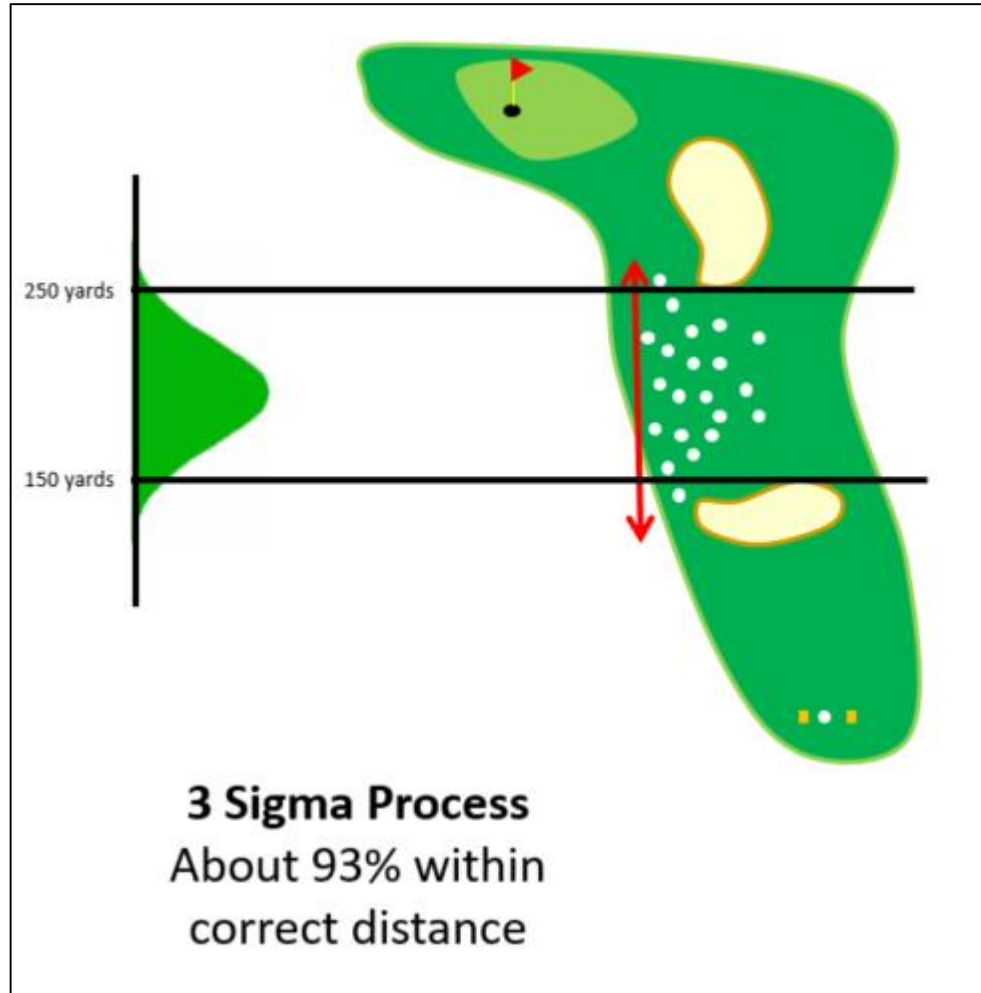
Six Sigma History

- Quality improvement program developed by Motorola in mid-1980's due to competition from Japan
- Techniques were not new (also influenced by Deming), but packaged in new way
- Started Motorola University to share techniques
- Gained popularity from GE and Jack Welch due to cost impact
- Strong focus on financials and certifications
- Spread into many industries in last few decades

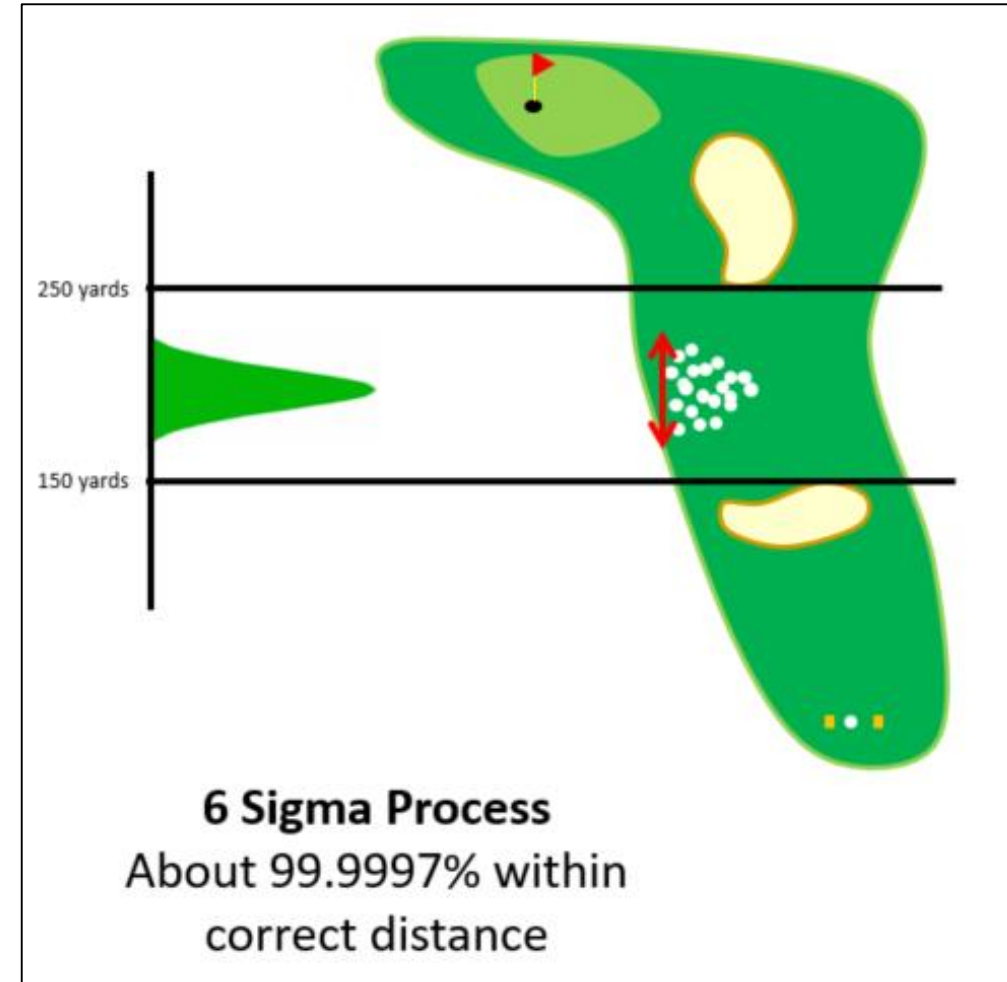
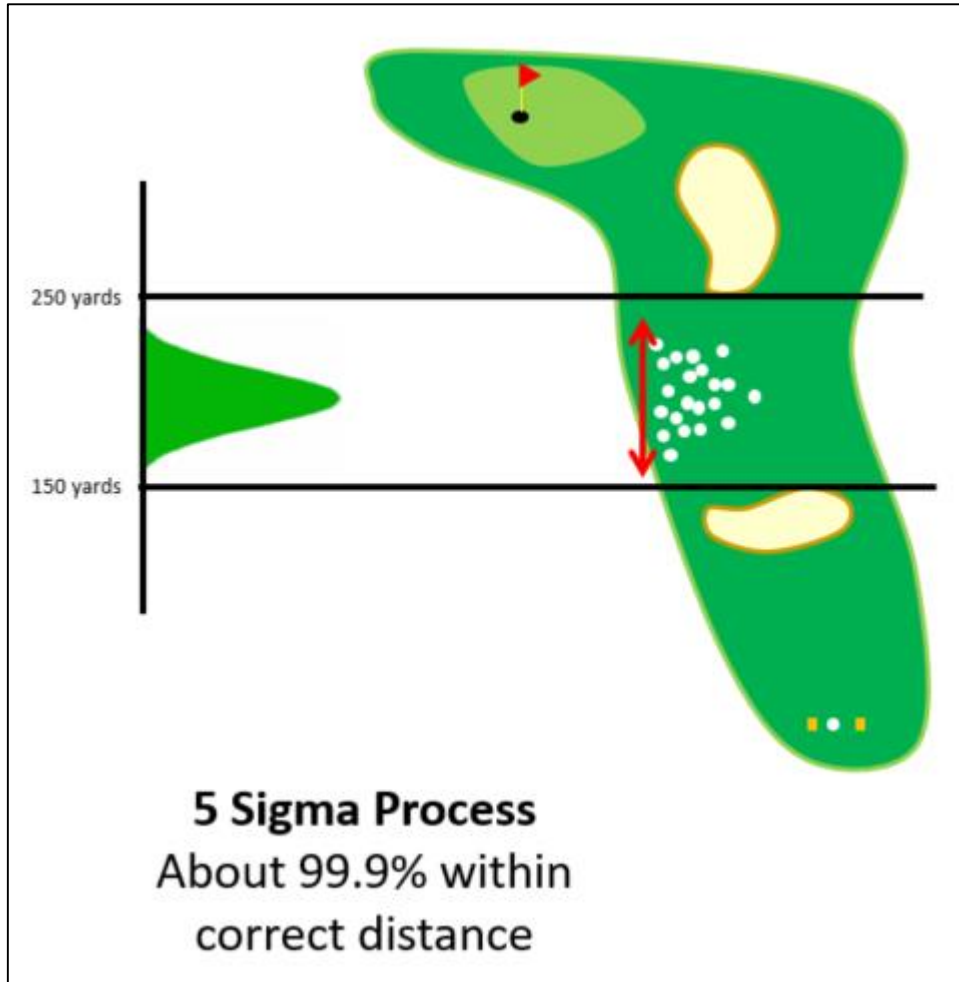
What is Six Sigma?



What is Six Sigma?



What is Six Sigma?

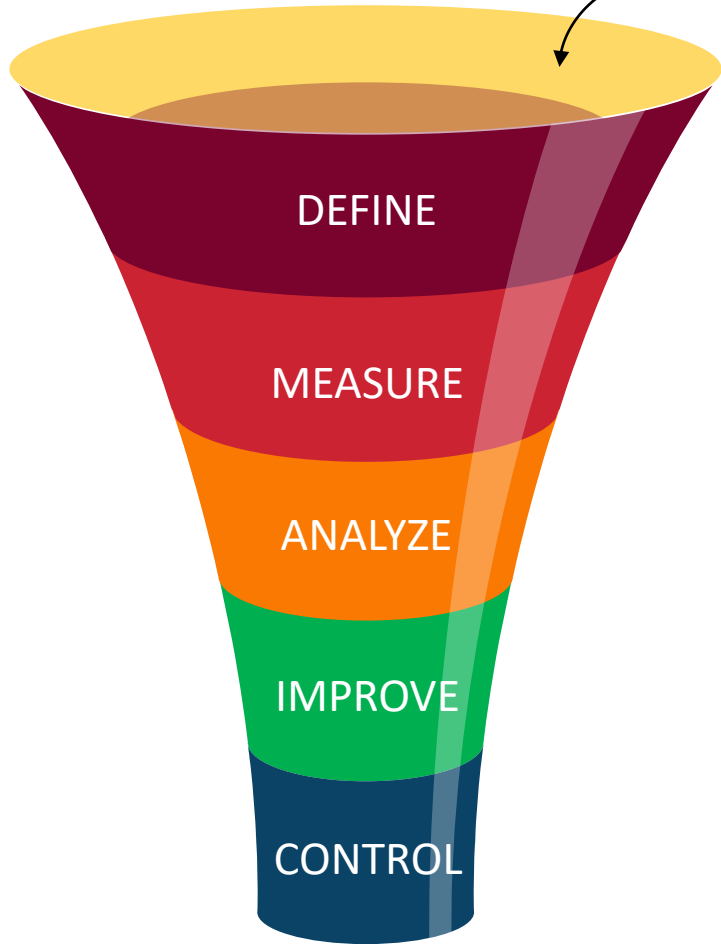


What sigma level are your processes?

	Sigma Level	Defects Per Million	Yield	Cost (% Sales)
Airline Safety →	6.0	3.4	99.99966%	Very Low (< 1%)
Airbag Deployment →	5.5	32	99.9968%	
	5.0	233	99.977%	Low (1-5%)
Invoice Accuracy →	4.5	1,350	99.87%	
	4.0	6,210	99.38%	Moderate (5-10%)
Baggage Handling →	3.5	22,750	97.7%	
	3.0	66,807	93.3%	High (10-20%)
Restaurant Billing →	2.5	158,655	84.1%	
	2.0	308,537	69.1%	Very High (20-30%)
Tax Advice →	1.5	500,000	50.0%	
	1.0	691,462	30.9%	Excessive (> 30%)

DMAIC

Problem



Long term solution

1

DEFINE

Determine key projects for organization success
Project Charter with Business Case & Leader Support

2

MEASURE

Gather actual baseline of current process with team
Map, Go and See, C&E Matrix, Capability, Pareto

3

ANALYZE

Determine root cause or largest contributor
Root cause analysis and statistical analysis.

4

IMPROVE

Test out and validate improvements statistically
Prioritization matrix, pilot study, behavior change

5

CONTROL

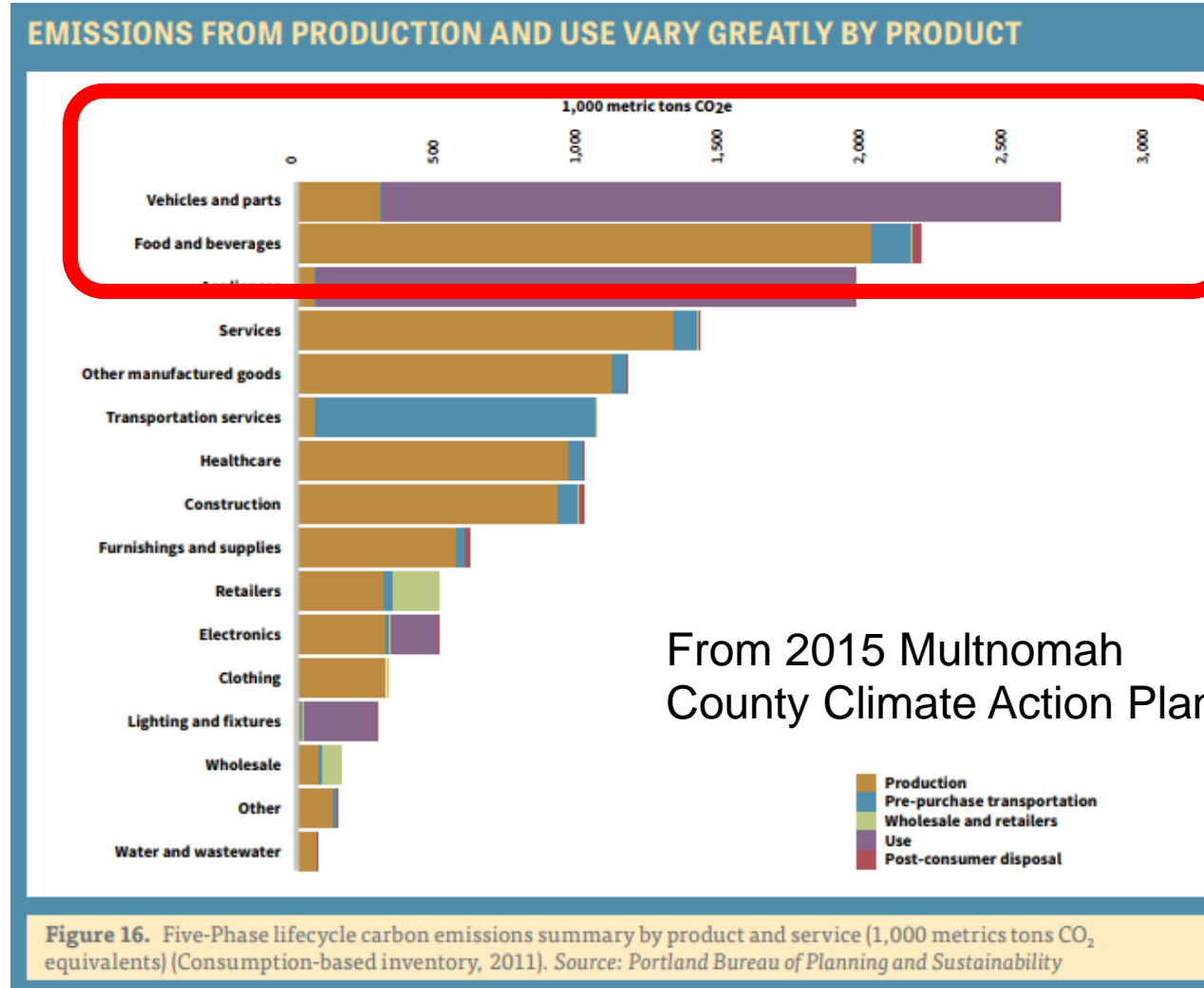
Add process controls & calculate long-term benefits
Control plan, SPC, Final Report

Data

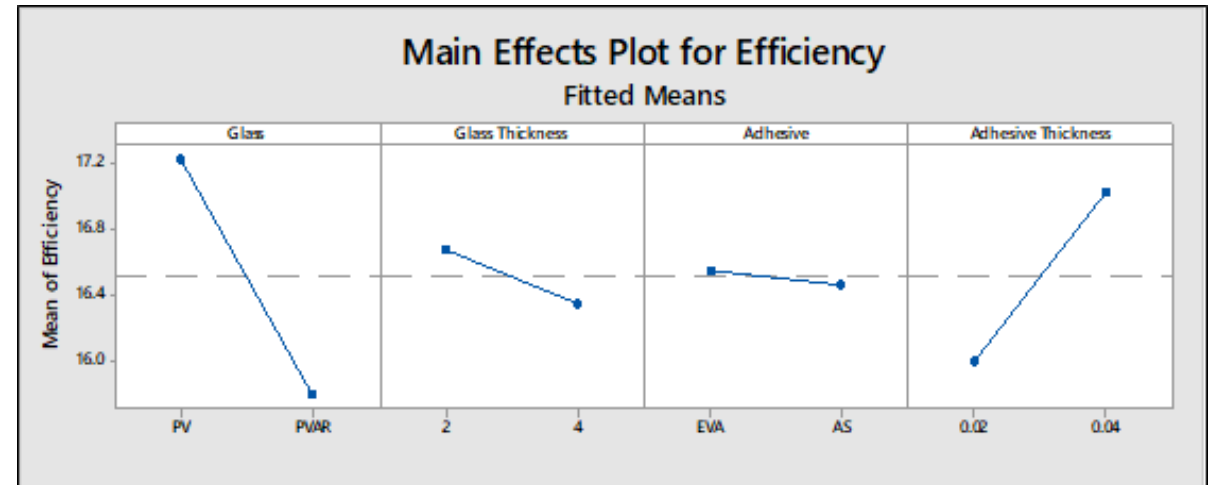
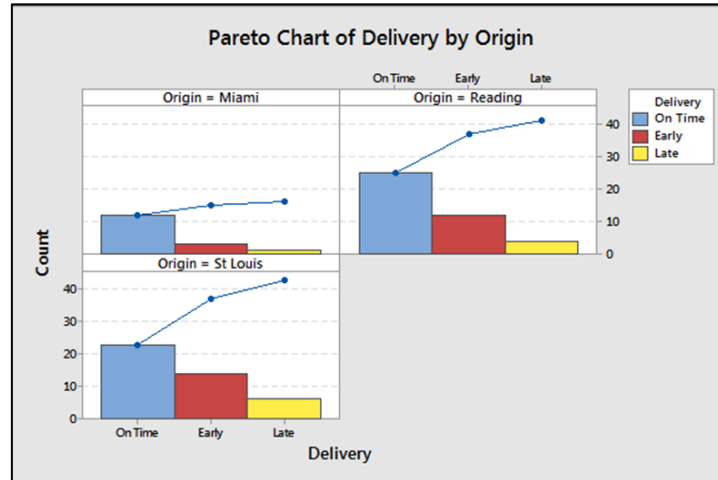
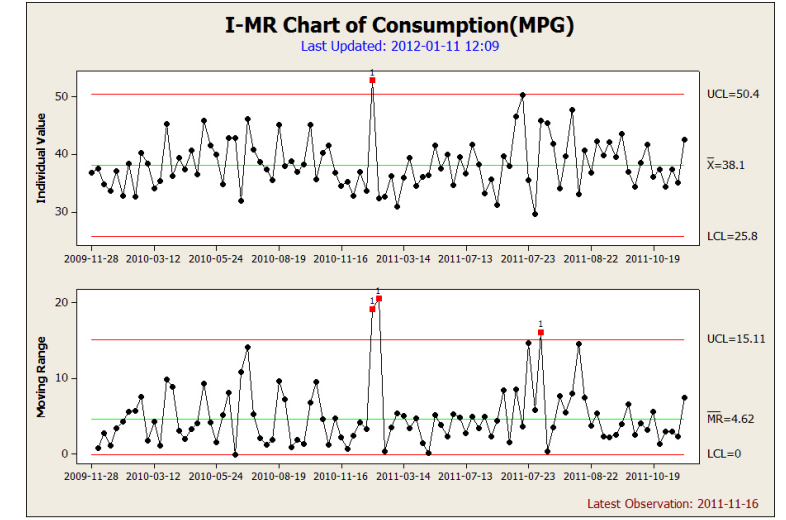
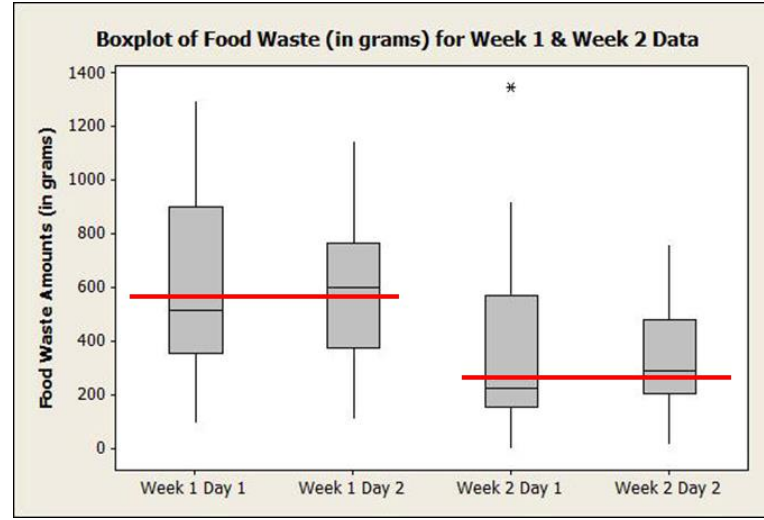
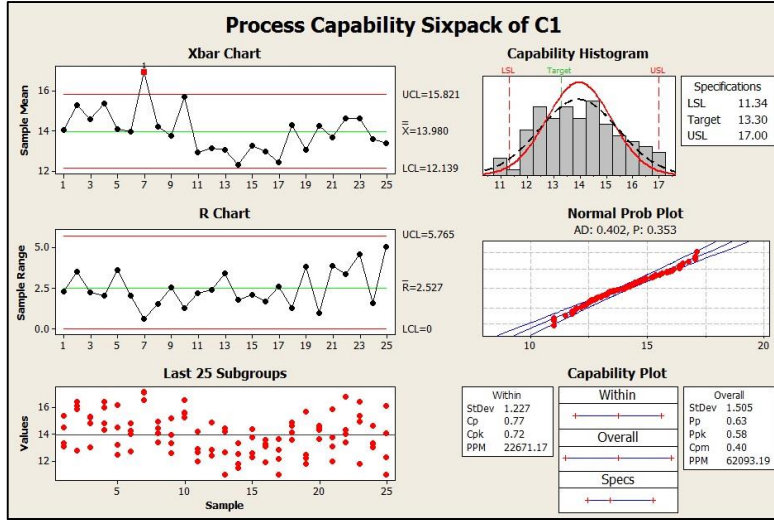
- Data is at the heart of Six Sigma
- Without data, there can be no assurance of improvement
 - Just educated guessing
 - Not a reliable method for improving
- Focus is on separating true improvement from random chance
- “Garbage in, garbage out!”



Prioritization with Pareto Charts



Charts and Graphs



Can you tell a difference?



Fiji[®]



Zephyrhills[®]



7-11[®] Generic



Filtered Tap
Water

<http://leansixsigmaenvironment.org/index.php/does-bottled-water-actually-taste-better-attribute-agreement-analysis/>

Nope!

Cup #	Actual	Tester #1	Tester #2	Tester #3	% Correct
1	Generic	Generic	Tap	Fiji	33%
2	Tap	Zephyrhills	Generic	Tap	33%
3	Fiji	Fiji	Fiji	Generic	67%
4	Zephyrhills	Fiji	Fiji	Generic	0%
5	Fiji	Tap	Tap	Zephyrhills	0%
6	Tap	Zephyrhills	Zephyrhills	Tap	33%
7	Generic	Fiji	Fiji	Zephyrhills	0%
8	Zephyrhills	Tap	Generic	Fiji	0%
9	Tap	Tap	Tap	Zephyrhills	67%
10	Generic	Generic	Generic	Generic	100%
11	Fiji	Generic	Zephyrhills	Zephyrhills	0%
12	Zephyrhills	Fiji	Fiji	Zephyrhills	33%
Overall		42% (4)	33% (3)	42% (4)	8% (1)

Group Discussion

- What struggles do you have with gathering and analyzing data at work?



Belt Levels

- Based on martial arts belt system
 - **White Belt** – One day overview class
 - **Yellow Belt** - White Belt + Basic tools
 - **Green Belt** - Advanced tools (1-2 weeks)
 - **Black Belt** - More advanced tools (4-5 weeks)
 - **Master Black Belt** - Even more advanced tools + deployment planning (6-10 weeks)
- Level increase also requires project experience
- Pros and cons of certification



Statistical Process Control (SPC)

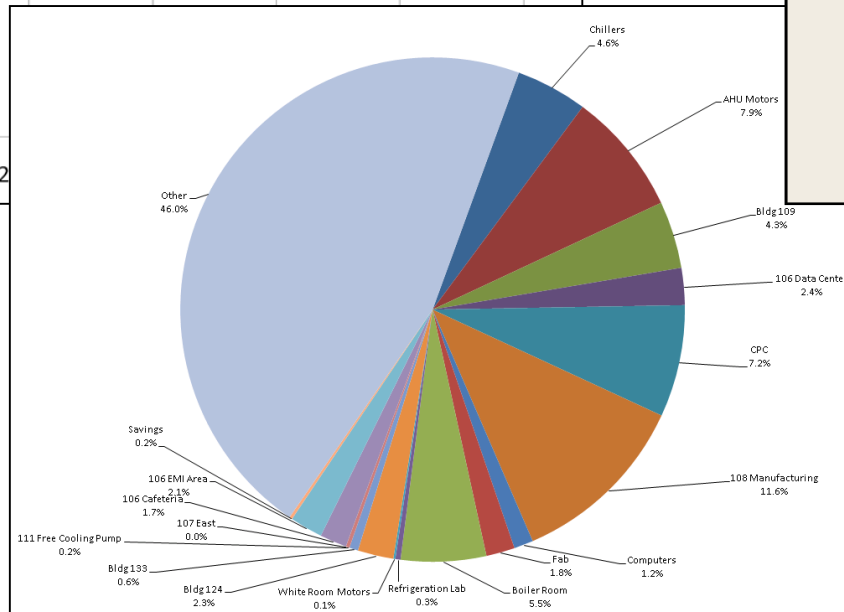
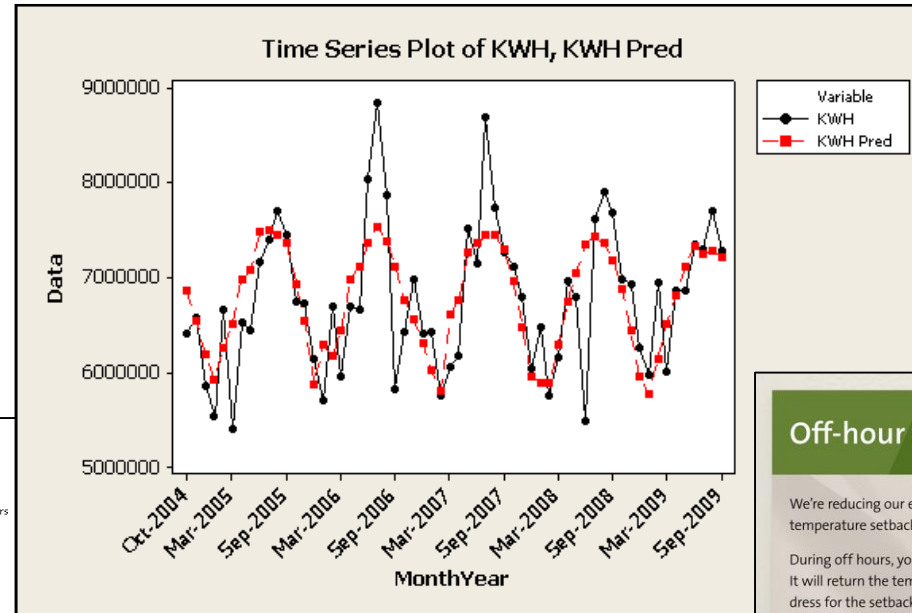
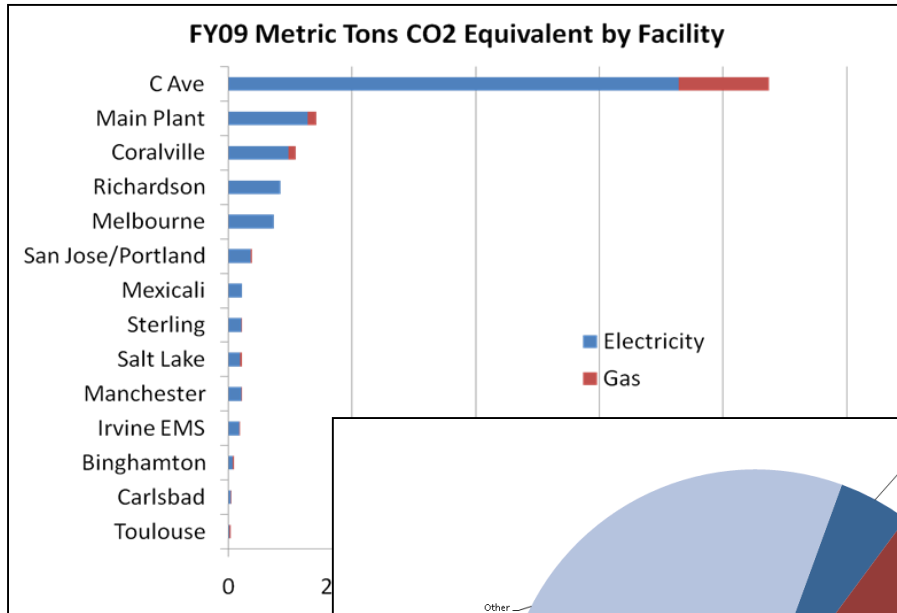


<https://www.youtube.com/watch?v=Sdj-8ZBYYmo>

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Energy Project



Off-hour temperature adjustment

We're reducing our energy consumption and environmental impact with a temperature setback system that works like a programmable thermostat.

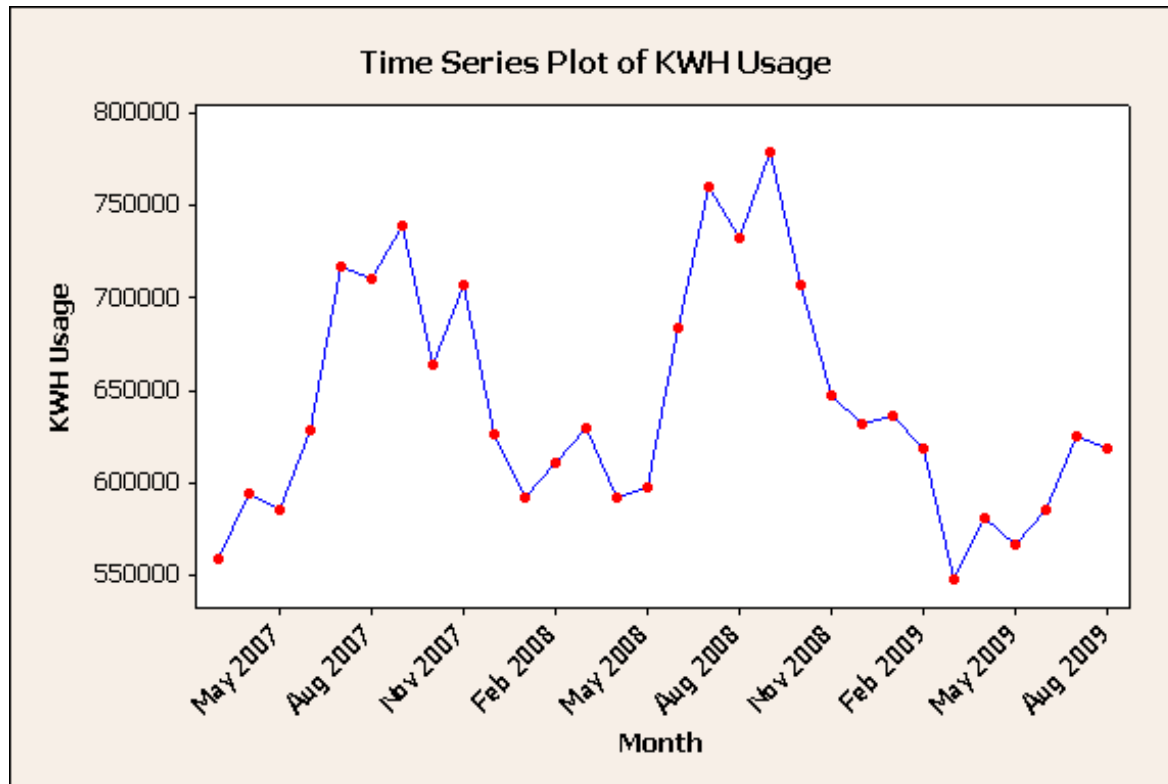
During off hours, you can override the setback via the adjustment control. It will return the temperature to its regular setting for two hours. Please press for the setback temperature during off hours and avoid overriding the program if you intend to work for only a brief period.

Thank you for helping Rockwell Collins become even more energy conscious.

Contact:
Facilities Services
295.5595

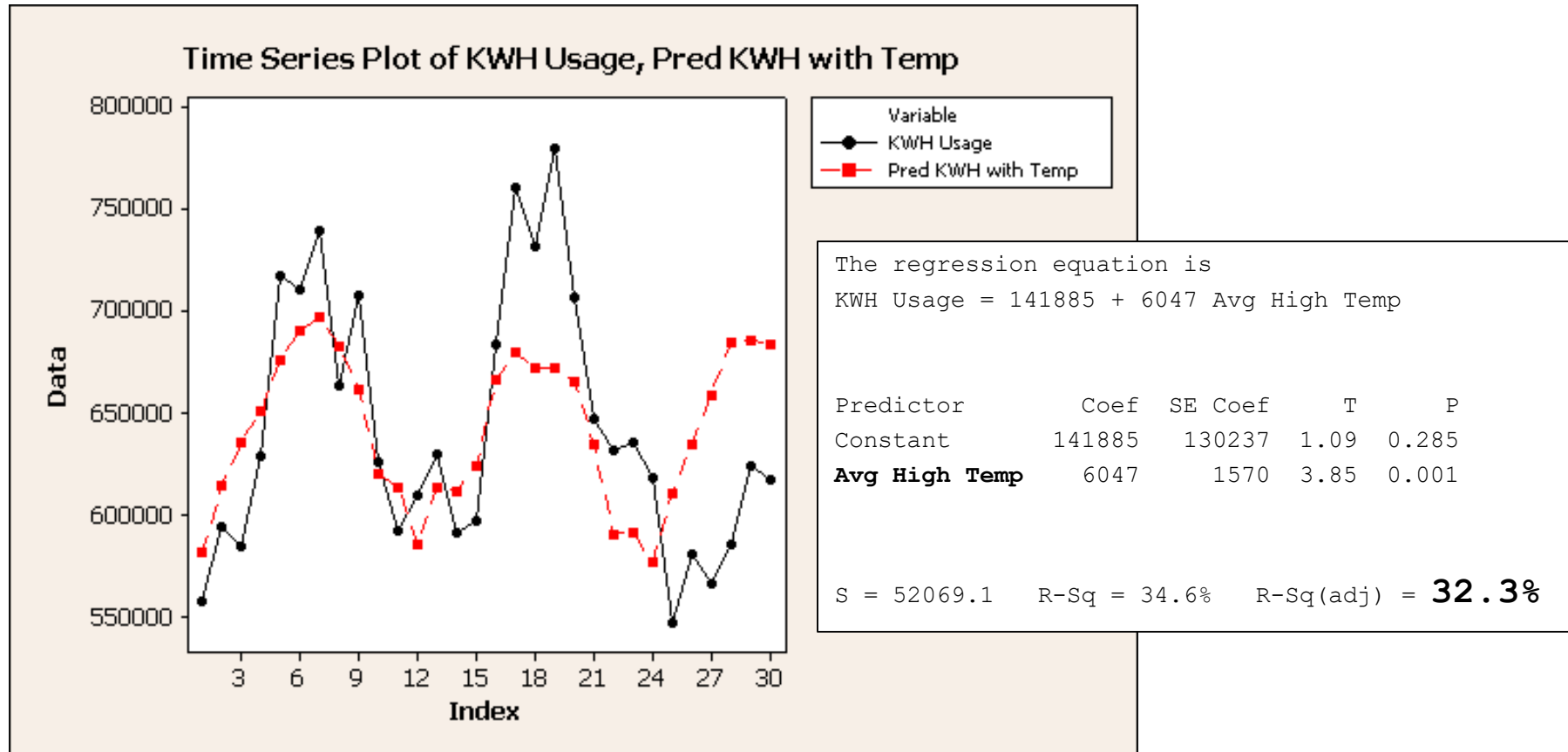
Regression

- Regression analysis is widely used for prediction and forecasting, to understand relationships among the independent variables (inputs) are related to the dependent variable (output)



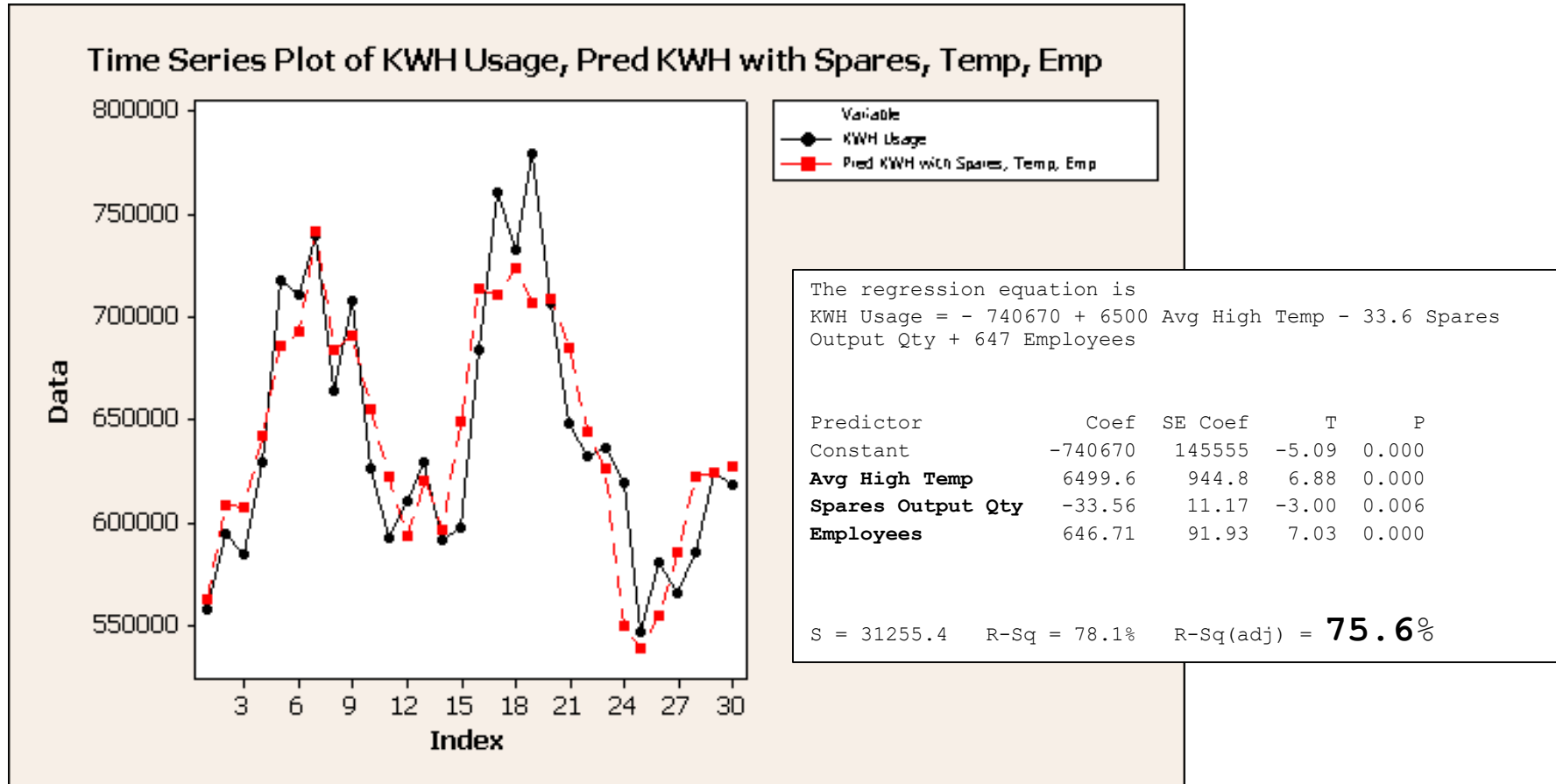
What variables affect KWH usage?

Let's try Average High Temp per Month



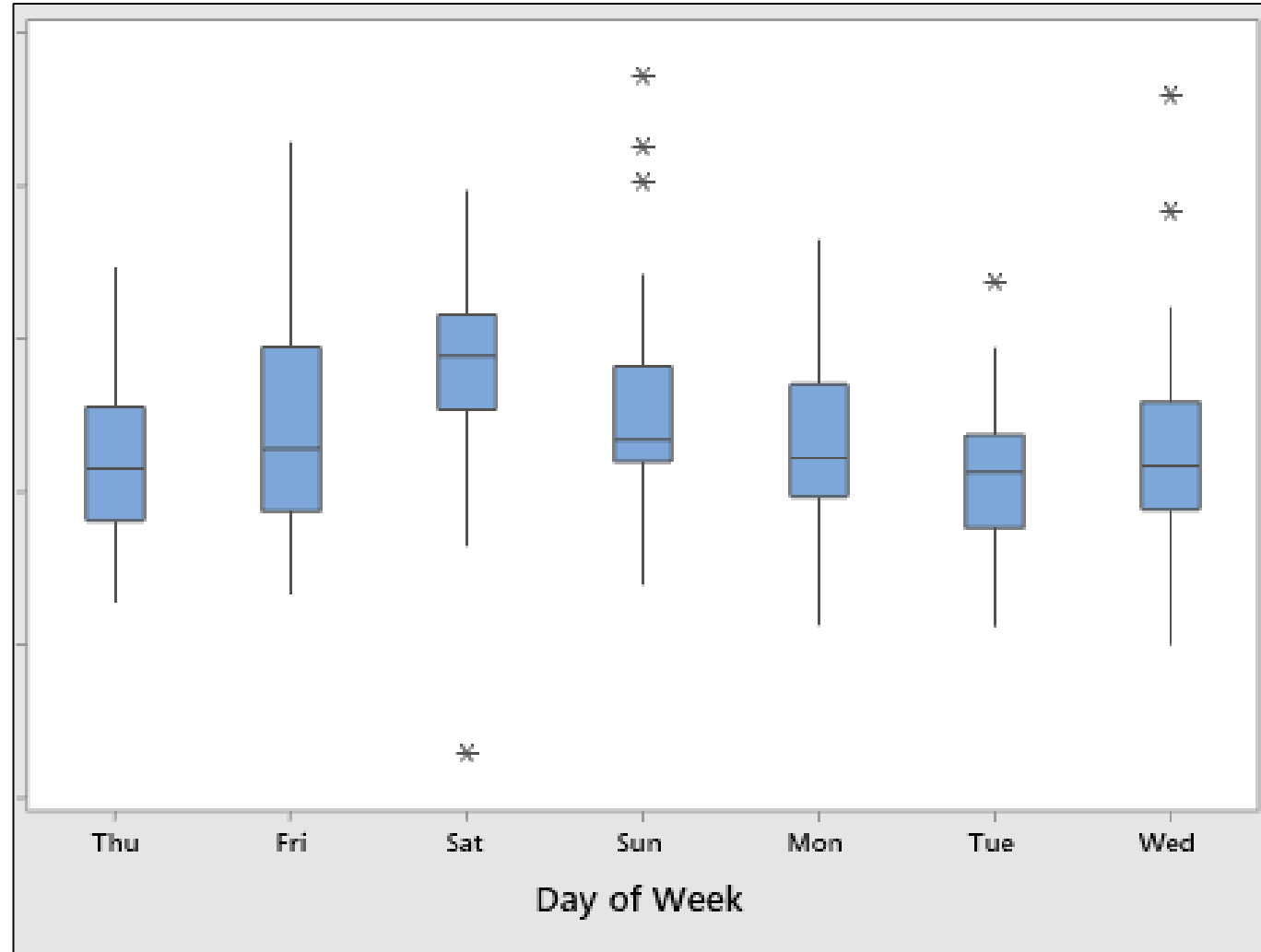
Good, but we can do better...

Add Employee Count and Spares Output

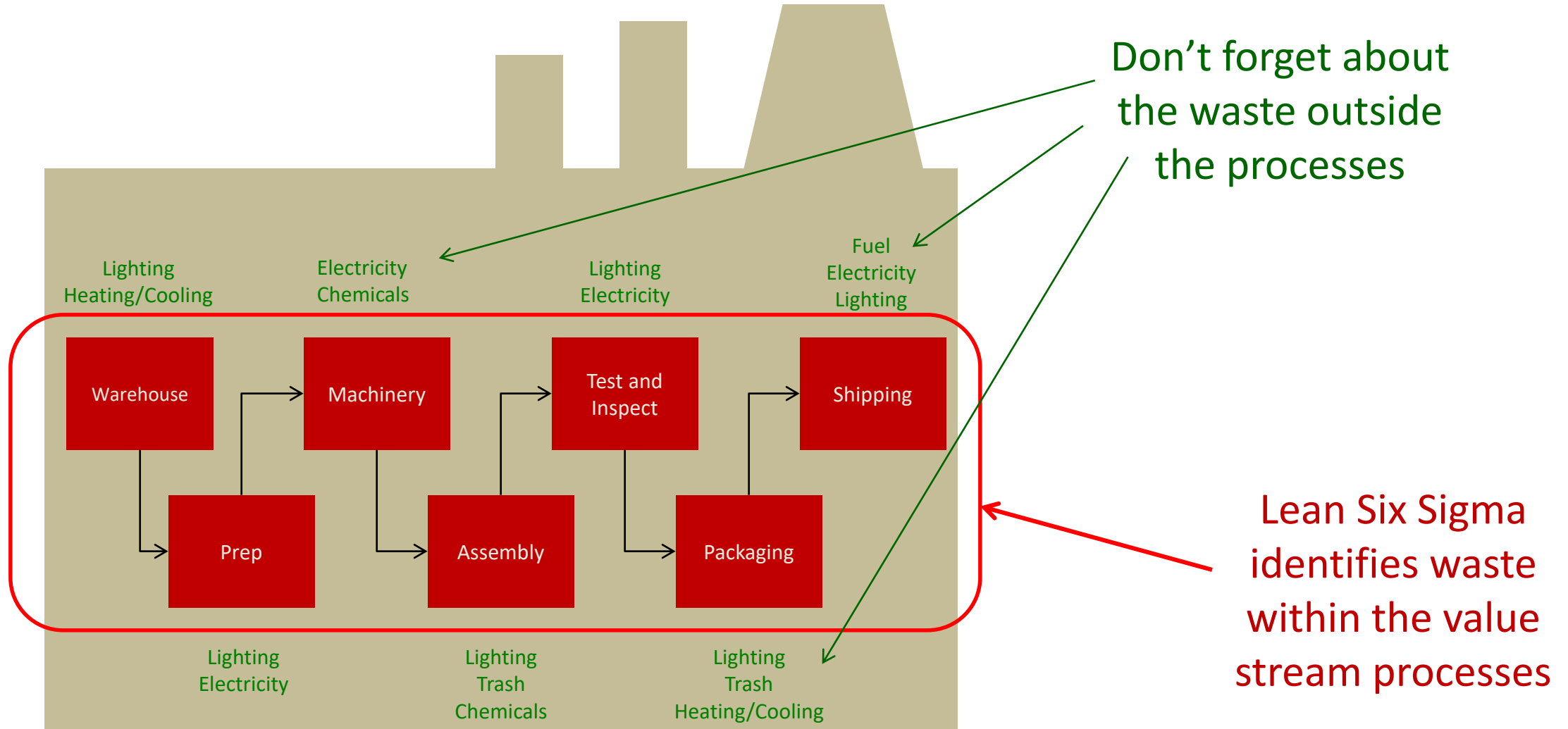


Much more accurate...how would you address these?

Six Sigma Example - Community



Gaps from current process evaluations?



Common Struggles with Improvement

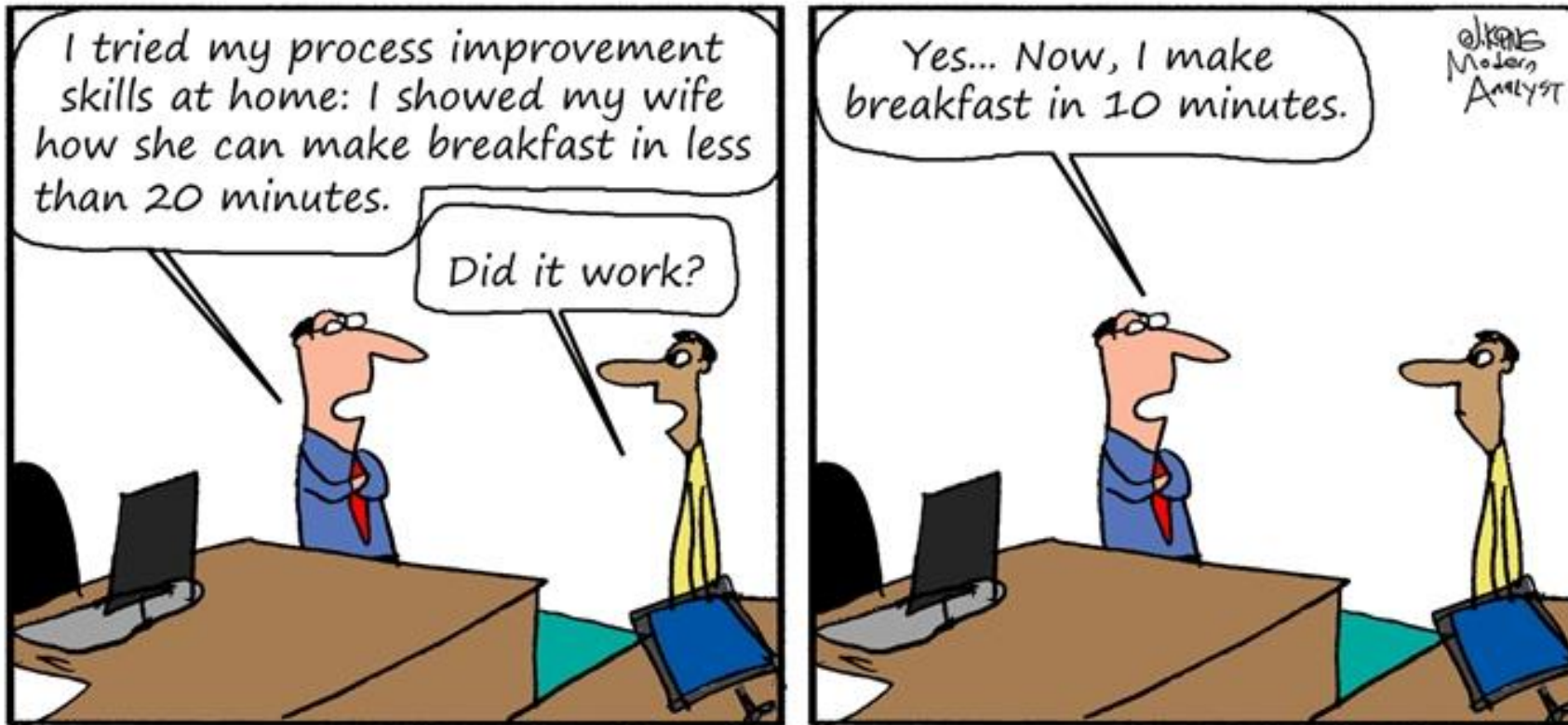
- Not enough time?
 - Block out 10 mins a day, or 60 mins a week
 - Improvements leads to more free time
- Management doesn't support?
 - Improve your own work (or apply at home)
- Don't know enough?
 - Start with 8 wastes and 5S
 - Practice more important than training
 - Internet has almost everything you need
 - Take the free online course

Group Discussion

- How can you apply these Lean and Six Sigma concepts to your personal life?



Fix your own problems



<https://www.modernanalyst.com>

FREE: Lean Six Sigma and the Environment

Lean Six Sigma and the Environment

Chapters

Achievements & Progress 0 / 87


Discussion

Search by lesson title

- Introduction (Free)
- Toyota Production System Improves Food Bank Delivery
- Quiz: Toyota Video
- Applying Lean Six Sigma in East Africa
- Quiz: East Africa Video
- Department of Ecology and AccraFab Partner to Save Money and Reduce Environmental Wastes
- Quiz: Accra-Fab Video

This is one of my favorite videos, as it shows how Lean improvement techniques can be used to help a community, not just companies make more money.

Watch the video below (7 mins)



This course will show how some of these same techniques have been used to reduce environmental impacts in a community or within an organization.

The next video will show you how Six Sigma techniques were applied in East Africa to save money and improve quality of care.

<http://business-performance-improvement.thinkific.com/courses/lean-six-sigma-and-the-environment>

Summary

- Lean and Six Sigma are proven techniques to help any organization achieve better results
- Look for 8 wastes in your work and personal life
- Organize your space with 5S methods
- Start with small improvements frequently, not large solutions
- Collect data to better understand problems'
- Help your co-workers and staff become better problem solvers
- Work in teams (more heads better than one)
- Never lose sight of customer and stakeholder needs

Other Websites

- Business Performance Improvement
 - BIZ-PI.com
- Lean Six Sigma and the Environment (Planet) – FREE COURSE
 - LeanSixSigmaEnvironment.org
- Lean Six Sigma for Good (People)
 - LeanSixSigmaForGood.com
- Lean Portland – Local volunteer group
 - LeanPortland.com

Q&A



Contact Info



Brion Hurley

Lean Six Sigma Master Black Belt
Portland, Oregon (USA)

brion@biz-pi.com

+1-321-271-5361



@brionhurley



@brionhurley