Applying Agile Techniques to Process Development: Lessons Learned

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Topics

- ►(Agile Development) Defined
- ►Agile (Process Development) Defined
- ►Process Development Planning
- ►Process Architecture Design
- ►Process Rollout Management
- ►CMMI® Model Implementation Choices
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(Agile Development) Defined

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► Main Principles of Agile Development
- Individuals and Interactions *over* processes and tools
- Working software *over* comprehensive documentation
- Customer collaboration *over* contract negotiation
- Responding to change *over* following a plan

► "That is, while there is value in the items on the right, we value the items on the left more."

► Source: www.agilemanifesto.org

Agile (Process Development) Defined[1]

► **Individuals and Interactions over process development techniques**
  - Who are the experts in which processes and how can we empower them and work with them to quickly capture their knowledge and arrive at decent documented processes *over*
  - Using more formal and methodical ways of developing processes

► **Piloting process work products over baselined policies, process documentation, and procedures**
  - Get process forms, tools, templates drafted, try them out and work out the kinks *over*
  - Waiting on the complete set of process assets to be approved including approved policies, processes, procedures as well as their associated work products

Agile (Process Development) Defined$_2$

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► "Customer" collaboration over following the formal process improvement workflow

- Working with the end process users (e.g. project staff) to understand their process needs *over*
- Waiting to author and implement process improvement suggestions or change requests

► Responding to change over following a plan

- Addressing the more urgent needs of the process users *over*
- Following "the" process development plan or spending a lot of time in re-planning the process development effort

Process Development Planning[1]

►Assuming CMMI is implemented but whether implementing the staged or continuous representation, there are some good choices in planning an Agile approach

- Incremental Process Development
  - Allows increments of your process assets to be piloted and rolled out across the organization, perhaps per process area
- Iterative Process Development
  - Allows you to build up your process assets and to pilot and roll them out while only partially complete, perhaps to implement a process thread or to just get an initial capability in the hands of your projects
- A combination of the two is also possible as well as other approaches

Process Development Planning$_2$

►**Regardless of approach, be prepared to respond to changing needs and adapt quickly**

- ■ Assuming an initial set of process needs were elicited from the end process users, they may soon realize they need something more or different sooner
  - Continue to work with the project teams to understand their changing needs or priorities
  - Change course as needed without worrying about updating the plan unless major changes might jeopardize the results
  - Small tweaks will only affect earned value and should not affect overall effort, resources, cost or schedule. It might actually reduce schedule, potentially.

Process Development Planning₃

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► **Don't underestimate resource needs or overestimate resource availability**

- Depending on experience level and knowledge, expect to spend a minimum of 80 hours (expert level) developing the processes and assets for each PA (at CL3)
- Take into account infrastructure
  - Process Asset Library, Measurement and Project Repositories
- Allocate plenty of time for process tweaking
  - Expect about 10 tweaks per PA (0.5 to 8 hours/tweak)
- If using project resources to develop processes
  - Expect availability to be low, *plan* for no more than 10% (4 hours/week), 5%-8% (2 to 3.5 hours/week) is more typical
- Allocate time for process review/rework/approve/improve cycles

Process Architecture Design[1]

► Give consideration to how everything fits and works together

  ■ Create an integrated solution

► Capture the know-how in the process descriptions

  ■ If people have to go hunting down folks for help, you got more work to do

► Use the cookie cutter approach to create easy to use project repositories (create templates for them)

► Stick with the classics (e.g., IBM's ETVX)

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Process Architecture Design$_2$
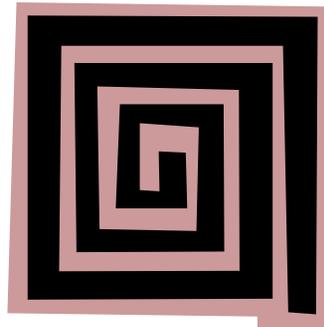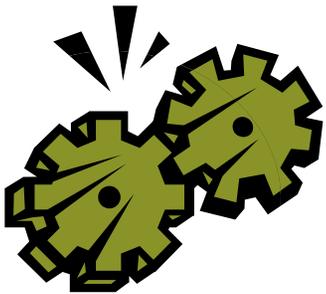
►**Leverage Technology to reduce foot print of manually intensive processes**

■ Use a DAR process to introduce automation or technology to reduce cycle time, human error and paperwork

- Typically applied to defect tracking, action item tracking, configuration management, requirements management, document workflow, metrics collection, trending and analysis
- Make sure to do a proof of concept before buying

■ Reassess technology improvements as part of annual process improvement planning

- What processes take the most time, produce the most pain?

Process Rollout Management₁
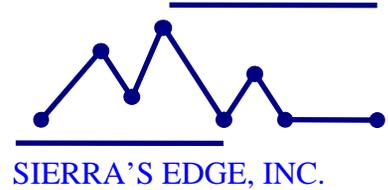
► **Process implementation is an often overlooked area**

- Processes are baselined and approved
- Project personnel are trained (so far so good)
- But most project plans are from their customer's or product development perspective, not the organization's new process perspective
  - Process implementation and institutionalization is at risk at this critical stage

Process Rollout Management$_2$

►Several strategies need to be planned for, put in place and proactively monitored and managed to guarantee success

- Potentially re-plan projects to introduce new processes but not at the nitty-gritty level
- Mentor and Lead by Example
  - Provide process assets that show what is expected or what might be a good example of the harder to produce work products
  - Bootstrap the more major processes, like CM
    - For example, facilitate configuration control boards
  - Walk around and mentor staff during rollout until they are comfortable with the new processes

Process Rollout Management$_3$

► Create a "plan" of process implementation for each project

- Gain an understanding of when projects will be using the new processes and when evidence of their use materializes
  - When each expected work product will be created
- Develop a tool to record this data to arrive at a forecast for each project's full compliance (FC) or process implementation schedule

► Train the project to track their progress toward meeting these expectations and revise as needed

- Try to avoid overly optimistic commitments
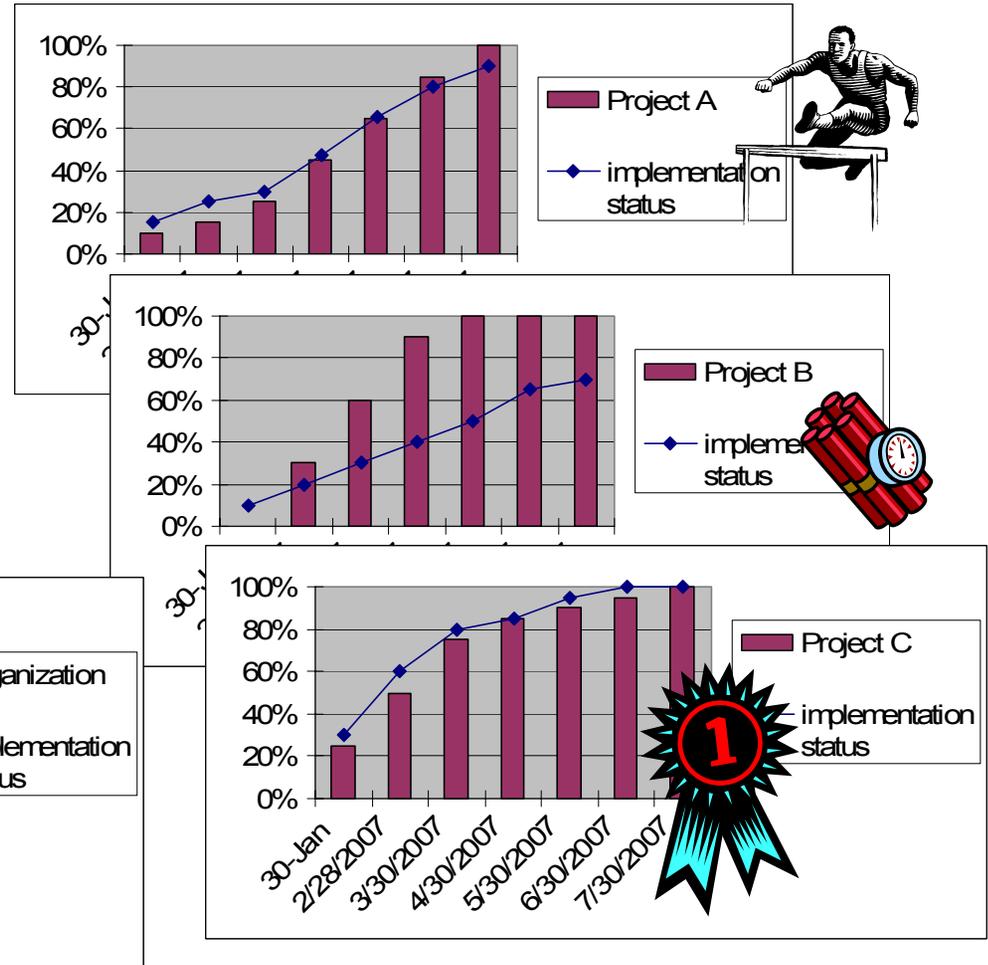
Process Rollout Management₄

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▶ Aggregate and proactively monitor and manage all the project rollout forecasts at the organizational level (sounds like OPF, huh?)

■ Take corrective action when it seems any project is falling significantly behind their forecast

■ Take corrective action when the organization is falling significantly behind its forecast

▶ Organizational process compliance forecasting helps determine appraisal readiness and can predict the SCAMPI appraisal milestone date

Process Rollout Management$_5$
Case I: 3 Projects, Same Start Date

► **What does an example forecast look like?**

- Bars represent forecasted compliance
- Lines represent actual compliance achieved
- Projects A&B are behind schedule in implementing processes
- Project C has reached full compliance on schedule!
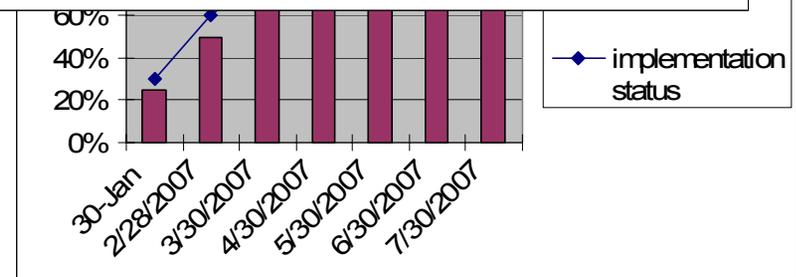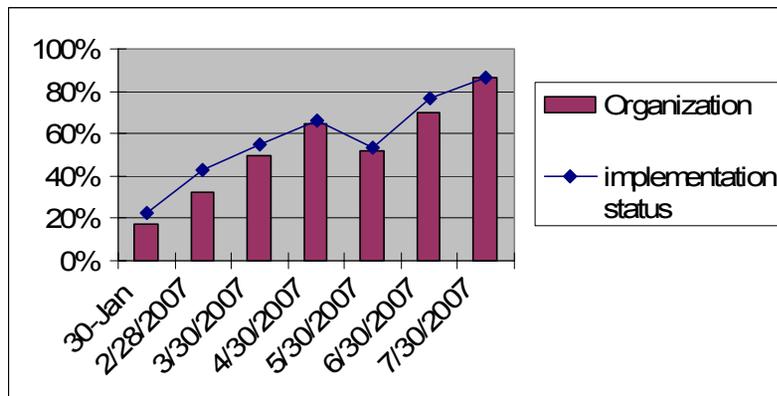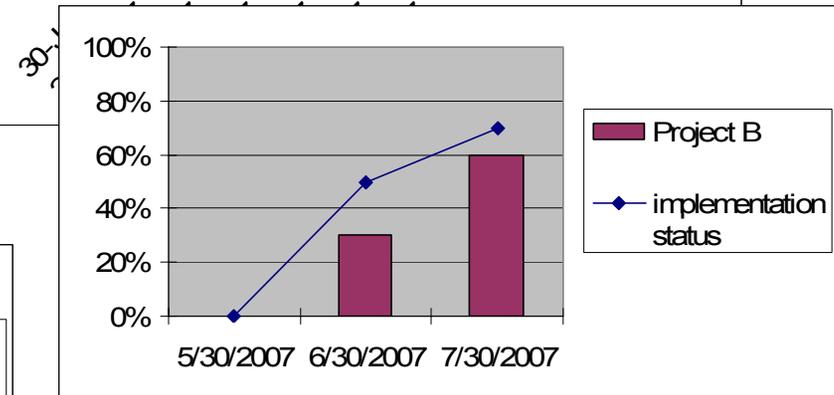
Process Rollout Management[6]
Case II: 1 Project, Later Start Date

► Notice in this case that the organizational forecast takes a dip as the new project starts up

► It may take a couple of months or more to achieve full compliance

► Note, compliance can regress for other reasons like process abandonment
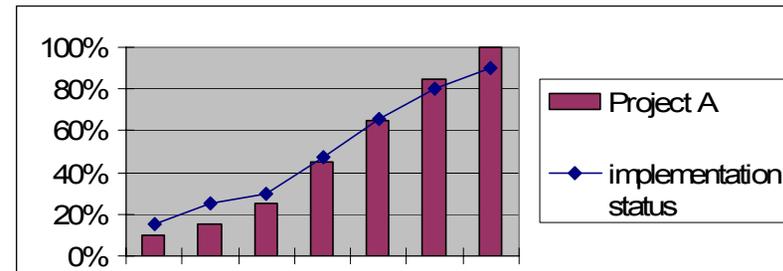
Process Rollout Management[7] Sampling of other Cases

► **More complex cases are possible**

- Projects using different lifecycle processes
  - Development
  - IT
  - Maintenance
  - Services
- Projects tailoring out processes
- Projects using customer processes

► **Need to take into account how these cases affect forecasting at the project and organizational level**

Process Rollout Management$_8$

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► Reaching full compliance (FC) does not necessarily mean a project or organization has fully institutionalized its processes
  ■ For this, one might
    ● Track how consistent the new processes are being applied after reaching full compliance
      – Is the expected frequency of work product outputs consistent?
    ● Track the commitment of the organization's staff to the new processes
      – Is there wide or expected levels of staff participation?
  ■ Both of these measures can be forecasted and tracked in a similar manner as the work products

► Once the organization has reached FC and has achieved institutionalization, the result is a higher degree of confidence towards a successful appraisal outcome

Process Rollout Management$_9$

► Achieving institutionalization is a challenging problem in organizational change

- Depending on the existing company culture and personalities involved, it can be quite a challenge to implement change in a smooth fashion
- The goal is to foster a self-reinforcing process and achieving high taken-for-grantedness
  - Process rollout forecasting and tracking helps
  - But carefully managing the expectations of staff and all stakeholders from the very beginning is the real key
  - Lessons can be learned from Psych-101
    - See: http://changingminds.org/disciplines/change_management/-change_management.htm

CMMI Implementation Choices[1]

▶ **Which Representation to Use?**

  ■ Staged or Continuous?
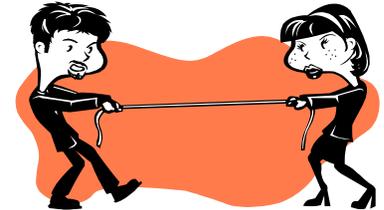
▶ **My take on it and the choices:**

  ■ Develop, appraise and market processes using the staged representation

  ■ Develop, appraise, and market processes using the continuous representation

  ■ Develop using the continuous representation and appraise and market using the staged representation

CMMI Implementation Choices$_2$

► Can all 3 be done in an Agile way?

- Short answer: Yes
- Long answer: staged representation is a bit more restrictive than the other 2 approaches

► Why do I prefer using the continuous representation?

- Because I like the power of performing the activities associated with OPD, OPF, DAR right away (assuming the goal is ML2) and perhaps other higher level process areas even if only at a capability Level 1!
- Most companies do, too. They implement OPD and OPF even for an ML2 rating, they just don't realize they are using the continuous representation!

CMMI Implementation Choices$_3$

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►Typically organizations achieve a continuous representation target profile without realizing it

- Most implement OPD, OT, OPF to help develop their ML2 processes, train their people and rollout their processes
- Some even formalize these processes and actually achieve higher CL ratings for these support "activities"

►Some organizations have people that champion their own particular causes and start implementing other processes "outside" the main improvement effort

- For example, the test manager might implement VER and VAL processes right away (hint, I was one!)

CMMI Implementation Choices$_4$

► Once you realize the power of the paradigm shift to the continuous representation

- You can leverage it to make your process development Agile from the very beginning

- You can plan for it

- You can give your organization a jumpstart on reaching higher levels of maturity while providing the support it needs to achieve its current goal

Real-World Example[1]

►Company ABC
- Name changed to develop this presentation in an Agile manner!
- Size and Business: 75 employees, IT services and consulting
- Goal: Achieve ML2 rating
- Initial Planned Approach: Incremental Process development and rollout
  - REQM, PP, PMC, CM, PPQA, SAM, and MA in that order
  - All processes developed by yours truly
  - Staged ML2 appraisal in 13 months
  - Fixed Price Contract

Real-World Example$_2$

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► Initial estimate was nearly 1300 hours to develop CL3 (we don't do CL2) processes and process assets across the 7 ML2 process areas

► Assumptions included client creating the PAL (process asset library), measurement repository and training material

► Unfortunately, budget was cut to 1000 hours and client was not informed of assumptions

  ■ Resulting in significant scope creep with a 20+% decrease in the budget!

Real-World Example$_3$

► Would it be possible to implement a process development effort using cost-effective strategies from the software world to reduce effort and risk?

- Use systems engineering to create a more streamlined set of processes and process assets?

- Reduce effort by reuse?

- Reduce downstream issues and risks by prototyping to detect issues earlier?

Real-World Example$_4$

► Borrowing software development techniques to reduce effort/risk (continued)

- Take advantage of agile techniques like iterative development, leveraging collaborative teaming, etc.?
- Reduce training requirements by creating a turnkey solution that provides some built-in help?
- Build QA into the process to increase quality of delivered product?

► But is there a limit to just how much scope creep can be absorbed using agile techniques?

- What will be sacrificed as budget limit is reached?

Real-World Example$_5$

►Agile Adaptations:

- Approach altered to use continuous representation (surprise, surprise) and more Agile approach changing major process development sequence to:
  - OPD$_{CL1}$, OPF$_{CL1}$, DAR$_{CL3}$, REQM$_{CL3}$, PP$_{CL3}$, PMC$_{CL3}$, CM$_{CL3}$, PPQA$_{CL3}$, MA$_{CL3}$
  - Notice the further increase in scope
    – SAM was dropped (deemed not applicable) but 3 out-of-scope processes were added, providing us this strategic opportunity:
      » We are teaching folks how to fish!

Real-World Example$_6$

► Agile Adaptations (continued)

- Embedded iterative approach within increments
  - But did not plan iterations, adapted to project's needs
- Produced several process assets out of sequence (and iteratively) to tackle immediate project issues
  - Action item tracking, PMR slides, change management, meeting agendas/minutes, project status meeting process, requirements specification template, schedule template, metrics to track project progress
- Integrated process and infrastructure
  - Metrics, project repository design, QA audits and process descriptions were designed in an integrated fashion

Real-World Example$_7$

► Result

■ Organization achieved ML2 Rating in 9 months with 6 global strengths, and strengths in many process areas, with only 2 weaknesses

■ Notice organization passed appraisal at FC point

- Lead Appraiser felt processes were highly stable and fully institutionalized by this point

- I left the organization at 6 month mark (June 30th) with all processes completely rolled out and organization at 83% process (and CMMI) compliance

Implementation Status vs. Forecast

Legend:
- % Complete of SEI CMMI Level 2
- Implementation Status
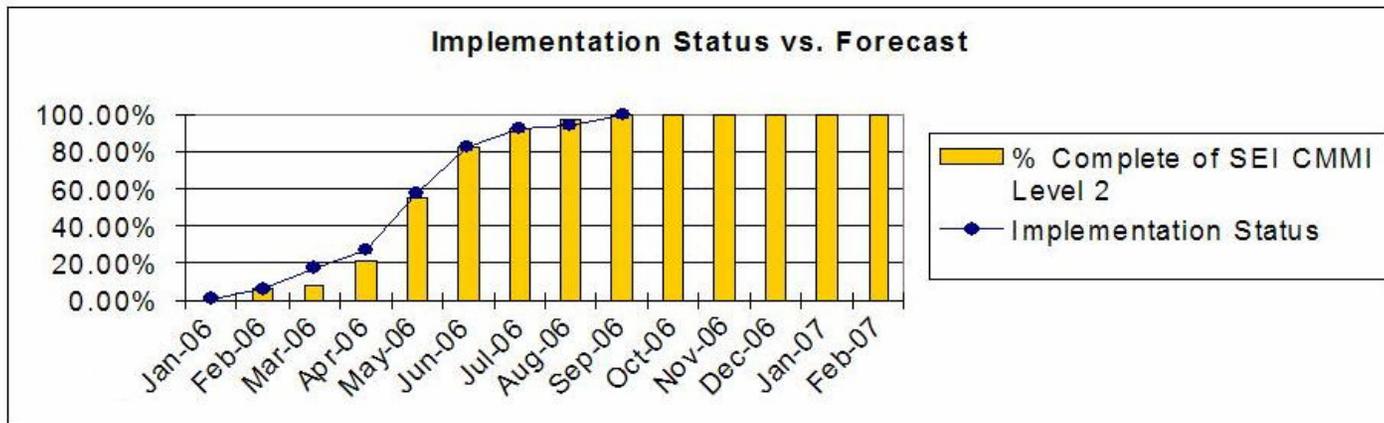
Real-World Example$_8$

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► How good were our Agile/mitigation strategies?
- ▪ Savings
  - REQM: 44%, PP: 11%, PMC: 24%, MA: 13%, SAM: 100%
  - Schedule: 30%, Appraisal: 40% (3 days actual vs. 5 days planned)
  - Process group setup: 90%
- ▪ Over-runs
  - PPQA: 36% (not right-sized to organization, but high quality)
  - CM: 10% (under estimated)
  - Planning: 93% (plan had to be revamped due to scope creep)
  - Rollout: 371% (effect of significant scope creep!)
    - – Unplanned training, infrastructure development, meetings, etc.
- ▪ Items sacrificed
  - Appraisal readiness
  - Residual mentoring and tweaks on CM and PPQA
- ▪ Original plan would have yielded a 4% budget cushion

Real-World Example$_9$

►How effective was our approach?

- PPQA was overweight for the organization
  - Effort involved overran by 36%
  - Resulting process was inefficient and went beyond the point of diminishing returns for QA

- Training and mentoring absorbed more time than envisioned

- Although our approach was very successful, perhaps we were a bit too Agile
  - Training and QA could have benefited from more formal design techniques

Lessons Learned$_1$

► **Run the PI effort as a piloting project**

- **Use the PI effort as an early testing ground to develop key planning and management artifacts**

  - Project plan, schedule, action item tracking, project review (PMR forerunner), project status report, metrics collection and reporting, earned value management, risk management, change control

  - The PI effort should be run as well if not better than the projects as it can potentially provide good examples of work products for projects to follow

Lessons Learned$_2$

► Pilot some key processes in a process group to jumpstart processes in other process areas (PA)

- For example, an software engineering process group (SEPG)
- The SEPG becomes the PI effort project staff
- Some SEPG processes can be adapted to other PA's, like process change control to software change control (CM)

► When process experience is lacking use an external consultant to bootstrap the SEPG

- Consultants can show the group what kinds of action items are needed to get process improvement activities going
- Consultants can chair the meeting until the designated chair is ready
- Consultants can develop initial PI plan and mentor the team through an initial set of suggested improvements

Lessons Learned$_3$

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►Use the ample resources of the Internet to speed process development

■ Learn to use the right set of buzz words to find useful examples of policies, processes, templates, tools and even educational material

►Use the IEEE Software Development Library instead of reinventing the wheel when it comes to documentation standards

■ It saves time and is an excellent return on investment

■ See http://shop.ieee.org/ieeestore/Product.aspx?product_no=SE113

Lessons Learned₄

► Track metrics to understand the efforts involved and to help predict future process improvement outcomes

Consulting Hours Breakdown - June 2006

Action Items Opened per SEPG Meeting

Current Month Per Process Area Compliance vs. Forecast

Consulting Activity Trending

Lessons Learned$_5$

► Appraisal readiness is in the eye of the beholder
- Just how much institutionalization is enough to be appraisal-ready can vary from Lead Appraiser to Lead Appraiser
  - Criteria should be metrics-based rather then subjective
  - Better to be "over-prepared" to cover the wide range of interpretation
- Agile approaches to process development may lead to earlier appraisals as many processes are up and running quickly
  - However, expect weaknesses in those processes rolled out nearer the appraisal if an appraisal is scheduled too aggressively
  - I prefer seeing all the processes used for at least 4 to 6 months if not more
    - It takes a while for processes to become stable and reach full institutionalization (where you can walk away and they continue ad infinitum and there is evidence of continuous PI)
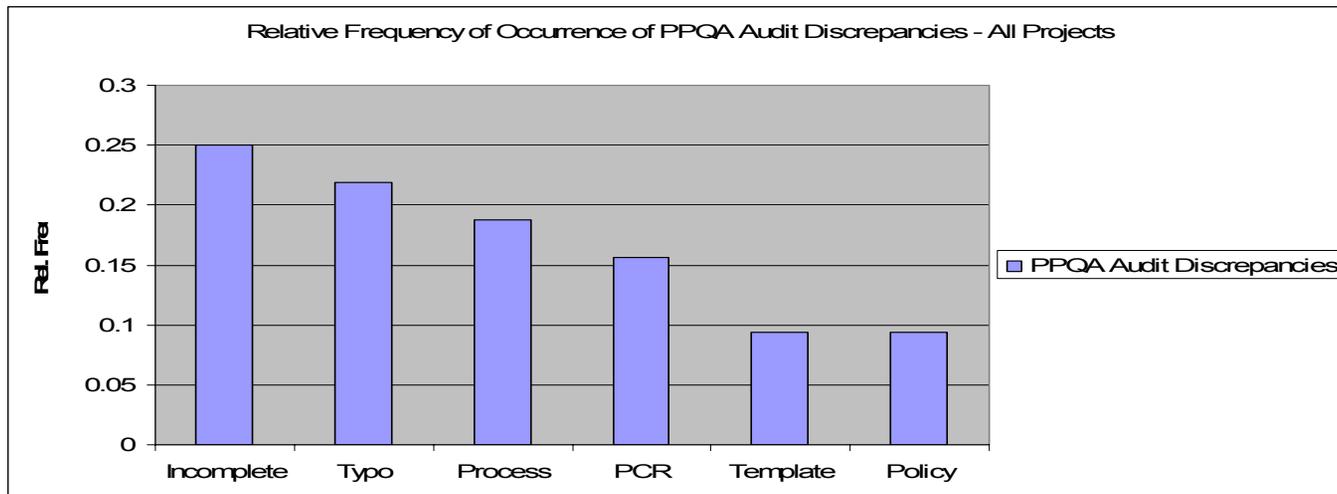
Lessons Learned$_6$

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► Outsourcing PPQA audits is a common approach to accelerating the path to an appraisal

- However, make sure you have independence in the organization to manage and track any deficiencies uncovered to closure
  - Company ABC did not have a full-time QA manager at the time, so a project lead was assigned the role
  - As a result some conflict of interest was introduced and created a weakness in the tracking of issues associated with their project
  - This was reflected in the appraisal results as an issue was uncovered
- This approach only makes sense if the processes have had a chance to stabilize
  - Otherwise, you're just being a bean counter to check off a box to pass an appraisal and discounting the real value that PPQA brings to the organization
  - Doing audits too early will just create a bunch of unnecessary work, you'll generate a ton of issues due to unstable processes
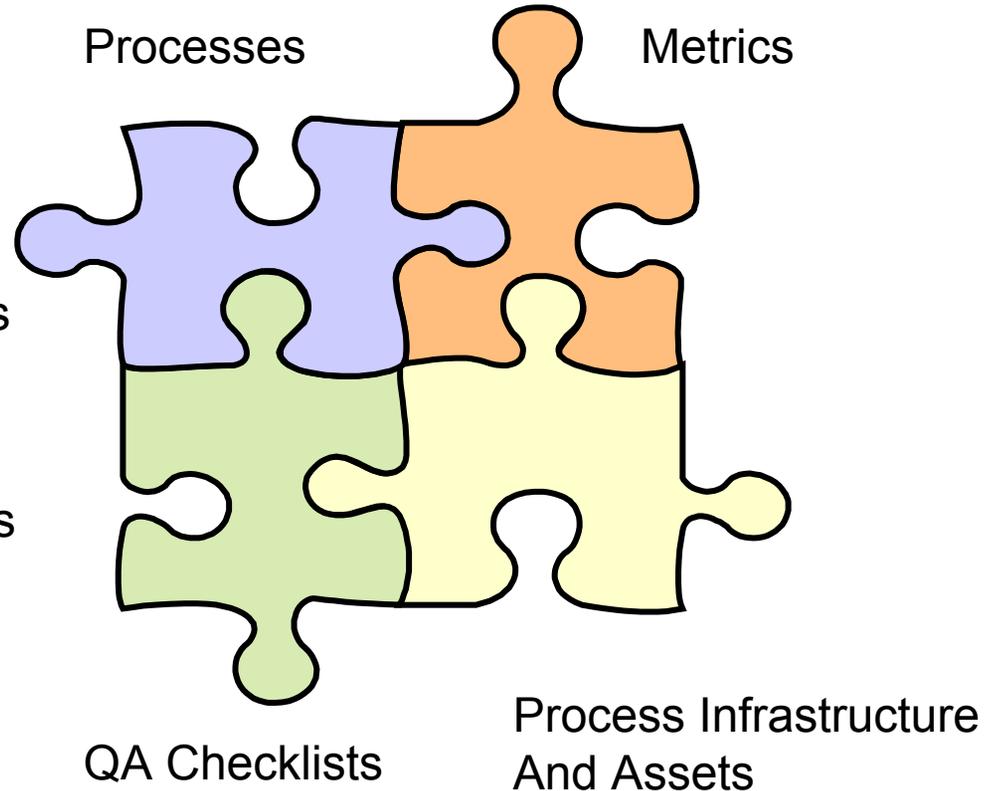
Lessons Learned$_7$

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► A review of the PPQA audit results showed evidence that full process stability had not yet been achieved

- Work product issues accounted for 35% of audit findings
- Process/Policy issues accounted for about 30%
- Process Tweaks introduced to account for 15% of issues
- However, audit process was detailed enough to see these trends
- Audit processes are usually a weakness for most organizations

Relative Frequency of Occurrence of PPQA Audit Discrepancies - All Projects

Legend: ■ PPQA Audit Discrepancies

Categories: Incomplete, Typo, Process, PCR, Template, Policy

Lessons Learned$_8$

► **Create an integrated process solution**
  - Process descriptions identify metrics to be collected
  - Measurement Repository points to source processes
  - Processes identify QA verification
  - QA checklists relate process threads to process assets and infrastructure for evidence
  - Process infrastructure reflects process architecture

► **Smoothes roll out and use**

Processes

Metrics

QA Checklists

Process Infrastructure And Assets

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Lessons Learned$_9$

► Implement some CMMI-Friendly and hence Appraisal-Friendly processes

- Show traceability within some of the process assets to the CMMI process areas
  - Acts as a built-in mentor, reinforces CMMI training
  - Effective if processes map very clearly to CMMI
- Reduces logistics (and stress levels) to prepare for an appraisal
- Simplifies appraisal process
- Reduces appraisal time

► Some examples

- Meeting agenda/minutes, PMR slides, project repository, measurement repository, plan, schedule
- Preparing project summary presentations with CMMI traceability is also very appraisal-friendly as it helps the appraisal team more easily verify and give credit for oral affirmation data

Lessons Learned$_{10}$

► Create defined processes and assets

- Moving process implementation to CL3 and working out kinks allows the organization to use more stable processes
- Reduces the effort of the major improvement push associated with going to ML3
  - Allows those new to process time to build experience needed to identify improvements and practice continuous improvement
  - Provides a common approach on all projects and simplifies moving from one project to another
- We implemented a hybrid between ETVX (entry criteria, tasks, verification, exit criteria) and ETXM (m=metrics) to produce ETVXM process architecture
- Hint: If trying to be appraised at CL3, remember to update process asset library with examples of well-implemented work products and other PI data

Lessons Learned$_{11}$

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►Spending more effort using more formal process design practices could have benefited QA and created training material

- Employ other software development techniques
  - Context diagrams
  - Event sequence diagrams
  - Reuse design outputs as training and overview material (plan on leveraging those documents, think ROI)
- Create tools to right-size process to environment
  - Metrics-based tailoring toolset
- Incorporate Agile aspects into resulting products!

Summary

► Creating a more streamlined approach for process improvement is not only possible but can even lead to surprising results

- Apply Agile principles
- Be prepared to adapt to customer needs as you learn what they really need
- "Beg, Steal and Borrow" to leverage widely available resources and reduce overall effort while also potentially increasing quality
- Pro-actively manage process rollout to understand where you are and how far you still need to go to reach your process improvement goal
- Learn where to place your priorities

Questions and Answers

Acronyms[1]

- ► CL2/3 – Capability Level 2/3
- ► CM – Configuration Management
- ► CMMI – Capability Maturity Model Integration
- ► DAR – Decision Analysis and Resolution
- ► ETVXM – Entry Criteria, Tasks, Verification, Exit Criteria, Metrics
- ► FC – Full Compliance (with processes)
- ► FI – Full Institutionalization
- ► IEEE – Institute of Electrical and Electronics Engineers
- ► IT – Information Technology
- ► MA – Measurement and Analysis
- ► ML2 – Maturity Level 2
- ► OPD - Organizational Process Definition
- ► OPF – Organizational Process Focus
- ► OT – Organizational Training

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Acronyms$_2$

► PA – Process Area
► PAL – Process Asset Library
► PI – Process Improvement
► PMR – Program Management Review
► PP – Project Planning
► PMC – Project Monitoring and Control
► QA – Quality Assurance
► REQM – Requirements Management
► ROI – Return on Investment
► SAM – Supplier Agreement Management
► SCAMPI – Standard CMMI Appraisal Method for Process Improvement
► SEPG – Software Engineering Process Group
► SEI – Software Engineering Institute
► VAL – Validation
► VER - Verification

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Presentation Sources

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