

Practical Software and Systems Measurement

Objective Information for Decision Makers



***Program Measurement –
Is it different for Agile Development?
July 31, 2012***

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Program Measurement – Is it different for Agile Development?

- ***An issue often cited is that a program using Agile development techniques cannot be measured or tracked like traditional development programs***
- ***The objectives are the same - to manage cost, schedule, quality, size and productivity using facts and data***
- ***Post Workshop:***
 - ***At the objective and measurable concept level, Agile is not different***
 - ***There will be some base measures which are Agile specific***

Objectives of the Workshop

- ***Examine how:***
 - ***Traditional measures address the need to manage using facts and data for Agile development***
 - ***Agile specific measures augment the traditional measures to reflect the Agile development processes more completely***
- ***Post Workshop:***
 - ***Objectives still accurate***

Workshop Format

- ***Around the room – 15 mins***
 - ***Who you are (company, role, experience)***
 - ***How agile are you and your company?***
- ***Constraints – group discussion – 15 mins***
- ***Definitions - 15***
- ***Structured discussion using the ICM (Information Category-Measurable Concept-Prospective Measures) Table established by PSM in July 2011 – 120 mins***
- ***Out brief discussion – 15 minutes***
 - ***Post Workshop:***
 - ***A workable approach***

Intended Output

- ***Updated ICM Table showing the measurement relationship between Agile and traditional development.***

- ***Post Workshop:***
 - ***Project portion partially covered***
 - ***Did not get to Enterprise portion***

Constraints – Good discussion

- ***What are the boundaries that limit the benefits and/or adoption of Agile development methods?***
 - ***Command and control management structure***
 - ***Fixed price and fixed requirements and fixed schedule***
 - ***Rules and regulations of an organization***
 - ***Some of these could be legal requirements***
 - ***Other requirements laid on top of the Agile process just because that is the way it has always been done***
 - ***Scalability***
 - ***Large scale ability? Does this require more up front work based on experience?***
 - ***Learning curve; Adjusting behavior***
 - ***Hardware/Software linkage dependent systems***

Summary

- ***Recognized there are many constraints or boundaries which limit the benefits and/or adoption of Agile development methods***
- ***Of the Measureable Concepts addressed in the ICM matrix there was no concept which was not applicable to Agile development methods***
 - ***The over arching framework and the base data driving the measures is the same***
 - ***There is additional Agile base data which can be used to measure the questions to be addressed***
 - ***Management of the programs requires looking at some of the data differently***

Conclusions, Recommendations, and Results

- ***Updated ICM Table showing additional base data which can be used for Agile development for the concepts addressed during the workshop***
- ***Workshop addressed the following Information Categories for Program measures***
 - ***Schedule and Progress***
 - ***Resources and Cost***
 - ***Size and Stability***
 - ***Product Quality – Functional Correctness only***
 - ***Process Performance – Process Efficiency only***

Next Steps/Action Items

- ***Open for discussion***

Project - Information Category-Measurable Concept-Prospective Measures						
Information Categories	Measurable Concepts	Questions Addressed	Prospective Indicators	Measures		
				Base Measures		
				Notes		
				Traditional Only	Common to Both Traditional and Agile	Agile Only
Schedule and Progress	Milestone Completion	Is the project or service meeting scheduled milestones? Are critical tasks or delivery dates slipping?	- Milestone Progress		- Number of milestones started and completed versus plan 1. Completion should be based on achieving specific quantifiable milestone completion criteria 2. Milestones may include inch stones, or major critical milestones 3. Might also look at critical path performance (slack time)	1. Milestones in Agile might need to be at the major critical milestone level and completion criteria may need to vary.
Schedule and Progress	Work Unit Progress	Are specific activities and products completed as scheduled?	- Requirements Progress - Problem Reports Progress - Reviews Progress - Change Requests Progress - System Elements or Units Progress - Test Cases Progress - Action Items Progress - Sprint, Release, or Product Burndown		- Requirements defined, traced, verified, validated - Problem reports discovered, closed - Reviews completed - Change requests opened, resolved - System elements or units designed, implemented, integrated, approved, qualified, accepted - Test cases developed, attempted, passed - Action items opened, completed 1. Other work unit progress measures may be defined based on the work in progress 2. Other schedule performance indicators are included with financial performance indicators (e.g. earned value measures).	- Stories defined, planned, completed, remaining - Story points defined, planned, completed, remaining - Task lists defined, planned, completed, remaining
Schedule and Progress	Work Backlog	Is the backlog of work units growing? Has the backlog of work units been adequately addressed?	- Work Unit Backlog Trends - Burndown Rates		- Work units in backlog, work units in backlog resolved 1. Measure/categorize by priority level and age 2. Work units may be: -- actions, assignments -- service requests -- story points, features or ideal days -- maintenance actions -- open defects or open stakeholder problem reports	
Schedule and Progress	Incremental Capability	Is capability being delivered as scheduled in incremental builds, releases, or service provisions?	- System Elements Integrated - Functionality Integrated		- Systems elements integrated (planned versus actual) - Functions integrated (planned versus actual)	- Stories planned versus actual
Resources and Cost	Financial Performance	Is the project or service meeting budget and schedule objectives?	- CPI, SPI Trends - Earned Value Cost and Schedule Variance - Budget Adequacy and Trends - Cost Trends		- Earned Value: -- Budgeted Cost of Work Scheduled (BCWS) -- Budgeted Cost of Work Performed (BCWP) -- Actual Cost of Work Performed (ACWP) -- Budget at Completion (BAC) -- Latest Revised Estimate (LRE) -- Estimate at Completion (EAC) - Budget, planned, and actual costs 1. For deployed systems, costs include those to operate, maintain (resolve problems), and enhance system.	1. Budget is still known in Agile. WBS needs to be structured to accommodate the Agile development lifecycle. 2. Story points could be used an alternative approach to determined % complete of work scheduled.

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Resources and Cost	Personnel Effort	Is effort being expended according to plan? Is there enough staff with the required skills?	- Staff Level Sufficiency - Effort Distribution and Trends - Skill Profiles - Staff Turnover Rates		- Number of staff on project and projected - Number of staff by skill level - Number of staff by activity - Staff added, removed, quit 1. Can also focus on key staff 2. Effort distribution and trends by activity provides a more detailed profile 3. Look at these measures for the current state and future projection 4. Skills includes expertise, experience, training, education, and domain knowledge.	
Resources and Cost	Facilities and Support Resources	Are needed facilities, equipment, tools, and materials available as needed to meet milestones?	- Resource availability - Resource utilization		- Quantity needed, available - Time required, available, used	
Size and Stability	Physical Size and Stability	How big is and how much change is occurring with the product's physical size, physical characteristics, or interfaces?	- System Element Trends - Interface Complexity - Interface Compatibility - Lines of Code Trends		- System elements added, modified, deleted - Interface number (unique), complexity, growth, approval rates, changes, TBD/TBR closure per plan - Lines of code added, modified, deleted 1. Consider both internal and external interfaces 2. System elements can include software or hardware elements.	
Size and Stability	Functional Size and Stability	How big is and how much change is occurring with the product's functional size, content, or logical characteristics?	- Requirements Trends - Architecture Element Trends - Functional Element Trends - Work Unit Backlog Size Trends - Function Points Trends - Call Center Request Trends - TBD/TBRs Trends - Story or Story Point Trends		- Number added, modified, deleted 1. This can be applied at any part or level of the system definition 2. Functional architecture changes can be at the level of architecture description, model, or elements 3. Call center requests can be categorized as problems or enhancements	- Stories and Story Points planned vs actual
Product Quality	Functional Correctness	Is the product good enough for delivery to the user? Are identified problems being resolved?	- Defect Profiles - Defect Density - Technical Measurement Trends - System Elements Accepted		- Defects by status, severity, priority, distribution, age, etc. - Technical measurement requirement, target, threshold, budget, and actual - System elements verified 1. Technical measurement includes Measures of Effectiveness, Measures of Performance, and Technical Performance Measures	1. Defect management is applicable to Agile. The definition of when a change is considered a defect must be defined and can vary by organization (ie sprint level or release level).
Product Quality	Supportability - Maintainability	How much support does the system require? How difficult is it to support?	- Time to Restore - Mean-Time-to-Repair - Cyclomatic Complexity		- Hours to restore - Calendar hours and labor hours to repair - Number of paths through system 1. Support includes maintenance, training, provision of supplies, etc.	

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Product Quality	Efficiency	Does the target system make efficient use of system resources?	- Utilization - Throughput - Response Time		- System element capacity available, used - Time for function (budget, actual) 1. It is important to capture benchmark times for key system functions. These can be reviewed as the system is maintained or altered, to ensure that no degradation occurs.	
Product Quality	Portability	To what extent can the functionality be re-hosted on different platforms?	- Interface Compliance		- Interfaces verified 1. Use of portability can also include reusability and adaptability.	
Product Quality	Usability	Is the user interface adequate and appropriate for operations? Are operator errors within acceptable bounds?	- User Interface Acceptability - Operator Error Trends		- Actions from user interface reviews - Operator errors	
Product Quality	Dependability - Reliability	How often is service to users interrupted? Are failure rates within acceptable bounds?	- Mean-Time-to-Failure - Availability		- System element failures by severity, priority - System element start, end times 1. Instead of availability, might measure downtime (outages).	
Product Quality	Security - Safety	How many vulnerabilities are identified and remediated by life cycle phase? How many relevant attack patterns have been covered by test cases?	- Profile of vulnerabilities - Cost to fix vulnerabilities - Attack Pattern Test Coverage Profile		- Vulnerabilities discovered, remediated - Cost to fix vulnerabilities - Test cases developed, verified per attack pattern	
Process Performance	Process Compliance	How consistently does the project implement the defined project and enterprise processes?	- Process Reference Maturity/Capability Rating - Process Audit Findings Distribution		- Maturity/Capability Rating Goal, Assessed - Number of audit findings by process area	
Process Performance	Process Efficiency	Are the processes efficient enough to meet current commitments and planned objectives?	- Productivity Performance Trends - Cycle Time Performance Trends - Service Level Agreement (SLA) Response Trends		- Work unit size -- Lines of Code -- Stories -- Function Points - Effort expended - Elapsed calendar and time expended	1. For agile developments, team velocity is a measure of productivity within the team only. A common size measure such as function points or lines of code must be used when comparing productivity across programs.

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Process Performance	Process Effectiveness	Are the processes generating the results expected? How much rework is occurring?	- Defect Containment - Test Effectiveness - Test Coverage - Defect-prone system elements distribution - Operational and Maintenance Effectiveness - Rework Effort Distribution - Rework System Elements Trends		- Defects by phase injected, discovered, and resolved (defect propagation) - Defects discovered per test case and test type - Defects discovered per system element - Schedule and effort expended - total and rework - System elements requiring rework 1. Defects per system element is particularly important for key elements of the architecture, or if safety/security related. 2. For services, schedule and effort expended might include those related to service calls. 3. Rework in production might measure waste of production units 4. Could also measure benefits of processes (e.g. cost prevention) 5. Defect containment is also called "Defect Escapes"	
Technology Effectiveness	Technology Suitability	Can technology meet all allocated requirements, or will additional technology be needed?	- Requirements Coverage		- Requirements met by technology	
Technology Effectiveness	Technology Maturity	Is the technology ready to be used in this project?	- Technology Maturity Trends		- Technology readiness level (TRL) 1. Might also consider technology obsolescence - is the technology about to become obsolete?	
Technology Effectiveness	Technology Volatility	Does new technology pose a risk due to too many changes?	- Technology Baseline Changes Trends		- Number of requirements impacted by changed technology	
Customer Satisfaction	Customer Feedback	How do our customers perceive our performance for individual projects and the enterprise? Are we meeting user expectations?	- Satisfaction Ratings Trends - Award Fee Distributions		- Satisfaction ratings - Award fees received 1. Contractor Performance Assessment or other survey	
Customer Satisfaction	Customer Support	How quickly are customer support requests being addressed?	- Support Request Distributions - Support Time Trends		- Number of support requests - Calendar time to address requests	
Risk	Technical Risk	Is the technical risk exposure at an acceptable level? Are the risk treatment actions performed per plan and are they effective?	- Risk Status - Risk Exposure Trends - Risk Treatment Trends		- Number risks by status and severity - Number risk treatment actions by status (new, in progress, closed) - Risk probability, impact, and criticality (to calculate exposure) 1. Risk Treatment is also referred to as Risk Handling. 2. Technical impacts of risks that are realized could also be quantified (e.g. performance impacts). 3. Opportunities can also be identified and tracked, as well as enablers for those opportunities to occur.	

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Risk	Cost and Schedule Risk	<p>Is the project realistic within established cost and schedule parameters?</p> <p>Is the project at risk of exceeding acceptable cost and schedule objectives?</p>	<p>- Schedule Impact Risk Trends</p> <p>- Cost Impact Risk Trends</p>		<p>- Schedule risk - Cost risk</p> <hr/> <p>1. Include updates as schedules and funding changes. 2. Develop a range of resource/Cost values with associated probabilities, not just one value. This facilitates improved awareness of potential resource/Cost exposure. 3. Cost impacts of risks that are realized could also be measured. 4. Could use the likelihood of exceeding specified percentage levels for cost and a specified number of months for schedule over the project baseline.</p>	