Information Category-Measureable Concept-Prospective Measures						
	Information Categories	Measurable Concepts	Questions Addressed	Measures		Notes
				Prospective Indicators	Sample Base Measures	
Project	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	- Completion should be based on achieving specific quantifiable milestone completion criteria. - Milestones may include inch stones, or major critical milestones. - Might also look at critical path performance (slack time).
		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	- 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	- Other work unit progress measures may be defined based on the work in progress. - Other schedule performance indicators are included with financial performance indicators (e.g. earned value measures).
		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	- Measure/categorize by priority level and age. - Work units may be: -- actions, assignments -- service requests -- story points or features -- maintenance actions -- open defects or open stakeholder problem reports
		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)	
	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	For deployed systems, costs include those to operate, maintain (resolve problems), and enhance system.
		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	- Can also focus on key staff. - Effort distribution and trends by activity provides a more detailed profile. - Look at these measures for the current state and future projection. - Skills includes expertise, experience, training, education, and domain knowledge.
		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	
	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)	- Risk Treatment is also referred to as Risk Handling. - Technical impacts of risks that are realized could also be quantified (e.g. performance impacts). - Opportunities can also be identified and tracked, as well as enablers for those opportunities to occur.
		Cost and Schedule Risk	Is the project realistic within established cost and schedule parameters? Is the project at risk of exceeding acceptable cost and schedule objectives?	- Schedule Impact Risk Trends - Cost Impact Risk Trends	- Schedule risk - Cost risk	- Include updates as schedules and funding changes. - Develop a range of resource/Cost values with associated probabilities, not just one value. This facilitates improved awareness of potential resource/Cost exposure. - Cost impacts of risks that are realized could also be measured. - Could use the likelihood of exceeding specified percentage levels for cost and a specified number of months for schedule over the project baseline.

Information Categories	Measurable Concepts	Questions Addressed	Measures		Notes
			Prospective Indicators	Sample Base Measures	
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	- Consider both internal and external interfaces. - System elements can include software or hardware elements.
	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	- Number added, modified, deleted	- This can be applied at any part or level of the system definition. - Functional architecture changes can be at the level of architecture description, model, or elements. - Call center requests can be categorized as problems or enhancements.
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	Technical measurement includes Measures of Effectiveness, Measures of Performance, and Technical Performance Measures.
	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	Support includes maintenance, training, provision of supplies, etc.
	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)	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.
	Portability	To what extent can the functionality be re-hosted on different platforms?	- Interface Compliance	- Interfaces verified	Use of portability can also include reusability and adaptability.
	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	
	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	Instead of availability, might measure downtime (outages).
	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 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 - Effort expended - Elapsed calendar and time expended	For agile developments, team velocity is a measure of productivity.
	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	- Defects per system element is particularly important for key elements of the architecture, or if safety/security related. - For services, schedule and effort expended might include those related to service calls. - Rework in production might measure waste of production units - Could also measure benefits of processes (e.g. cost prevention) - 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 Maturity	Is the technology ready to be used in this project?	- Technology Maturity Trends	- Technology readiness level (TRL)	Might also consider technology obsolescence - is the technology about to become obsolete?
	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	Contractor Performance Assessment or other survey
	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	

	Information Categories	Measurable Concepts	Questions Addressed	Measures		Notes
				Prospective Indicators	Sample Base Measures	
Enterprise	Schedule & Progress	Milestone Completion	Are the projects or services within this enterprise on track? Which ones need management attention (which ones are most behind)?	- Enterprise Milestone Status	- Number of milestones started and completed versus plan (percent complete versus plan)	- Milestones mean major milestones or sum of set of milestones. - For the enterprise, want some early indication of whether major milestones will be met, for each project in the enterprise (or those strategically important or those most at risk).
		Work Backlog	What is the enterprise work backlog? What should be scheduled next?	- Work Unit Backlog Trends - Burndown Rates	- Work units in backlog by priority level for major item - Work units in backlog resolved	Work units may be: - open stakeholder requests - defects - enhancements, needs - tasks - new contracts, RFPs - deliveries
	Resources & Cost	Financial Performance	Is the enterprise receiving and spending money as planned? Does the enterprise financial process support the needs of the projects? Is the enterprise meeting its goals and objectives?	- Funding Availability - Disbursement / Obligation Rate Trends - Earnings Progress - Return on Investment Capital	- Budget, planned, and actual funds available - Disbursements, obligations - Sales, costs, incentive/award fees, taxes - Contribution to overhead - Invested capital, additional revenue	Is funding available as needed? Consider: - spread of money across the year for multiple projects - color of money and plus-ups for government projects - funding blocks, pull-backs - studies, management reserve, as well as development and maintenance projects
		Personnel Effort	Within the enterprise, are there sufficient qualified people to satisfy commitments?	- Staff Level Sufficiency - Effort Distribution and Trends - Workforce Skills Profiles - Workforce Age Profiles - Staff Turnover Rates	- Number of staff within enterprise - Number of staff by skill level and project, needed and assigned to project - Number of staff by age - Staff added, removed, quit	- Both a project and enterprise issue. - Skills includes expertise, experience, training, education, and domain knowledge.
		Facilities+C31 and Support Resources	Are needed facilities, equipment, tools, and materials available, across the enterprise? Where should future investments occur?	- Resource availability - Resource utilization	- Quantity needed, available - Time required, available, used	For the aggregate set across all projects.
	Risk	Technical Risk	Is the technical risk exposure for the enterprise at an acceptable level? Do we have a balanced risk/reward portfolio?	- Portfolio Risk Status - Risk Tolerance	- Number risks by status and severity	Should also consider enterprise risks, in addition to assessing aggregate risks across projects.
		Cost and Schedule Risk	Is the enterprise at risk of exceeding acceptable cost and schedule objectives?	- Schedule Impact Risk Profile - Cost Impact Risk Profile	- Schedule Risk - Cost Risk	
	Size & Stability	Physical Size and Stability Functional Size and Stability	How many (unique) platforms, systems, or applications are in development, maintenance, operations? Are they compatible, where needed?	- Platform/System Trends - External and Cross-Platform Interface Complexity and Compatibility	- Number of unique platforms, systems, or applications - Interface number (unique), complexity, growth, changes	
	Product Quality	Functional Correctness Dependability-Reliability	Is the set of projects delivering quality products that meet user expectations? Are known problems being resolved?	- Stakeholder Defects Distribution - Stakeholder Requirements Validation Profile - Warranty Trends	- Defects by status, severity, priority, distribution, etc. - Number of stakeholder requirements Validated Successfully - Warranty claims	Stakeholder defects are those identified after fielding.
	Process Performance	Process Compliance	Are enterprise processes being applied across the enterprise?	- Reference Maturity/Capability Profile - Process Audit Findings Distribution - Exception Distributions	- Maturity/Capability Rating Goal, Assessed - Number of audit findings by process area - Number of exceptions by process element	Exceptions include waivers and amount of tailoring.
		Process Efficiency	What are enterprise norms for completing life-cycle activities (schedule, cost, performance)? Do the majority of projects meet the norms?	- Productivity Baselines and Trends - Cycle Time Baselines and Trends	- Work unit size - Effort expended - Elapsed calendar and time expended	
		Process Effectiveness	Are the enterprise processes sufficient to accomplish enterprise objectives? How much rework is occurring?	- Rework Effort Distribution - Rework System Elements Distribution	- Schedule and effort expended - total and Rework	Rework in production might measure waste of production units
	Technology Effectiveness	Technology Maturity	Does the enterprise have sufficient technology management plans and implementations? Is technology investment in place to ensure adequate leverage of technology into projects?	- Technology investment versus plan - Needs Met by Technology Insertion - Technology Refresh Rate	- Investment amount - Number of needs met by inserted technology - Technologies replaced	
	Customer Satisfaction	Customer Feedback	How do our customers perceive the enterprise's set of products (product lines)? Are they meeting user expectations?	- Satisfaction Ratings Trends - Market Share - Value for Money (government)	- Satisfaction ratings - Enterprise sales, total market sales, new contracts awarded - Assessed value	- Generally measured through a survey. - Government is focused on mission accomplishment (versus market share or investment)