



National Defense Industrial Association



A Path Toward Consensus Measures for Iterative Software Development

Summary Progress and Status

Geoff Draper, Cheryl Jones

Sep 2019

Summary Progress and Status

DSB SW



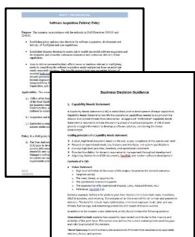
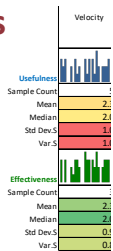
DIB SWAP



<https://innovation.defense.gov/software/>

Info Needs Measures Surveys

- PSM
- NDIA
- INCOSE
- SERC



Draft DoD SW policy

Key Initiatives

Collect industry feedback on agile/CID info needs and measures (DSB, DIB, ...)
(usefulness, effectiveness)

Kickoff at PSM User Conf (Sep '18).
Conducted surveys (~60; PSM, INCOSE, NDIA, SERC).
• Analysis results: brief at PSM 10/19, NDIA 10/19
(see summary excerpts in backup)

Provide industry recommendations to DoD for implementing DSB SW Task Report (and DIB SWAP)
(NDIA/INCOSE/PSM Continuous Iterative Development & Sustainment WG)

Delivered 2 briefings 4/15/19 to DoD A&S, R&E
(posted on [NDIA SE Div website](https://ndia.org/divisions/systems-engineering/studies-and-publications)):
• Detailed recommendations
• Executive summary
Briefed OUSD A&S and R&E 5/21/19.

DoD DIB SWAP study finalized and published 5/3/19.
OUSD A&S brief to Congress Jun '19.

<https://innovation.defense.gov/software/>
Likely mandated by GFY20 NDAA.

Develop consensus CID measurement framework (PSM)

Formed PSM/INCOSE/NDIA SME WG.
Draft ICM table & indicator specs late Jul for review.
Seeking additional reps for core team and reviewers.
POC: Cheryl Jones, Geoff Draper, Larri Rosser

Provide industry feedback to DoD on draft SW acquisition policy ("SW 5000.02")

Industry review in progress – seeking INCOSE input.
Comments due to DoD early August.
POC: G.Draper, C.Jones, G.Roedler, R.Yeman

Industry collaboration and outreach to further consensus on agile/CID development and measures.

- PSM CID WG. PSM User's Group (Sep '19).
- NDIA SE Conference (Oct '19)

<https://www.ndia.org/divisions/systems-engineering/studies-and-publications>

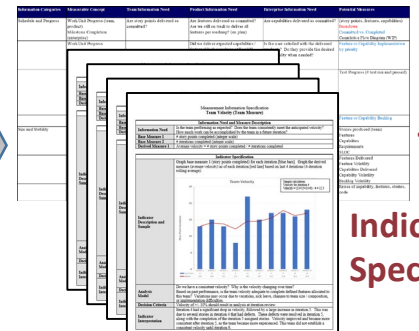
Studies and Publications

2019 Reports

- [Implementing Continuous Iterative Development and Acquisition](#)
Defense Science Board (DSB) released a report in Feb-2018 containing seven recommendations regarding software design and acquisition. Section 808 of NDAA 2019 mandates implementation of these recommendations within 18 months. The Defense Innovation Board (DIB) Software Acquisition and Practices (SWAP) study group has also provided many insightful and largely compatible recommendations.

NDIA, INCOSE and PSM support the DSB and DIB concepts and the opportunities they offer to DoD and the defense industry. In 2018 the NDIA Systems Engineering Division commissioned a working group to study the implementation of the DIB and SWAP recommendations. NDIA offers the working group's recommendations below to OUSD(A&S) and OUSD(R&E) representing a broad "industry perspective" on a path forward.

[Executive Summary Brief \(pdf\)](#)
[Executive Summary Brief \(ppt with links\)](#) view in presentation mode
[Full Study Brief](#)
[Transmittal Letter to Dr. Boleng, OUSD \(A&S\)](#)



ICM Table

Indicator Specs

This week's goals: validate current info needs and measures.
Workshop to refine ICM table and indicator specs.

Acceleration	Automated Test Coverage	Burndown (Sprint/Release)	Defect Containment
Defect Escapes	Defect Resolution	Cycle Time	Lead Time
Release Frequency	Velocity		

DSB #3b: Measures for CID

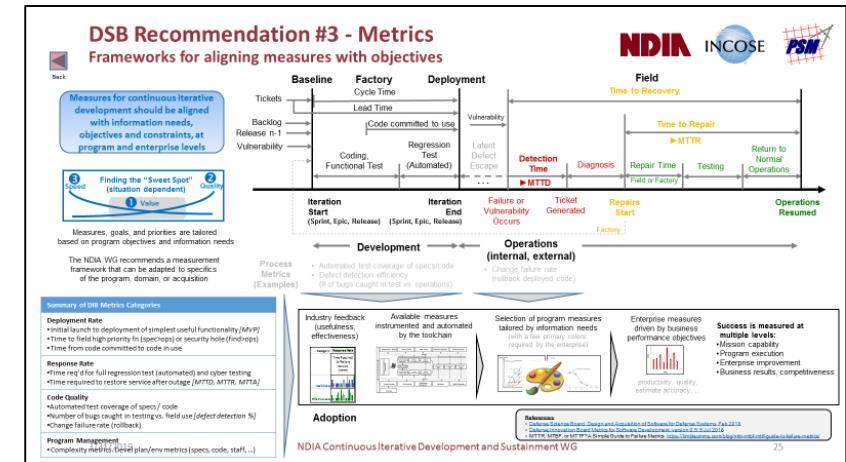
NDIA WG Recommendations

Picture of Success (end state)

Consensus frameworks	<ul style="list-style-type: none"> Objectives first - measures aligned and tailored from information needs, goals and constraints, at program and enterprise levels
Modernized measures	<ul style="list-style-type: none"> Migration toward consensus alternatives to traditional waterfall and phase-based SW measures (LOC, EVM, milestones, ...) Derived from SW factory processes, automated by toolchain Basis for measuring cost and schedule vs. plan
History-based estimates	<ul style="list-style-type: none"> Repositories collect performance-based measures (e.g., WBS, staff, cost, productivity) supporting future comparisons, basis of estimates, proposals, and program monitoring

Excerpt of measurement-related recommendations from NDIA WG for implementing DSB findings

CID: Continuous Iterative Development
 EVMS: Earned Value Management System
 LOC: Lines of Code
 WBS: Work Breakdown Structure



Measures for CID should be aligned with information needs and constraints, at program and enterprise levels

Recommendations for Path Forward:

Initiative	Action Plan
Software measurement framework for CID	<ul style="list-style-type: none"> Validate measurement framework (objectives, categories, measures) with Government and industry stakeholders (e.g., NDIA, INCOSE, PSM, SERC) Finalize initial consensus measures for software CID Pilot and validate measures/analysis on selected CID / DevSecOps programs. Develop contracting language requiring measurement set for future programs
WBS-based estimating of historical comparables for staff, cost, productivity	<ul style="list-style-type: none"> Recommend DoD expand WBS-based approach and historical DB measures to additional programs but at program level and <u>not specific to continuous software initiatives</u> (doubtful consistent data yet exists). Engage Government stakeholders on historical data estimating initiatives Partner with independent cost estimate (ICE) groups to migrate away from SLOC-based methods (CAPE, PARCA, ICE, ...); establish partnerships with industry for new methods (DSB #3)
Reach consensus on cost and schedule measures vs. plan for software CID	<ul style="list-style-type: none"> Consider alternatives to EVM for managing performance vs. plan. Review EVM agile studies, publications, and guidance. Hold workshops with Industry and Government to define framework and measures. Recommend consensus approach for DoD software acquisition

Click thumbnails to zoom

Candidate Measures

Deployment Rate

Response Rate

DSB
*Sprint burndown
*Epic and release burndown
*Velocity
*Cycle time (control chart)
Cumulative flow

Deployment Rate

Response Rate

Code Quality

DIB SWAP
*Time from launch to MVP (initial lead time)
*Time to field high priority functions (incremental lead time)
Time to fix new security hole (patch cycle time)
*Time from code commit to use (factory cycle time)
*Time for automated regression test
Time required to restore service (MTTR)
*Automated test coverage
*# of bugs caught in test vs. field (defect containment)
*Change failure rate (rollback)

Agile Process Metrics

Agile Quality Metrics

Agile Product Metrics

DevSecOps Metrics

Cost Metrics

Draft OUSD A&S SW Policy
Story points
*Velocity
Story completion rate
*Sprint burndown chart
Recidivism rate
*Defect count
Number of blockers
Delivered features
Delivered value points
Level of user satisfaction
Mean Time to Restore (MTTR)
*Deployment frequency
*Change fail rate – defect counts
*Total cost estimate
Burn rate

Deployment Rate

Response Rate

Code Quality

PSM **Draft**
Burndown (sprint/release)
Velocity
Acceleration
Cycle time
Lead time
Release frequency
Defect containment
Defect escapes
Defect resolution
Automated test coverage
Core PSM framework: <ul style="list-style-type: none"> Cost (est. vs. actual) Schedule (est. vs. actual) Staffing ...etc.

Industry Survey Feedback (usefulness, effectiveness)

Evaluation and Ranking of DSB Measures									
Category	1	2	3	4	5	6	7	8	9
Overall Rank	1	2	3	4	5	6	7	8	9
Velocity	1	2	3	4	5	6	7	8	9
Cycle Time (Control Chart)	1	2	3	4	5	6	7	8	9
Cumulative Flow	1	2	3	4	5	6	7	8	9
Time from Launch to MVP (Initial Lead Time)	1	2	3	4	5	6	7	8	9
Time to Field High Priority Functions (Incremental Lead Time)	1	2	3	4	5	6	7	8	9
Time to Fix New Security Hole (Patch Cycle Time)	1	2	3	4	5	6	7	8	9
Time from Code Commit to Use (Factory Cycle Time)	1	2	3	4	5	6	7	8	9
Time for Automated Regression Test	1	2	3	4	5	6	7	8	9
Time Required to Restore Service (MTTR)	1	2	3	4	5	6	7	8	9
Automated Test Coverage of Test Specs / Code	1	2	3	4	5	6	7	8	9
# of Bugs Caught in Test vs. Field (Defect Containment)	1	2	3	4	5	6	7	8	9
Change Failure Rate (Rollback)	1	2	3	4	5	6	7	8	9
Sample Count	1	2	3	4	5	6	7	8	9
Mean	1	2	3	4	5	6	7	8	9
Median	1	2	3	4	5	6	7	8	9
Std Dev	1	2	3	4	5	6	7	8	9
Var	1	2	3	4	5	6	7	8	9

* = addressed in draft PSM framework

See PSM framework for details.

- Information categories
- Measurable concepts
- Information needs
- Cross-reference mappings

Additional candidate measures are defined in draft ICM table but not implemented in first release.

DSB Recommendation #3 - Metrics

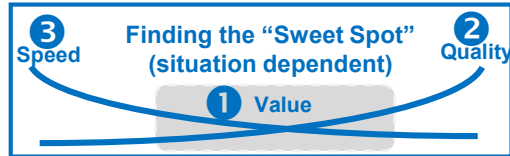
Frameworks for aligning measures with objectives

Adapted for PSM Workshop

*PSM Indicator Specs

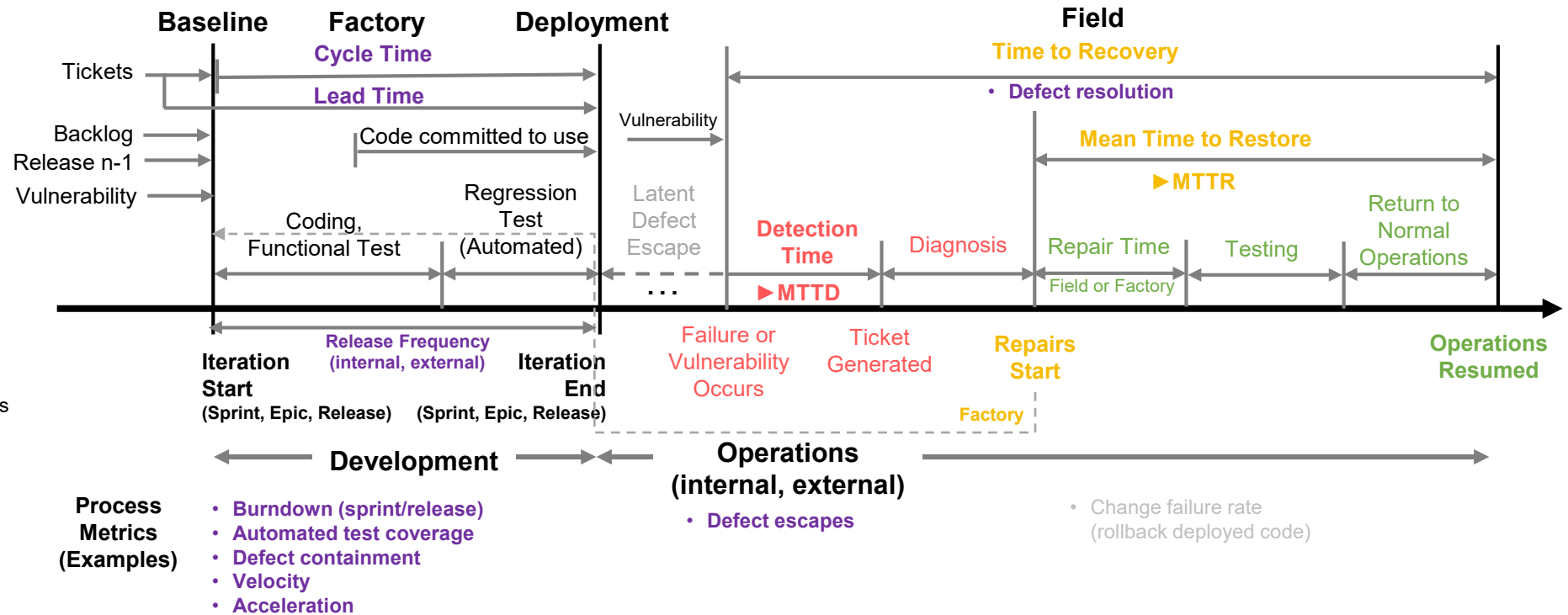


Measures for continuous iterative development should be aligned with information needs, objectives and constraints, at program and enterprise levels



Measures, goals, and priorities are tailored based on program objectives and information needs

The NDIA WG recommends a measurement framework that can be adapted to specifics of the program, domain, or acquisition



ICM Table (Draft) *Excerpts most relevant to PSM CID workshop – 1 of 3*

Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need	Potential Measures
Schedule and Progress	Work Unit Progress (team, product) Milestone Completion (enterprise)	Are story points delivered as committed?	Are features delivered as committed? Are we still on track to deliver all features per roadmap? (on plan)	Are capabilities delivered as committed?	(story points, features, capabilities) Burndown Committed vs. Completed Cumulative Flow Diagram (WIP)
	Work Unit Progress		Did we deliver expected capabilities / features? Is the roadmap still valid?	Is the user satisfied with the delivered products? Do they provide the desired functionality when needed?	Feature or Capability Implementation by priority
	Work Unit Progress		Is the integration and test progress proceeding as planned?		Test Progress (# test run and passed)
	Work Backlog		How much outstanding technical or mission debt exists?		Feature or Capability Backlog
Size and Stability	Functional Size and Stability Physical Size and Stability	How big is our system?	How big is our system?	How big is our system?	Stories produced (team) Features Capabilites Requirements SLOC
	Functional Size and Stability		How volatile are capabilities or features? Are we adding more features? What is the ability to accommodate changes in customer desirements?	How volatile are capabilities or requirements? What is the ability to accommodate changes in customer desirements?	Features Delivered Feature Volatility Capabilites Delivered Capability Volatility Backlog Volatility
	Functional Size and Stability	How much of the product is newly developed vs. reused from other sources?			Reuse of capability, features, stories, code

ICM Table (Draft) *Excerpts most relevant to PSM CID workshop – 2 of 3*

Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need	Potential Measures
Product Quality	Functional Correctness	Does new code functionality work as expected?	Does new code functionality work as expected?	Is rework identified and managed?	Stories Accepted (increment demo) Rework Stories Change Reports (defects) Written
	Functional Correctness	Does new code break previous functionality?	Does new code break previous functionality? (change failure rate, rollback)		Change reports (defects) written Rework hours Rework stories Change Failure Rate or Defect Density
	Functional Correctness		How many defects escape the increment?		Defects Found in Pipeline (saves)
	Functional Correctness		What is the quality of code deployed to the field?	What is the quality of code deployed to the field?	Defect Escapes to field Defect Escape Ratio
	Security - Safety		How secure is the product		Vulnerabilities by severity
	Supportability - Maintainability Dependability - Reliability		What is the reliability and availability of operational service capabilities?		Mean-Time-To: MTTD (Detect) MTTR (Repair or Restore) MTBF (Between Failure) MTTF (Failure) Ao (Operational Availability)

ICM Table (Draft) Excerpts most relevant to PSM CID workshop – 3 of 3

Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need	Potential Measures
Process Performance (Process Effectiveness)	Process Efficiency - Speed Security - Safety		How quickly can new security vulnerabilities be patched and deployed to fielded products?		Security vulnerability lead time Mean Time to Restore
	Process Efficiency - Speed Supportability - Maintainability Dependability - Reliability		How quickly can we address bug reports from the field?		Mean Time to Restore MTTD
	Process Efficiency - Speed	Is the team performing as expected?	Are teams performing as expected?		Velocity (average story points per increment) Capacity (staffhours per increment) Story points delivered vs. committed (on average) Cumulative flow diagrams
	Process Efficiency - Speed		How long does it take to deploy an identified feature/capability?		Lead time
	Process Efficiency - Speed		What is the frequency of product release or deployment?	What is the frequency of product release or deployment?	Release or deployment frequency
	Process Efficiency - Speed	How long does it take to release a viable product?	How long does it take to release a viable product?	How long does it take to release a viable product?	Release frequency Cycle time (increment, release, mean/median) Time to Minimum Viable Product (MVP)
	Process Efficiency - Speed		How much time does it take to conduct a full regression test? How much time for the automated regression test?		Test duration Automated test duration
	Process Effectiveness		How much of the testing is automated? How often do we perform automated testing?	How much of the testing is automated? How often do we perform automated testing?	Automated test coverage Automated test frequency
	Process Effectiveness	Is the backlog being managed appropriately?	Is the backlog being managed appropriately?		Cumulative flow diagram Backlog readiness
Customer Satisfaction	Customer Support		How long does it take to get a viable product released? (specific)	How long does it take to get a viable product released? (multiple systems) - time to market	Time to Minimum Viable Product (MVP)

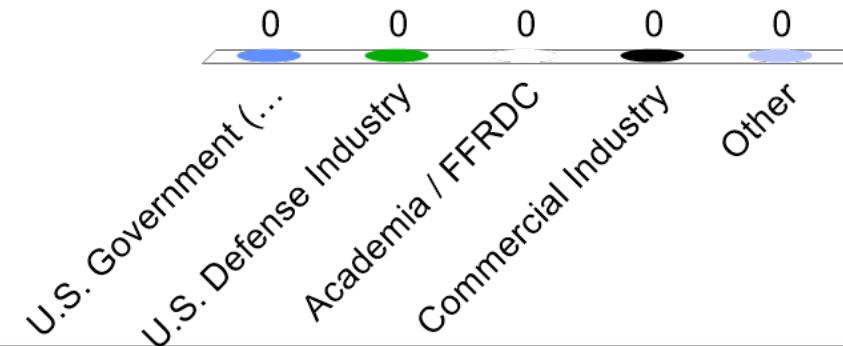
We would like your feedback on the draft framework for continuous iterative development

- ***Information needs*** – *interactive feedback in this session*
- ***Candidate measures*** – *deferred to breakout session*
- ***How should we measure size?***

How would you best characterize your organization?

Response
Counter

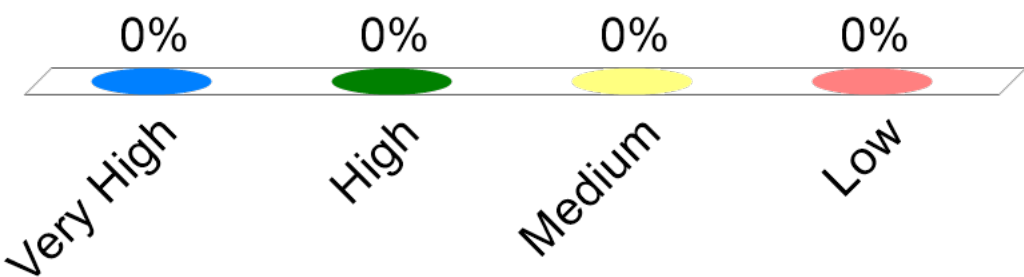
- 1. U.S. Government (DoD, agency)***
- 2. U.S. Defense Industry***
- 3. Academia / FFRDC***
- 4. Commercial Industry***
- 5. Other***



Are new story points, features, or capabilities being delivered as committed?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. **Very High**
- 2. **High**
- 3. **Medium**
- 4. **Low**



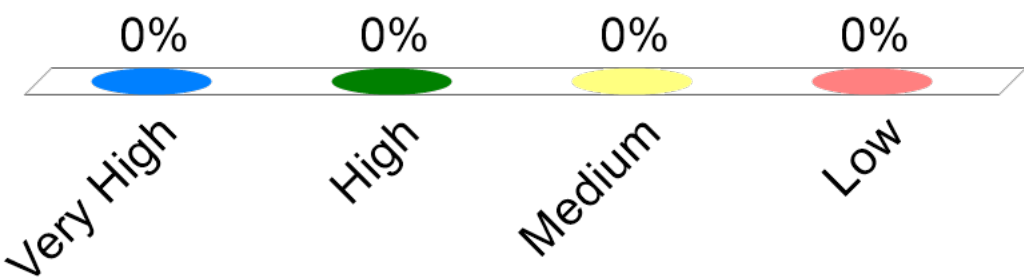
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Schedule and Progress	Work Unit Progress (team, product) Milestone Completion (enterprise)	Are story points delivered as committed?	Are features delivered as committed? Are we still on track to deliver all features per roadmap? (on plan)	Are capabilities delivered as committed?

Response Counter

Do delivered products provide the expected functionality to users when needed?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



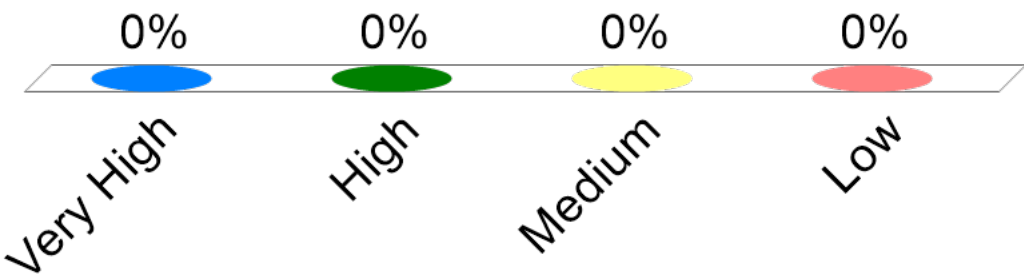
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Schedule and Progress	Work Unit Progress		Did we deliver expected capabilities / features? Is the roadmap still valid?	Is the user satisfied with the delivered products? Do they provide the desired functionality when needed?

Response Counter

How much technical or mission debt exists in the backlog?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



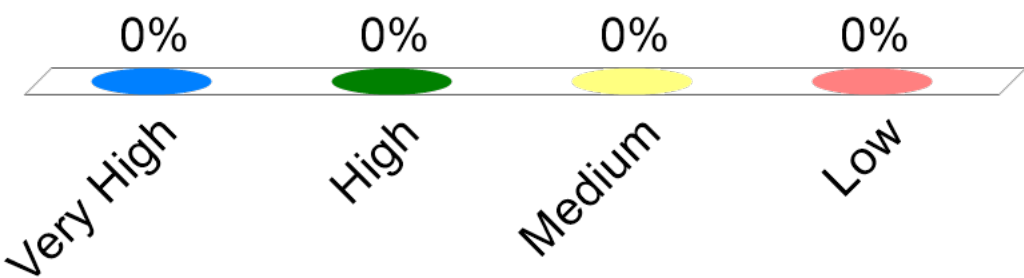
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Schedule and Progress	Work Backlog		How much outstanding technical or mission debt exists?	

Response Counter

Is the product correct? Does new code functionality work as expected?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



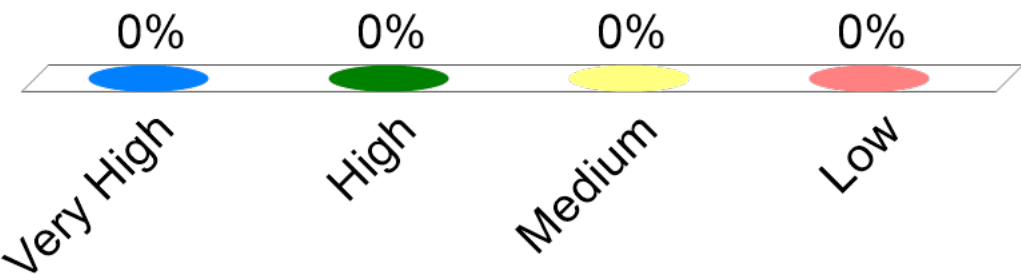
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Product Quality	Functional Correctness	Does new code functionality work as expected?	Does new code functionality work as expected?	Is rework identified and managed?

Response Counter

Does new code break previous functionality? (change failure rate, rollback)

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



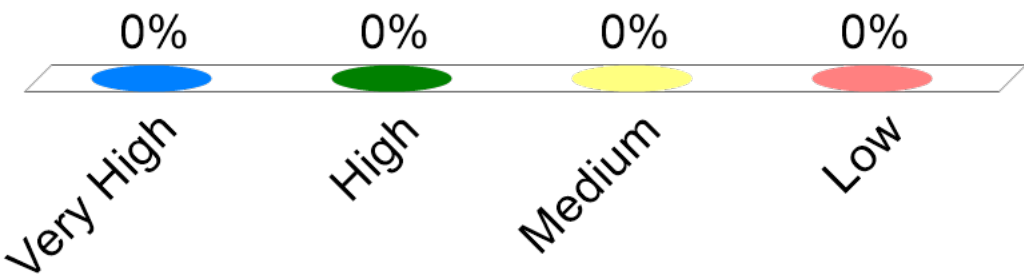
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Product Quality	Functional Correctness	Does new code break previous functionality?	Does new code break previous functionality? (change failure rate, rollback)	

Response Counter

How many defects escape the increment?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



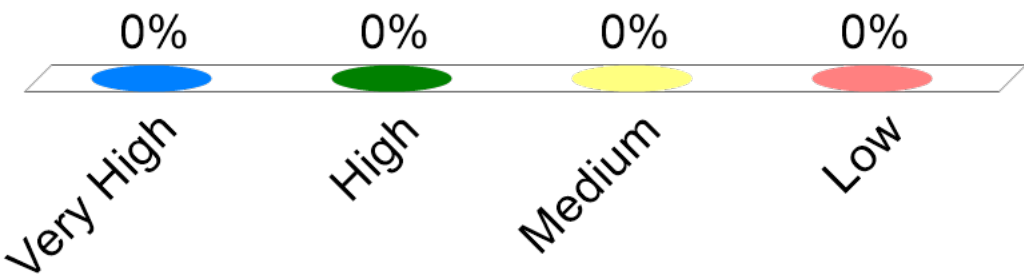
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Product Quality	Functional Correctness		How many defects escape the increment?	

Response Counter

What is the quality of code deployed to the field?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



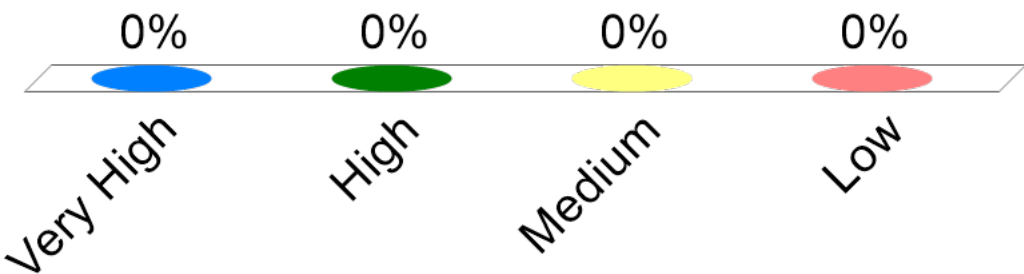
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Product Quality	Functional Correctness		What is the quality of code deployed to the field?	What is the quality of code deployed to the field?

Response Counter

What is the reliability and availability of operational service capabilities?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. **Very High**
- 2. **High**
- 3. **Medium**
- 4. **Low**



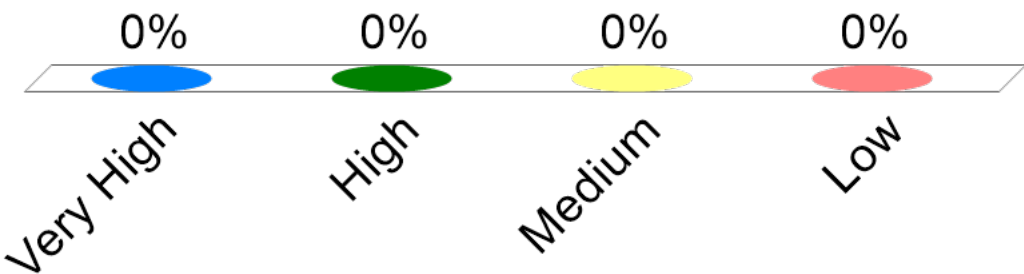
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Product Quality	Supportability - Maintainability Dependability - Reliability		What is the reliability and availability of operational service capabilities?	

Response Counter

How quickly can we address bug reports from the field?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



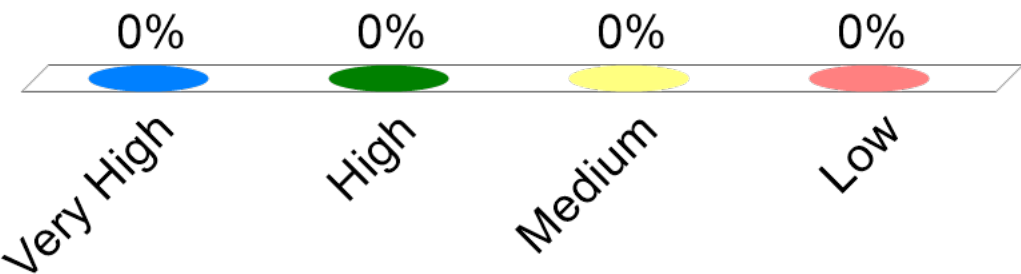
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Process Performance (Process Effectiveness)	Process Efficiency - Speed Supportability - Maintainability Dependability - Reliability		How quickly can we address bug reports from the field?	

Response Counter

Are teams performing as productively as expected?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. **Very High**
- 2. **High**
- 3. **Medium**
- 4. **Low**



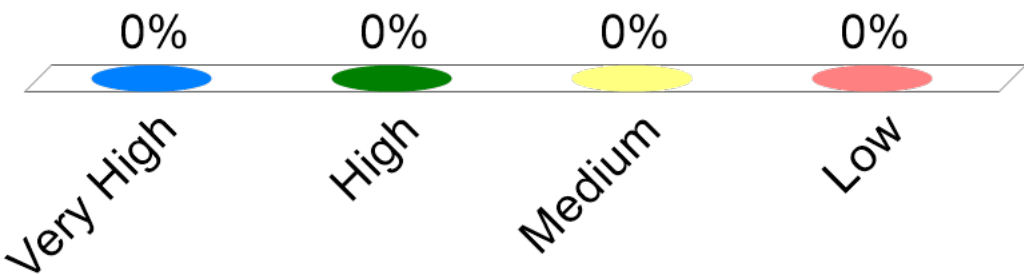
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Process Performance (Process Effectiveness)	Process Efficiency - Speed	Is the team performing as expected?	Are teams performing as expected?	

Response Counter

How long does it take to deploy an identified feature/capability?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



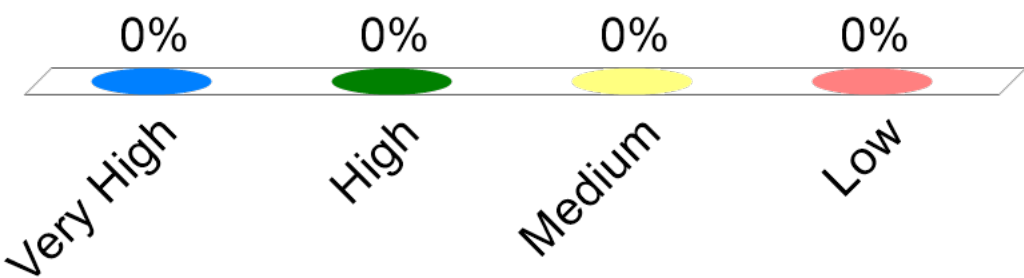
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Process Performance (Process Effectiveness)	Process Efficiency - Speed		How long does it take to deploy an identified feature/capability?	

Response Counter

What is the frequency of product release or deployment?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



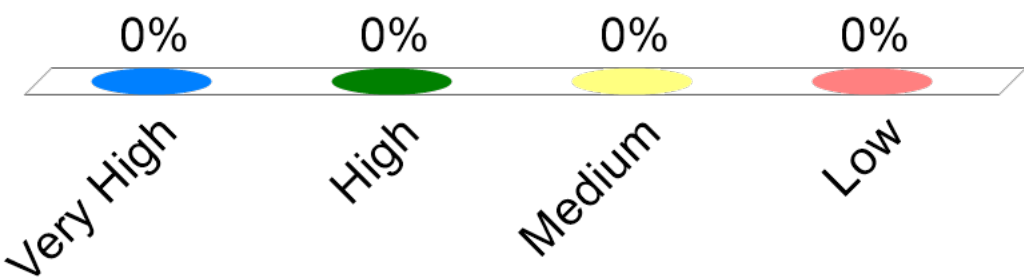
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Process Performance (Process Effectiveness)	Process Efficiency - Speed		What is the frequency of product release or deployment?	What is the frequency of product release or deployment?

Response Counter

How long does it take to release a viable product?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



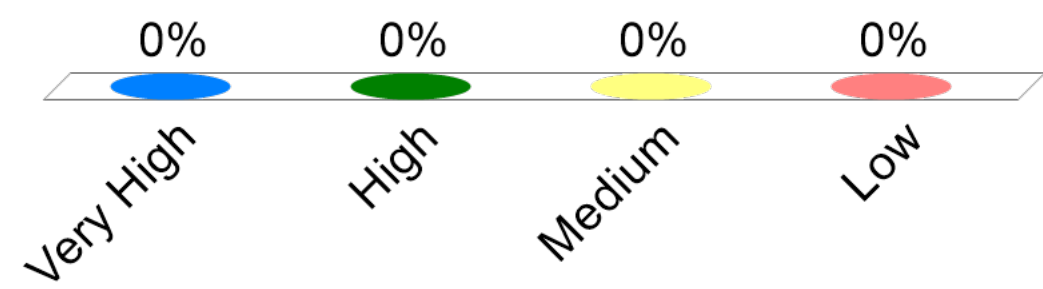
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Process Performance (Process Effectiveness)	Process Efficiency - Speed	How long does it take to release a viable product?	How long does it take to release a viable product?	How long does it take to release a viable product?

Response Counter

How much of the testing is automated? How often do we perform automated testing?

What importance would you place on this measurement information need for planning and managing continuous iterative SW development?

- 1. Very High**
- 2. High**
- 3. Medium**
- 4. Low**



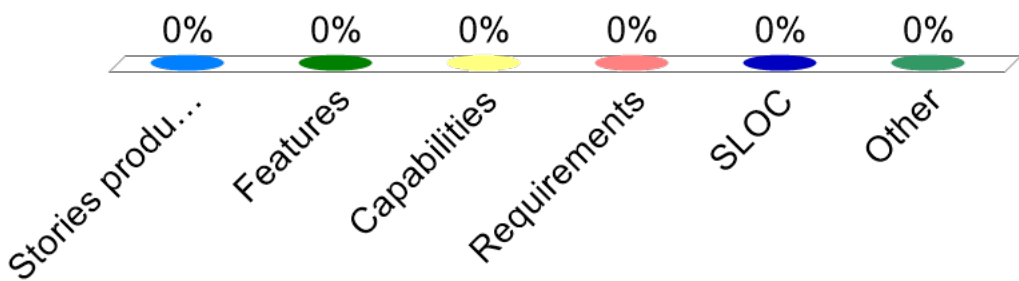
Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need
Process Performance (Process Effectiveness)	Process Effectiveness		How much of the testing is automated? How often do we perform automated testing?	How much of the testing is automated? How often do we perform automated testing?

Response Counter

How big is our system?

How should we count size for continuous iterative development programs (e.g., for estimating)?
(pick up to 2 choices)

- 1. **Stories produced (team)**
- 2. **Features**
- 3. **Capabilities**
- 4. **Requirements**
- 5. **SLOC**
- 6. **Other**



Information Categories	Measurable Concept	Team Information Need	Product Information Need	Enterprise Information Need	Potential Measures
Size and Stability	Functional Size and Stability Physical Size and Stability	How big is our system?	How big is our system?	How big is our system?	Stories produced (team) Features Capabilites Requirements SLOC

Response Counter

Thank you!

- ***Potential measures will be evaluated at the breakout workshop***
- ***We are seeking volunteers to help refine and publish the PSM framework for continuous iterative development***

Thank you also to those that participated in the prior survey (PSM, NDIA, INCOSE, SERC) of candidate information needs and measures

- ***They helped to inform our progress for the current work***
- ***Summary analysis provided in backup charts (briefing and workshop)***

BACKUP

Measurement Survey Results

Sep 2018 – Feb 2019

(PSM, NDIA, INCOSE, SERC)

Measurement Survey Integration and Analysis (PSM, SERC, INCOSE, NDIA)

	Measurement Information Needs for Continuous Iterative SW Development																				
	Interactive Survey of SMEs (Nov 2018 - Feb 2019)																				
	Categories Derived from DIB Recommended Measures																				
	(Importance: 1. VH; 2. H; 3. M; 4: L)																				
	Deployment Rate					Response Rate				Code Quality				Program Management, Assessment, and Estimation							
Category:																					
Least Favorable (N):																					
Most Favorable (1):																					
Category Rank	3	2	1	4	5	1	2	4	3	4	1	2	3	4	8	7	1	6	5	2	3
Overall Rank	15	5	2	15	17	8	9	14	10	11	1	3	4	13	21	20	6	19	18	7	12
	Delivery Speed	Update Speed	Patch Speed	Lead Time	Cycle Time	Regression Test	Cyber Test	MTBF, MTTR, Ao	Fix Bugs	Test Efficiency	Baseline Quality	Deploy Quality	Service Delivery	Code Platform / Maint	New vs Reuse	Release Capab	SW Plan Resources	Reqts Stable	Breach Threshold	I&T on Plan	Capability on Plan
Sample Count	58	60	59	60	42	59	58	61	42	61	61	59	63	58	61	61	61	60	41	42	42
Mean	1.91	1.58	1.37	2.25	2.02	1.86	1.91	1.75	1.83	1.95	1.28	1.47	1.79	1.90	2.79	2.18	1.77	2.38	2.27	1.79	1.90
Median	2.00	2.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00
Std Dev.S	0.76	0.65	0.67	0.84	0.92	0.75	0.76	0.85	0.76	0.83	0.61	0.68	0.86	0.79	0.99	0.96	0.72	0.78	0.81	0.81	0.66
Var.S	0.57	0.42	0.44	0.70	0.85	0.57	0.57	0.72	0.58	0.68	0.37	0.46	0.75	0.62	0.97	0.92	0.51	0.61	0.65	0.66	0.43
Very high																					
High																					
Medium																					
Low																					
Total	58	60	59	60	42	59	58	61	42	61	61	59	63	58	61	61	61	60	41	42	42
Weighted Score	1.91	1.58	1.37	2.25	2.02	1.86	1.91	1.75	1.83	1.95	1.28	1.47	1.79	1.90	2.79	2.18	1.77	2.38	2.27	1.79	1.90
4. How would you characterize your relative knowledge and experience with using measures for iterative SW development?	5. How quickly can we deliver initial capability for new products?	6. How quickly can we add and deliver high priority capabilities for an existing operational product?	7. How quickly can new security vulnerabilities be patched and deployed to fielded products?	8. What is the “lead time” duration from code committed to a repository to availability of tested functionality?	9. What is the cycle time to deliver a product?	10. How quickly can a full automated regression test be conducted to verify capability correctness?	cybersecurity test be successfully completed to ensure adequate resistance to vulnerabilities?	12. What is the reliability and availability of operational service capabilities?	13. How quickly can we address bug reports from the field?	coverage) appropriate relative to project plans? How long does it take to conduct testing within planned constraints?	15. Does new code functionality work as expected and not break previous functionality?	16. What is the quality of code deployed to the field?	17. Are product baseline updates reliable in the field such that operational service is not impacted?	18. Is the code and development platform well structured and maintainable?	19. How much of the code base is newly developed vs. reused from other sources?	20. How much capability has been delivered for each release?	21. Are sufficient resources available to execute the SW development plan? (staff, skills, tools, suppliers)	22. How stable are the mission capability requirements?	SW measures that indicate serious breach relative to baseline plans such that re-evaluation is needed?	24. Is the integration and test progress proceeding as planned?	25. Are the capabilities and features being implemented and completed as planned?
Expertise	Delivery Speed	Update Speed	Patch Speed	Lead Time	Cycle Time	Regression Test	Cyber Test	MTBF, MTTR, Ao	Fix Bugs	Test Efficiency	Baseline Quality	Deploy Quality	Service Delivery	Code Platform / Maint	New vs Reuse	Release Capab	SW Plan Resources	Reqs Stable	Breach Threshold	I&T on Plan	Capability on Plan

Measurement Survey Integration and Analysis

Evaluation of DSB and DIB Measures – Usefulness and Effectiveness: VH=1; H=2; M=3; L=4








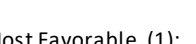







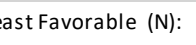


DSB Measures										DIB Measures																		
Evaluation and Ranking of DSB Measures										Evaluation and Ranking of DIB Measures																		
Interactive Survey of SMEs at SERC Workshop, Nov 2019 (Usefulness: 1-4; Effectiveness in Use: 1-4)										Interactive Survey of SMEs at SERC Workshop, Nov 2019 (Usefulness: 1-4; Effectiveness in Use: 1-4)																		
Deployment Rate				Response Rate						Deployment Rate								Response Rate				Code Quality Metrics						Category:
Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Useful	Effective	Value
																											(N) Least Favorable	
2		3		3		4		5		5		4		1		6		2		1		2		1		3		(1) Most Favorable
5	4	7	7	8	6	14	9	11	14	9	13	6	11	1	5	13	10	10	8	2	3	4	1	3	2	12	12	Category Rank
Sprint Burndown		Epic and Release Burndown		Velocity		Cycle Time (Control Chart)		Cumulative Flow		Time from Launch to MVP (initial lead time)		Time to Field High Priority Functions (incr lead time)		Time to Fix New Security Hole (patch cycle time)		Time from Code Commit to Use (factory cycle time)		Time for Automated Regression Test (reg test cycle time)		Time Required to Restore Service (MTTR)		Automated Test Coverage of Test Specs / Code		# of Bugs Caught in Test vs. Field (defect containment)		Change Failure Rate (rollback)		Overall Rank
54	31	53	34	53	33	54	33	53	34	52	31	54	35	56	31	53	30	53	31	53	33	55	33	55	30	53	30	Sample Count
2.21	2.35	2.09	2.56	2.30	2.39	2.41	2.82	2.55	2.94	2.30	2.90	2.11	2.89	1.72	2.61	2.73	2.83	2.48	2.87	1.70	2.45	1.83	2.24	1.80	2.20	2.55	2.93	Mean
2.00	2.00	2.00	3.00	2.00	2.00	3.00	3.00	3.00	3.00	2.00	3.00	2.00	3.00	1.00	2.00	3.00	3.00	3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	3.00	Median
0.84	0.80	0.68	0.82	1.05	0.90	0.99	0.92	0.87	0.98	0.77	0.98	0.87	0.83	0.88	1.05	0.80	0.91	0.76	0.88	0.74	1.18	0.57	0.97	0.87	1.00	0.87	1.05	Std Dev.S
0.71	0.64	0.46	0.68	1.09	0.81	0.98	0.84	0.76	0.97	0.59	0.96	0.75	0.69	0.78	1.11	0.64	0.83	0.57	0.78	0.55	1.38	0.32	0.94	0.75	0.99	0.76	1.10	Var.S
54	31	53	34	53	33	54	33	53	34	52	31	54	35	56	31	53	30	53	31	53	33	55	33	55	30	53	30	
2.41	2.35	2.13	2.56	2.40	2.39	2.59	2.82	2.75	2.94	2.31	2.90	2.15	2.89	1.80	2.61	2.79	2.83	2.53	2.87	1.83	2.45	2.15	2.24	1.75	2.20	2.51	2.93	
26. Is Sprint Burn a useful and effective measure?		27. Is Epic and Release Burndown a useful and effective measure?		28. Is Velocity a useful and effective measure?		29. Is Cycle Time (Control Chart) a useful and effective measure?		30. Is Cumulative Flow a useful and effective measure?		31. Is 'Time from program launch to deployment of simplest useful functionality' a useful and effective measure?		32. Is 'Time to field high priority functions (spec > ops)' a useful and effective measure?		33. Is 'Time to fix newly found security hole (find > ops)' a useful and effective measure?		34. Is 'Time from code committed to code in use' a useful and effective measure?		35. Is 'Time required for full regression test (automated)' a useful and effective measure?		36. Is 'Time required to restore service after outage' a useful and effective measure?		37. Is 'Automated test coverage of test specs / code' a useful and effective measure?		38. Is 'Number of bugs caught in testing vs. field use' a useful and effective measure?		39. Is 'Change failure rate (rollback deployed code)' a useful and effective measure?		

Measurement Survey Integration and Analysis

Evaluation of DSB and DIB Measures – Usefulness and Effectiveness: VH=1; H=2; M=3; L=4

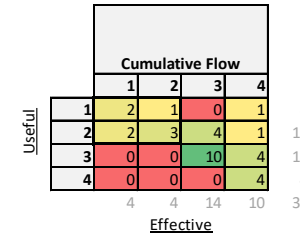
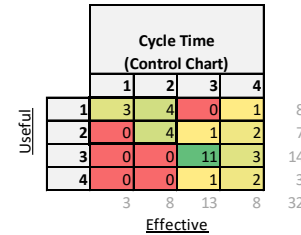
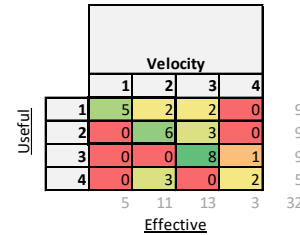
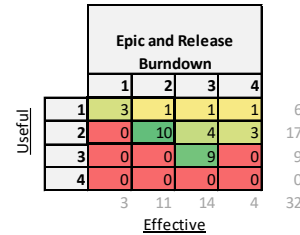
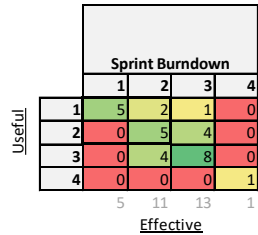


	Evaluation and Ranking of DSB Measures			Evaluation and Ranking of DIB Measures										
Category:	Response Rate			Deployment Rate				Response Rate		Code Quality Metrics				
Category Rank	3	4	5	5	4	1	6	2	1	2	1	3		
Overall Rank	8	14	11	9	6	1	13	10	2	4	3	12		
Usefulness	Velocity	Cycle Time (Control Chart)	Cumulative Flow	Time from Launch to MVP (initial lead time)	Time to Field High Priority Functions (incr lead time)	Time to Fix New Security Hole (patch cycle time)	Time from Code Commit to Use (factory cycle time)	Time for Automate Regression Test (reg test cycle time)	Time Required to Restore Service (MTTR)	Automated Test Coverage of Test Specs / Code	# of Bugs Caught in Test vs. Field (defect containment)	Change Failure Rate (rollback)		
													Least Favorable (N):	
													Most Favorable (1):	
	Sample Count	53	54	53	52	54	56	53	53	53	55	55	53	
	Mean	2.30	2.41	2.55	2.30	2.11	1.72	2.73	2.48	1.70	1.83	1.80	2.55	
	Median	2.00	3.00	3.00	2.00	2.00	1.00	3.00	3.00	2.00	2.00	2.00	3.00	
	Std Dev.S	1.05	0.99	0.87	0.77	0.87	0.88	0.80	0.76	0.74	0.57	0.87	0.87	
Var.S	1.09	0.98	0.76	0.59	0.75	0.78	0.64	0.57	0.55	0.32	0.75	0.76		
Effectiveness													Least Favorable (N):	
													Most Favorable (1):	
	Sample Count	33	33	34	31	35	31	30	31	33	33	30	30	
	Mean	2.39	2.82	2.94	2.90	2.89	2.61	2.83	2.87	2.45	2.24	2.20	2.93	
	Median	2.00	3.00	3.00	3.00	3.00	2.00	3.00	3.00	2.00	2.00	2.00	3.00	
	Std Dev.S	0.90	0.92	0.98	0.98	0.83	1.05	0.91	0.88	1.18	0.97	1.00	1.05	
	Var.S	0.81	0.84	0.97	0.96	0.69	1.11	0.83	0.78	1.38	0.94	0.99	1.10	

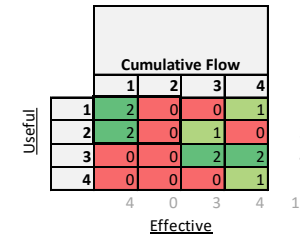
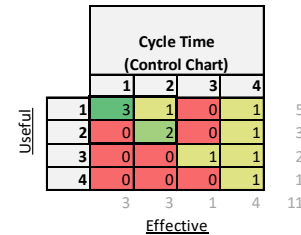
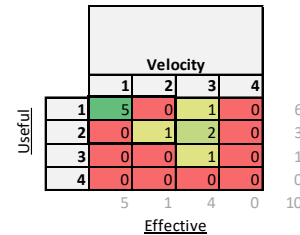
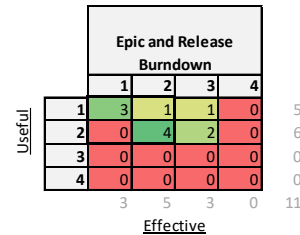
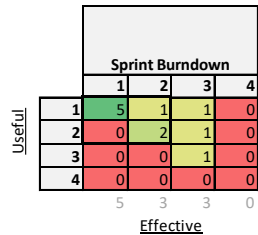
Metric Summary: Usefulness vs. Effectiveness (1-4)

DSB

All

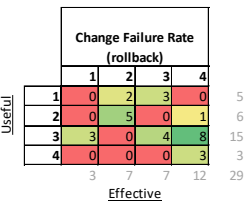
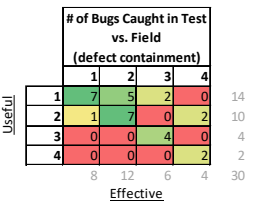
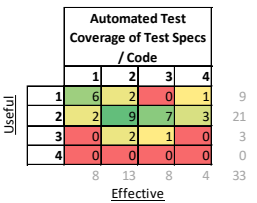
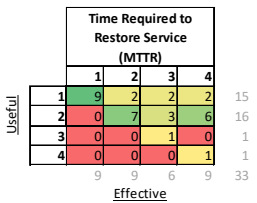
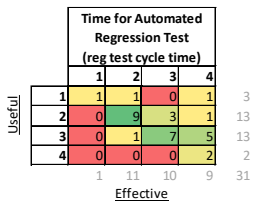
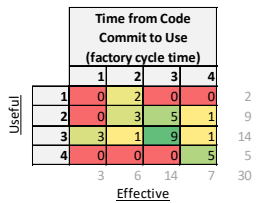
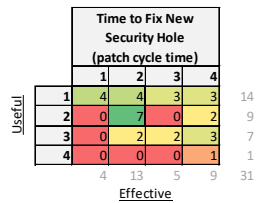
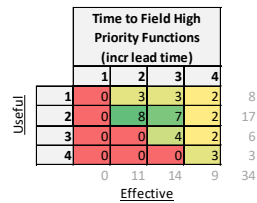
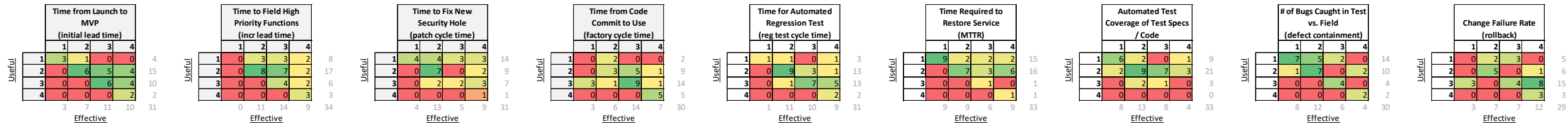


Industry



DIB

All



Industry

