# Can Six Sigma & CMMI Get Along?
## (The answer is Yes!)

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# About Intel IT Flex Services

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# IT Flex Services

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# Flex AQI Program

"Accelerated Quality Improvement":

- Internal quality improvement program (i.e. SEPG) for Flex Services

- An overhead function in a break-even Pay-Per-View organization

- That means we must both improve quality *and* be increasingly efficient

- Use Lean / Six Sigma as a methodology for improving our program practices as well as optimizing our organizational processes

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# DMAIC Overview

**What is important?**   **How are we doing?**   **What is wrong?**   **What needs to be done?**   **How do we guarantee performance?**

Define → Measure → Analyze → Improve → Control

| | |
|---|---|
| **Define** | **Describe the problem or opportunity, goal, process and requirements** |
| **Measure** | **Gather data about the problem and process** |
| **Analyze** | **Use hypothesis and data to find root causes** |
| **Improve** | **Develop, implement and refine solutions** |
| **Control** | **Plan for stability and measurement** |

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# DEFINE - AQI Productivity Improvement*



## Problem Statement/ Business Need:

- AQI is required to maintain an improved rate of process engineering toward implementing CMMI ML3/ML4, but at a reduced cost.

- The Flex break-even business model puts constant pressure on spending toward process improvement

- Intel business conditions add focus in efficiency improvements

## Goals/ Objectives:

- Demonstrate 15.0% or greater improvement in process engineering productivity toward closing CMMI ML3/ML4 gaps while maintaining existing pace of 2-4 "gaps" closed per month on average and an effort budget of no more than 2000 hours/quarter.

## Finance-Approved Business Impact:

- Over **three years**, this translates to a Business Value **of $138-$277K**.

*Taken from Six Sigma project charter document*

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# DEFINE - AQI Productivity Improvement

| What improvement is targeted and what will be the impact?<br><br>How do you quantify success? | Metrics | Baseline/ Current | Goal | Units |
|---|---|---|---|---|
| **Improvement Goal** | Monthly Productivity | .0046 | .00529 (+15%) | Monthly Gaps Closed/ Effort Hr |
| **Boundary Condition Maintain (or Exceed)** | Monthly Gap Closure rate | 2-4 | 2-4 | Goal Equivalents per Month |
| **Boundary Condition Maintain (or Decrease)** | Quarterly Effort rate | 2000 | 2000 | Effort Hours per Quarter |

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# Measure - Problem
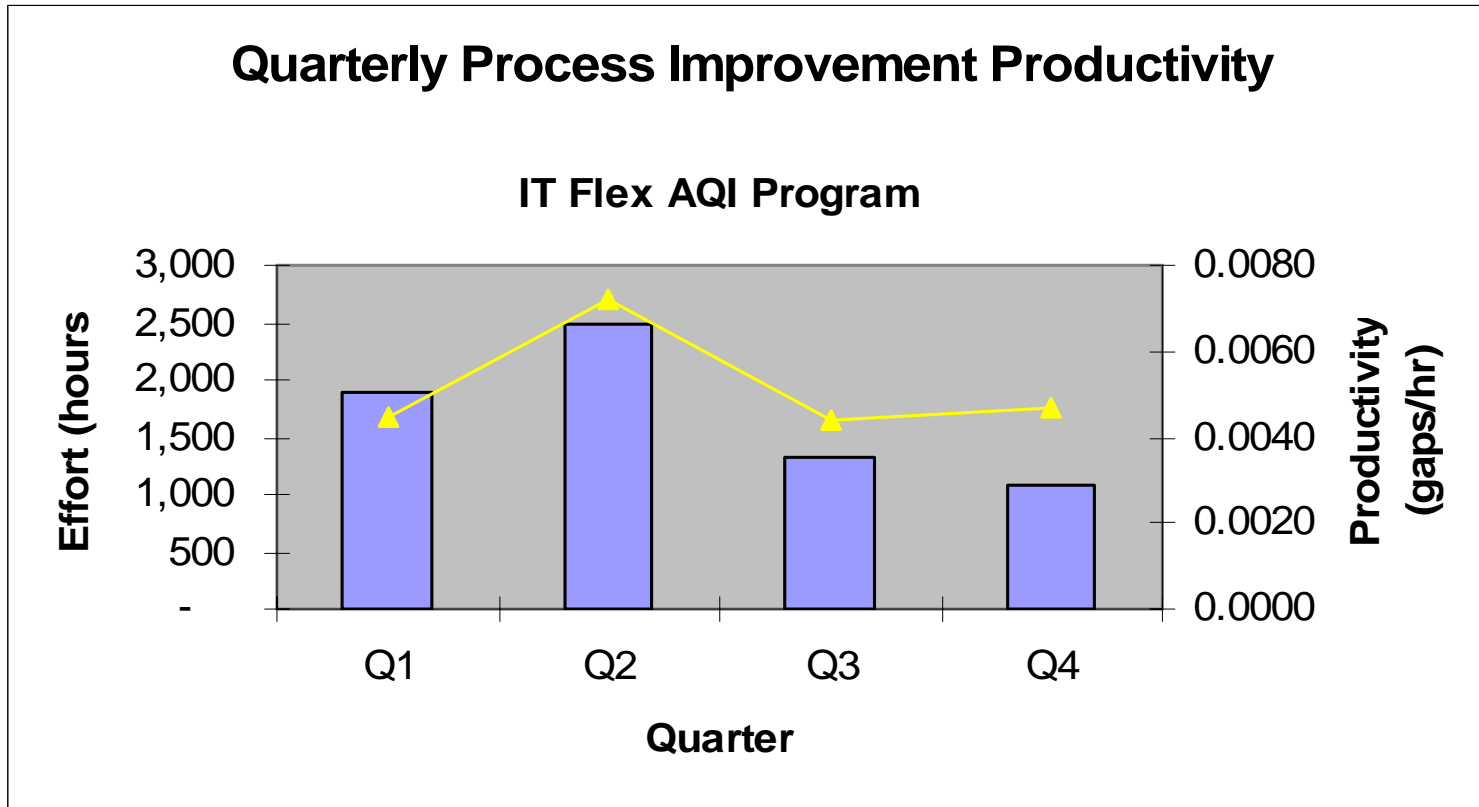


Figure 1a – Q4'06 Data Added (Q4 productivity=0.0047)

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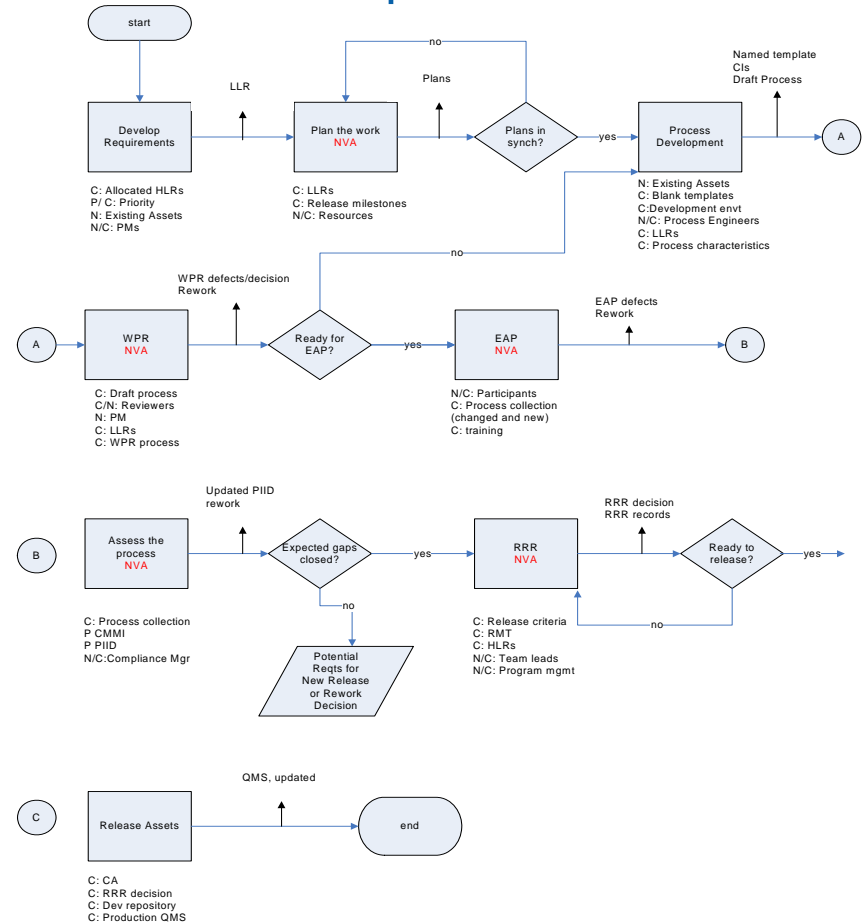
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# MEASURE - AQI Productivity Improvement

## Tree Map:
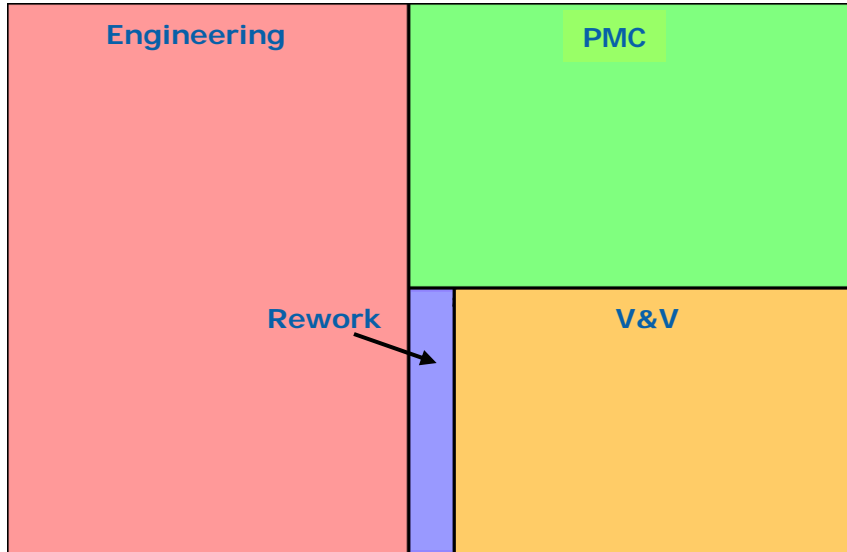


## Process Map:



**Key Takeaways:** Planning and Review are taking more effort than expected *and* have non-value added steps in the process diagram – improvement opportunities!!

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# MEASURE - AQI Productivity Improvement

| Suppliers | Inputs | Process | | Outputs | Customers | |
|---|---|---|---|---|---|---|
| Providers of the required resources | Resources required by the process | Top level description of activity | | Deliverables from the process | Anyone who receives a deliverable from the process | |
| | | Requirements | | | Requirements | |
| Alan (PIID status) | gaps | number of gaps left to CMMI ML3 | requirements allocated | | Satisfies Requirements (RRR criteria met) Support/Improve Biz quality (useful & painfree) satisfies requirements (ticket closure) | end users |
| | | gap doman | | | | |
| | | skillset and availability to support work to be done | | | (SCAMPI-ready in Q2'08) ML3 compliant on Vanguard Support/Improve Biz quality Effort Budget is low | Flex Staff |
| Flex Staff | resources | | quality improvement process (step 6.4 in particular) | QMS assets (standard processes) | | |
| CMMI | goals & practices | model expectations | | | tangible / available | appraisers |
| end users | tickets | priority, severity, reqts are clear, concise | | | tangible / available | Alan (PIID Changes) |
| IT, Flex staff, Intel | other biz rets | relevance to our processes/org | | | clear & conflict-free (coach-able/audit-able) | PQAG |
| | | | process release | | clear/conflict-free (teachable, conflict-free) | Training |
| | | | | | Satisfies Requirements (RRR criteria met) | AQI Program Mgt. |

**Key takeaways:** Knowing our Critical for Quality indicators helps us prioritize areas of opportunity and avoid fixing one thing just to break something else equally important.

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# ANALYZE - AQI Productivity Improvement Next Steps

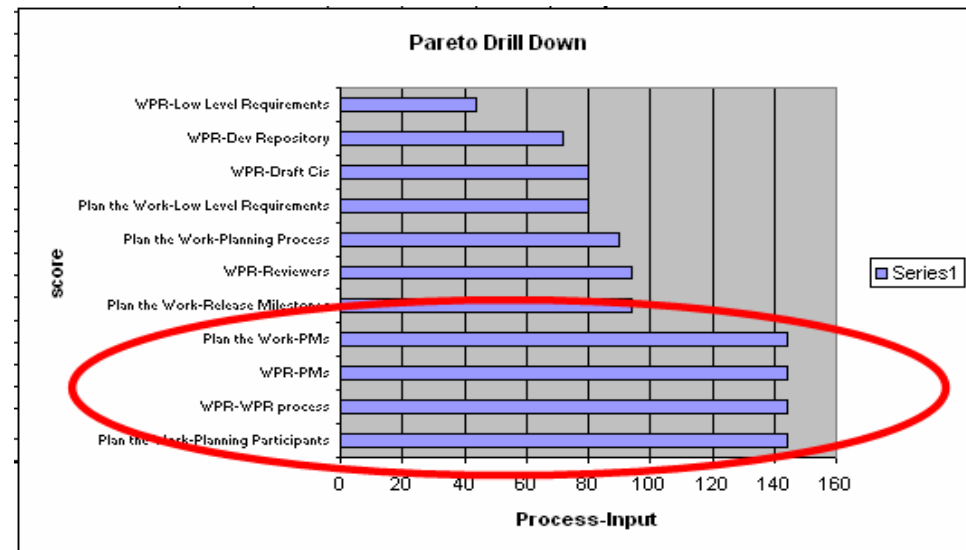Define → Measure → Analyze → Improve → Control

## Key Takeaways:

Using **Cause and Effect Matrix** and **Pareto Chart**, we identified top four key process step/inputs to further analyze:

- Plan the work – PMs
- Plan the work – Planning participants
- WPR – PMs
- WPR – WPR Process

Project team used **FMEA (Failure Modes Effects Analysis)** to identify root causes and appropriate actions.

### Cause and Effect Matrix

| | AQI Productivity | | Effort | ML3 transposed | ML3 Compliant on Vanguard | Support/Improve Biz Quality | Tangible/Available | Clear & Conflict Free | Description | Total Value |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Rating of Importance to Stakeholder | | 9 | 7 | 0 | 0 | 0 | 0 | Description | Total Value |
| 7 | Plan the Work | Planning Participants | 9 | 9 | 1 | | | | Plan the Work-Planning Participants | 144 |
| 8 | WPR | WPR process | 9 | 9 | 1 | | | | WPR-WPR process | 144 |
| 9 | WPR | PMs | 9 | 9 | 1 | | | | WPR-PMs | 144 |
| 10 | Plan the Work | PMs | 9 | 9 | 1 | | | | Plan the Work-PMs | 144 |
| 11 | Plan the Work | Release Milestones | 5 | 7 | 3 | | | | Plan the Work-Release Milestones | 94 |
| 12 | WPR | Reviewers | 5 | 7 | 3 | | | | WPR-Reviewers | 94 |
| 13 | Plan the Work | Planning Process | 3 | 9 | 1 | | | | Plan the Work-Planning Process | 90 |
| 14 | Plan the Work | Low Level Requirements | 5 | 5 | 5 | | | | Plan the Work-Low Level Requirements | 80 |
| 15 | WPR | Draft Cis | 5 | 5 | 5 | | | | WPR-Draft Cis | 80 |
| 16 | WPR | Dev Repository | 1 | 9 | 1 | | | | WPR-Dev Repository | 72 |
| 17 | WPR | Low Level Requirements | 1 | 5 | 5 | | | | WPR-Low Level Requirements | 44 |

**Pareto Drill Down**

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# ANALYZE - AQI Productivity Improvement

Define | Measure | Analyze | Improve | Control

FMEA (Failure Modes and Effects Analysis) was completed to identify root causes with biggest impact:

- Inappropriate reviewer selection

- PM skill level

- Poor Design

- Poor controls/detection

Actions/Owners were identified for each

| | |
|---|---|
| A - Establish Criteria for selecting right reviewers for Standard WPR methodology w/in AQI program;<br><br>B - Improve controls | A- Lisa;<br><br><br><br>B- Alan |
| C -Establish Criteria for selecting right PMs;<br><br>D- Improve controls | C-Keith;<br><br>D-Alan |
| E - Implement Design Phase and Design Reviews into AQI lifecycle;<br><br>F- Improve Controls | E-Keith;<br><br><br>F-Alan |

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# ANALYZE - AQI Productivity Improvement

Define → Measure → Analyze → Improve → Control

## Actions validated by re-calculating RPN for post-fix scenario
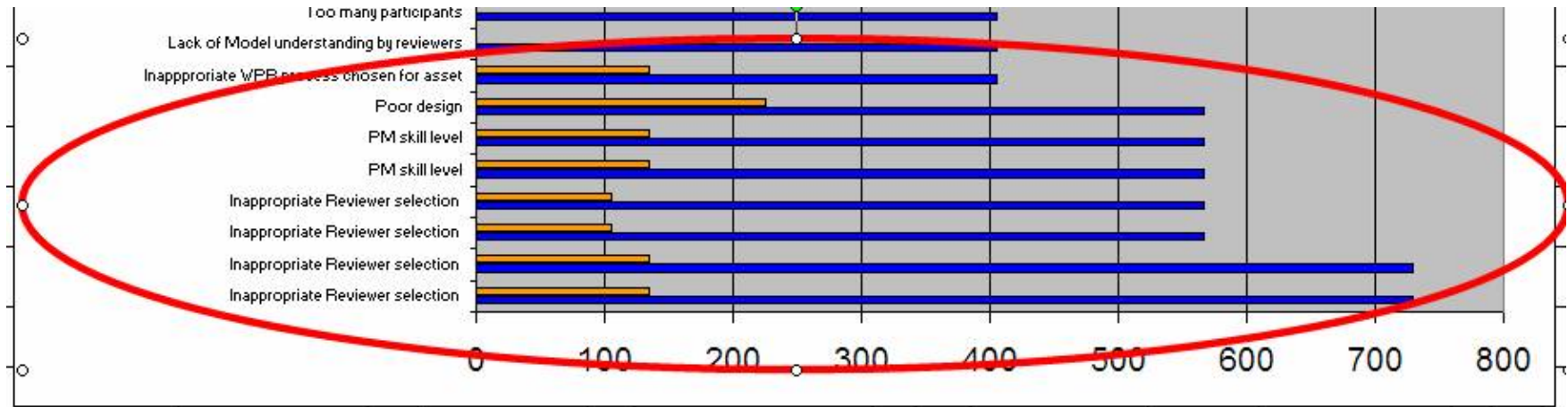


**Key Takeaways:**

Actions taken will improve highest RPN items in FMEA, but also address lower ones through 'collateral benefit' effect.

Flex Alternative Selection Process wasn't used in this case, but gives a good framework for evaluating alternative actions during this step if needed.

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# IMPROVE - AQI Productivity Improvement



Implement changes during "Sally" release Early Adopter Period and test with AQI program.

- Quality Improvement Process
  – WPR criteria added
  – AQI PM criteria added
  – AQI lifecycle added, includes design reviews
  – PPQA processes placed emphasis on AQI

- Aligned PQAG resources to mentor and review AQI projects
  – Adds control over AQI activities same as with full projects

Pending successful pilot, implement to production with "Sally" release at end of Q2.

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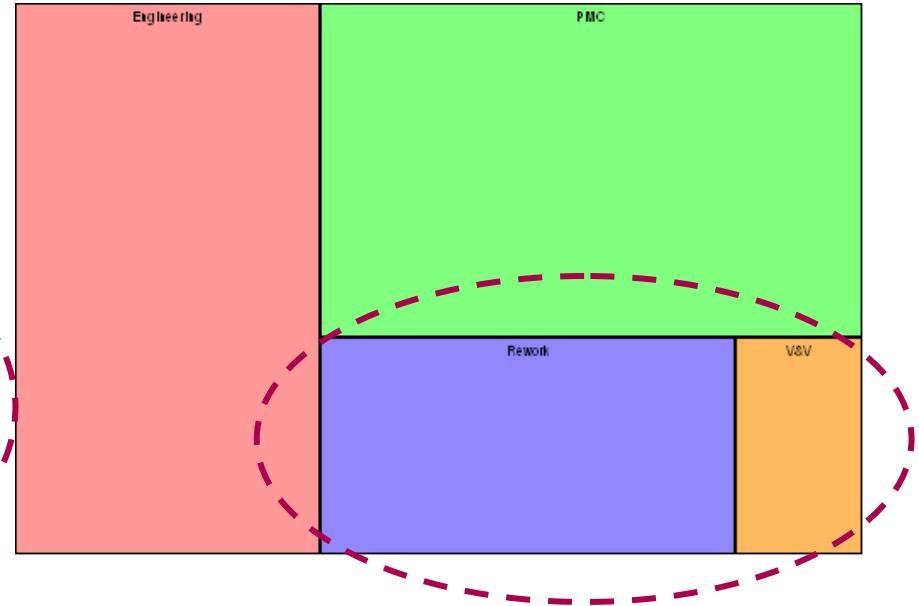# IMPROVE– New Work Product Review form

# IMPROVE - AQI Productivity Improvement
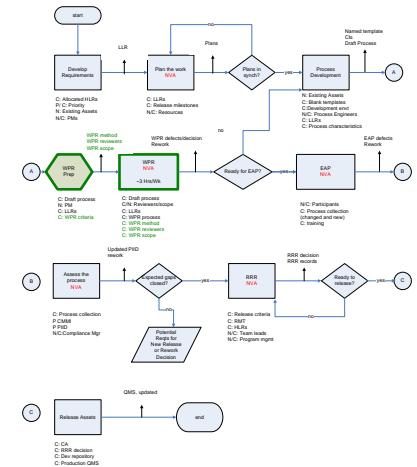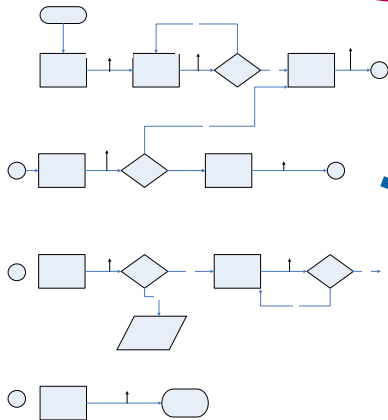


## Baseline
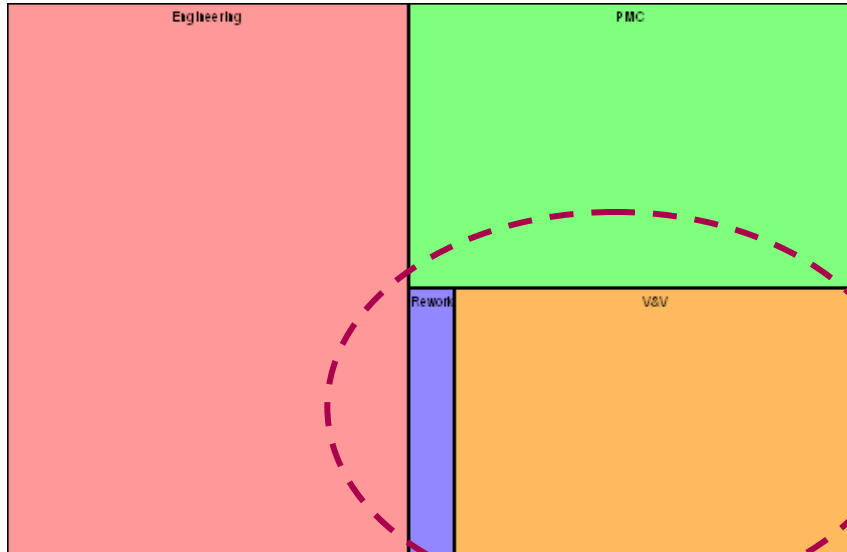
## Pilot



Key Take away:
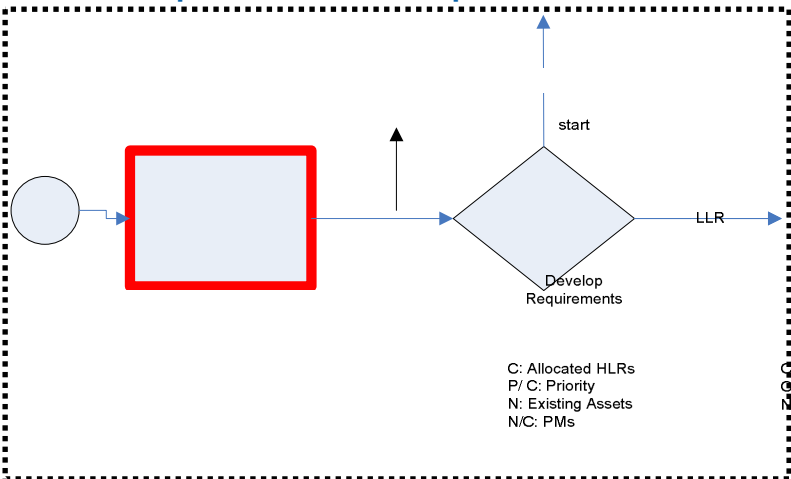   There is relative decrease in the V&V effort, yet a relative increase in rework effort.
   This indicates that the V&V activity is still finding defects and driving rework, just more efficiently.
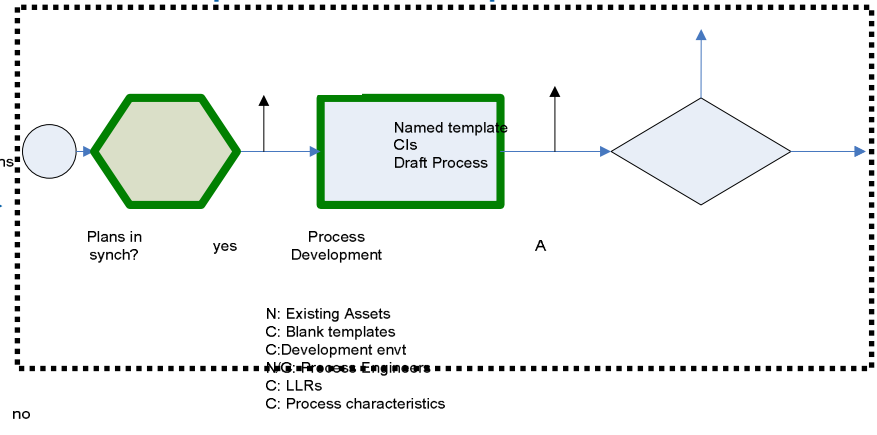
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# IMPROVE - AQI Productivity Improvement



**"As Is" process map**

**"To Be" process map**

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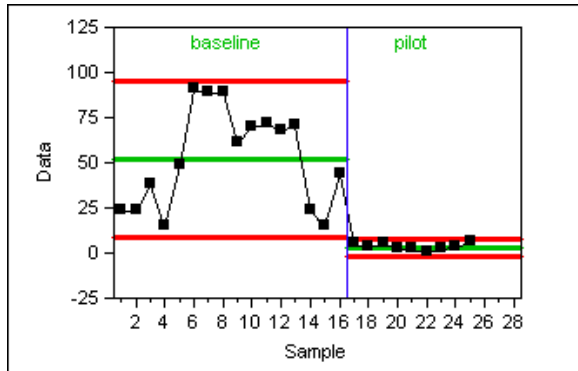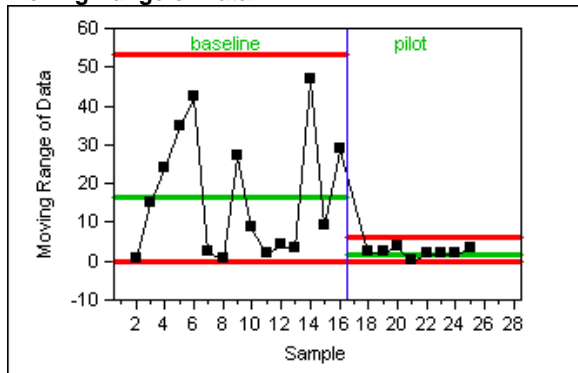innovative. strategic. solutions.

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# IMPROVE - AQI Productivity Improvement



**Control Chart bucket=V&V**
**Individual Measurement of Data**



**Moving Range of Data**



**Oneway Analysis of DATA By group**
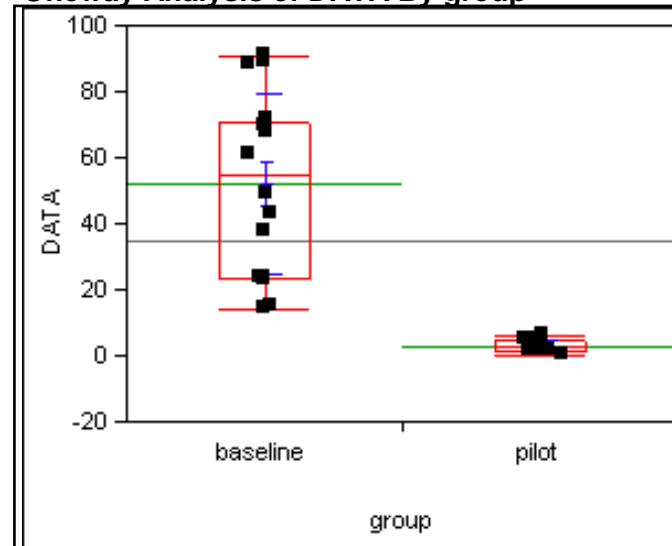


Key Take away-The control charts show a drop in weekly V&V effort, but the rework effort remains at roughly the same level. Another confirmation that we haven't thrown out quality.

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# IMPROVE - Updated FMEA

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# CONTROL - AQI Productivity Improvement

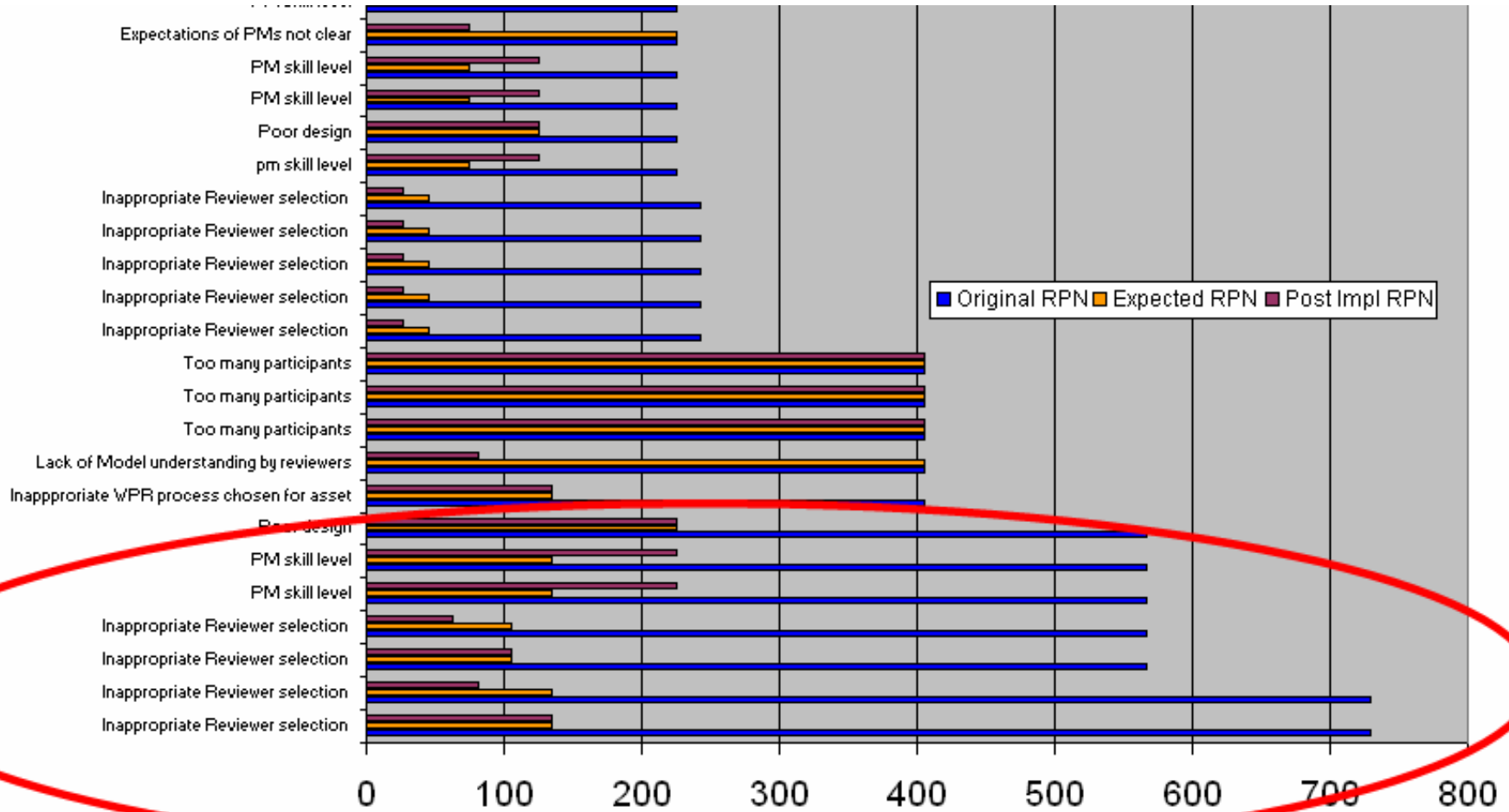Define → Measure → Analyze → Improve → Control

| Action | Who | When | How | Why | Corrective Action |
|---|---|---|---|---|---|
| Revise AQI's WPR & data mgt plan & execute to it | AQI PM - Keith | Bi-Weekly review | Update PrP, use PTOC, report to Lisa, review at AQI Coordination Meeting | Ensure that the program executes the improvements and captures data | Educate AQI team leads, assign ARs to correct and provide missing data |
| Monitor WPR & Rework effort data | AQI PM - Lisa | Monthly | AQI Coordination Meeting Review* | Observe & ID effort OOC & act on signals | Take action to get process back in control** |
| Monitor PM Compliance to AQI PDP re: WPR & data mgt. | PQAG - Rick | Quarterly<br><br>By Phase | Audit<br><br>Activity Review | Observe & ID process compliance & act on non-conformance issues | Log & Fix Non-conformances |
| Monitor the Control Plan | Compliance manager – Alan | Quarterly | Institutionalization audit via the checklist for OPF | Ensure accountability for the control plan | Ensure status of critical variables is visible |

\* Monthly review of V&V and Rework Effort in hours per week as plotted on a control chart using JMP. Data source is Tracking Tool for AQI Program

\*\* See past special causes.

# Summary of the outcome

- Weekly V&V effort dropped from ~50 hrs/week to ~3 hrs/week without compromising output or quality.

- Using a conservative figure of only 25hrs per week for calculations...
  - 25x52x$67=$87,100 per year which calculates out to **$261,300** in three years.
  - The original **Finance-Approved Business Impact over three years was $138-$277K**.

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# Quotes & Role Models

**George Box** - "All models are wrong; some models are useful"

**W. Edwards Deming:** "In God we trust, all others bring data"

**Peter Drucker -** "If you can't measure it, you can't manage it."

**Swiss Army Survival Guide -** "If the map doesn't agree with the terrain, in all cases believe the terrain."

**Gandhi –** "You should be the change that you want to see in the world."

**Wayne Gretsky –** "Skate to where the puck is going to be"

**Albert Einstein** – "Things should be made as simple as possible, but not any simpler."

**Watts S. Humphrey -** "Insane persons believe they can continue doing the same thing over and over and get a different result."

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# Any Questions?

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