Applying Agile Techniques to Process Development: Lessons Learned

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Topics

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► Agile (Process Development) Defined
► Process Development Planning
► Process Architecture Design
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(Agile Development) Defined

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

- 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

► “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
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
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 Planning

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

► 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)
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 Management

► 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
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

► 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 Management

► 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
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
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
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

- 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
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](http://changingminds.org/disciplines/change_management/-change_management.htm)
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

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

- 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!)
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

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

► 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!
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

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

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

► 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

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](chart)
Real-World Example

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**
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

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

► 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

► 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 Learned

- 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**

**Consulting Activity Trending**

**Current Month Per Process Area Compliance vs. Forecast**

<table>
<thead>
<tr>
<th>Process Area</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>REQM</td>
<td>95.00%</td>
</tr>
<tr>
<td>PP</td>
<td>93.00%</td>
</tr>
<tr>
<td>PPQA</td>
<td>92.00%</td>
</tr>
<tr>
<td>CM</td>
<td>89.00%</td>
</tr>
</tbody>
</table>

**Forecast**

- Project A
- Project B
- Project C

**Month**

- 12/31/2005
- 1/31/2006
- 2/28/2006
- 3/31/2005
- 4/30/2006
- 5/31/2006
- 6/30/2006
Lessons Learned

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 than 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)
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

- 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](image)
Lessons Learned

- 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
Lessons Learned

- 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

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

► 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

Huh?
Acronyms

- 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
Acronyms

- 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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