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Analyzing Projects Through the Implementation of a Metrics Repository: An Approach for Deployment of CMMi Level 2 Measurement and Analysis Process Area

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Purpose

This presentation show the experience of EDS – Rio de Janeiro, during its journey toward CMMI Level 5, in the implementation of a framework to support the collection and analysis of measures.

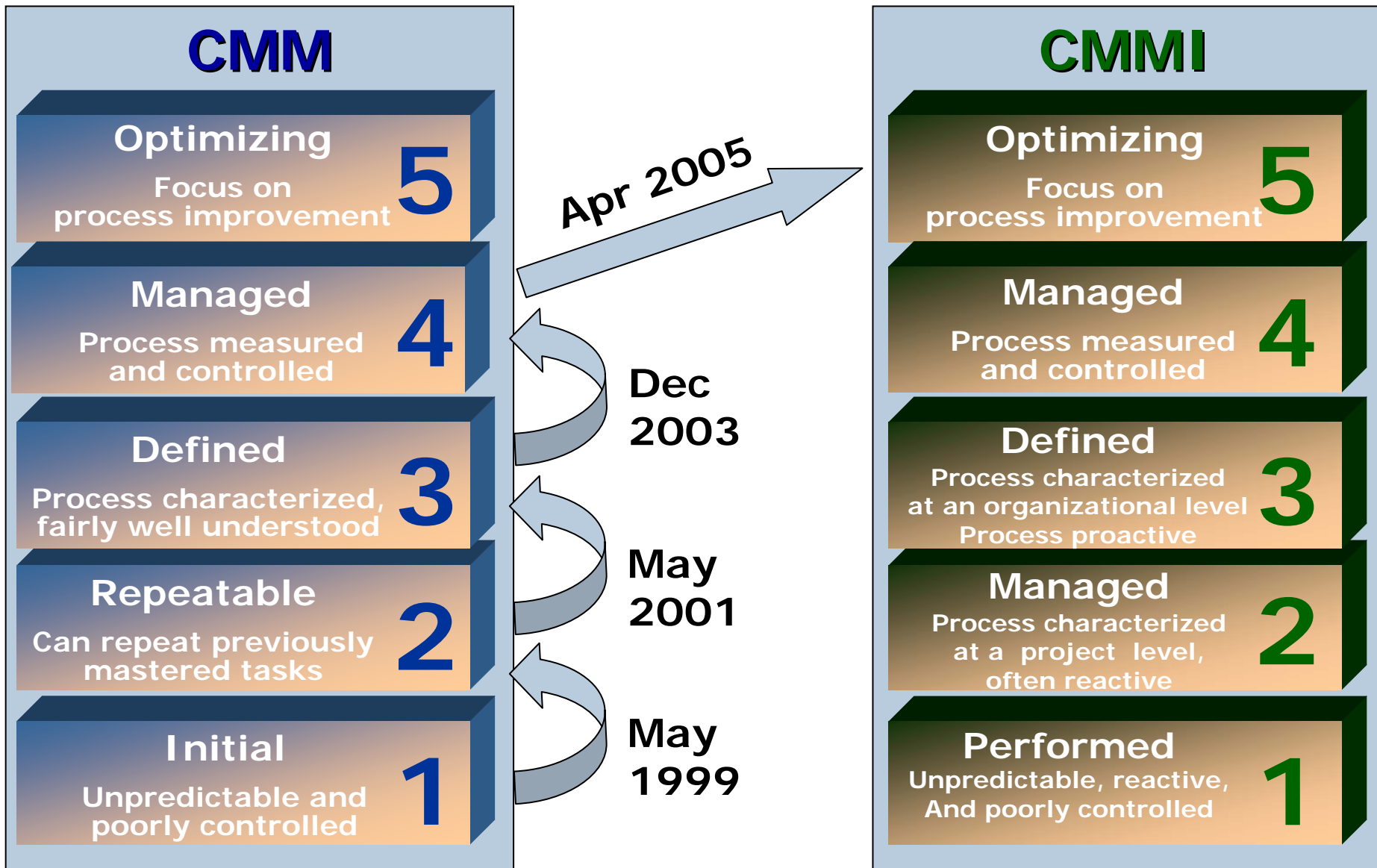
The framework is based on the definition of a metrics repository and performance indicators applicable to maintenance and development projects aligned to the organizational objectives.

Agenda



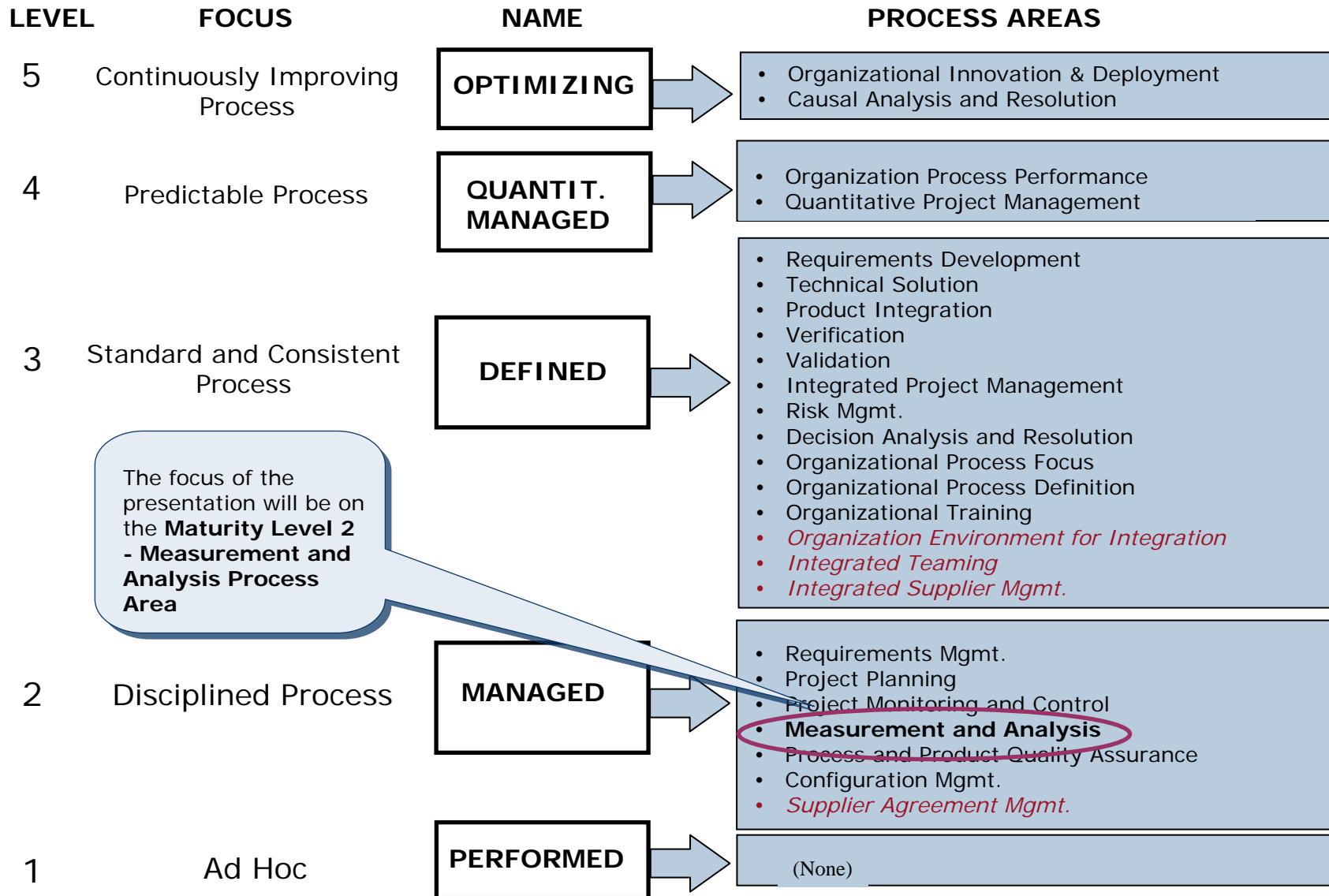
- EDS Organizational Model for AD&M
- The Process Improvement Journey for Rio de Janeiro
- Introduction to CMMI staged model
- Concepts of Measurement and Analysis Process Area
- Implementation Approach for Measurement and Analysis
- Association of measures with organizational objectives
- Repository to support metrics collection
- Metrics consolidation process
- Method to support metrics analysis
- Some Performance indicators selected analysis
- Benefits of the implementation

The Process Improvement Journey for Rio de Janeiro





Introduction to CMMI staged model

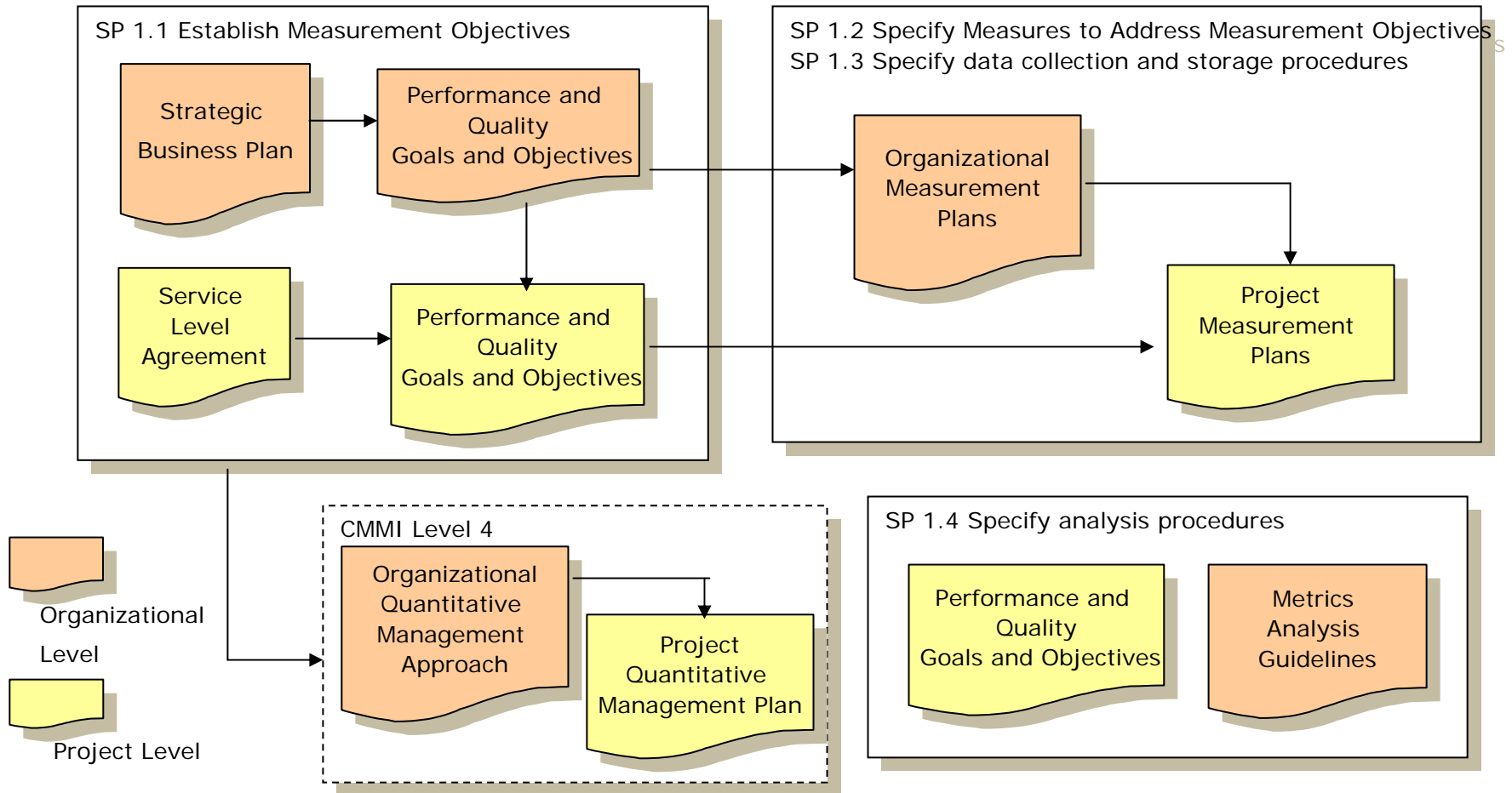


Concepts of Measurement and Analysis Process Area

- The purpose of Measurement and Analysis is to develop and sustain a measurement capability that is used to support management information needs, involving the following:
 - Specifying the objective of measurement and analysis such that they are aligned with identified information needs and objectives
 - Specifying the measures, data collection and storage mechanisms, analysis techniques, reporting and feedback mechanisms
 - Implementing the collection, storage, analysis and reporting of the data
 - Providing objective results that can be used in making informed decisions and taking appropriate corrective actions

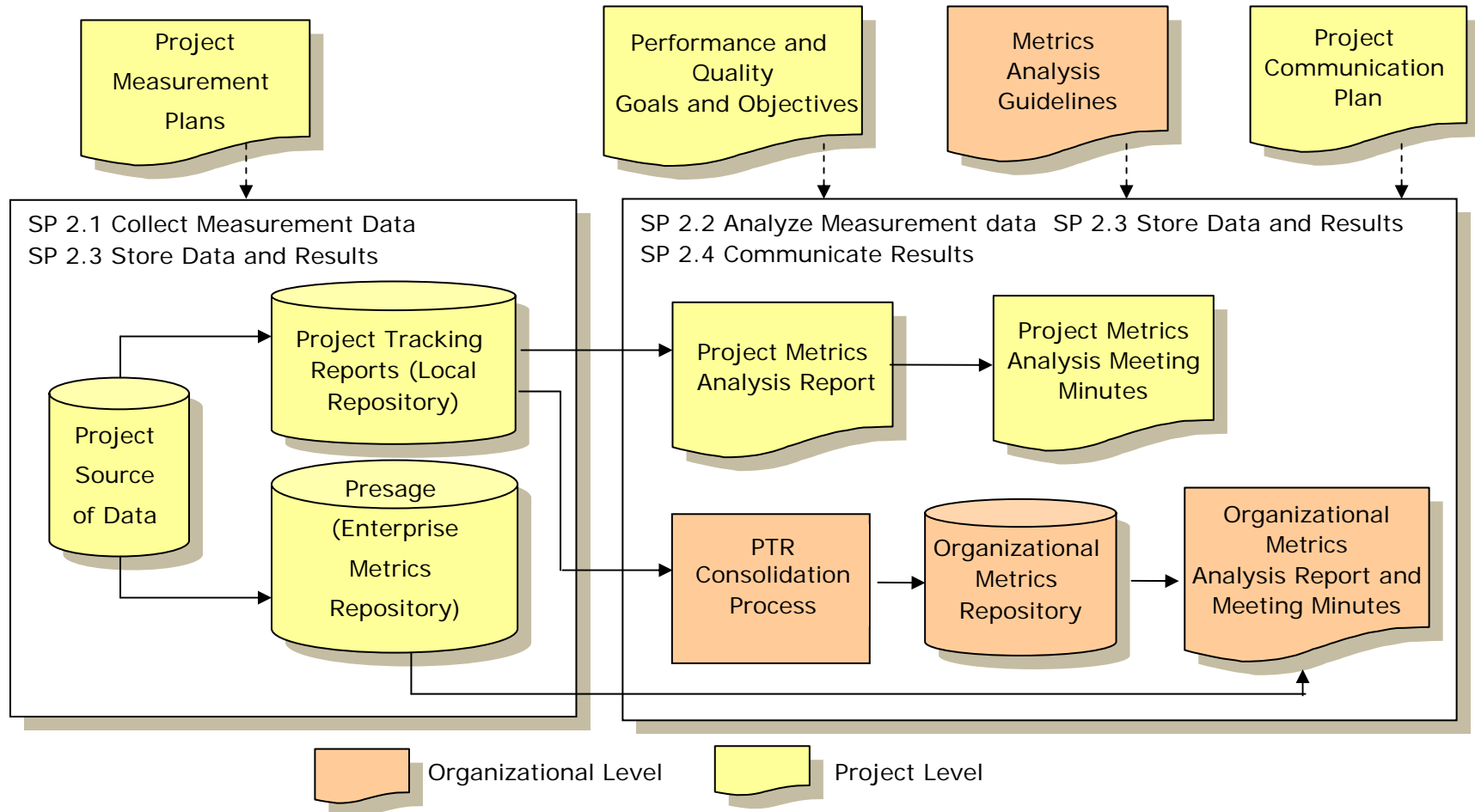
Implementation Approach for Measurement and Analysis

- Specific Goal 1: Measurement objectives and activities are aligned with identified information needs and objectives



Implementation Approach for Measurement and Analysis

- Specific Goal 2: Measurement results that address identified information needs and objectives are provided



Association of measures with organizational objectives

A project's process activities should be aligned with organizational goals/objectives/strategies and client expectations.

Based on this alignment, metrics should show progress against the goals/objectives/strategies and client expectations.

Without this alignment, the real business is separated from the process improvement world, thus no real business progress can be shown. Also, resources may be spent collecting data that may not be used.

Strategic
Business Plan

Business Goals/
Objectives/Strategies

Client Expectations

Performance and Quality - Goals
and Objectives

Aligned Measures

Association of measures with organizational objectives

Objective ID (EN=Enterprise O=Organizational C=Client P=Project Specific)	Goal	Enterprise Objectives	Organizational Objective	Recommended Project Objective	Measures			
O-01	Improve Rio SC productivity Improve Rio SC	EN-06 Monitor and report progress of pre-release defects (defect Applies to all CMMI Level 3 a	Increase pre-release defect detection rate in the early phases of life-cycle	Identify XX.X% of pre-release defects in the phase where they occur.	Defect Detection Effectiveness Review and Rework Effort Rate by Pre-Release Defects (non-PM and PM related activities) Pre-Release Defects Discovered by Severity Pre-Release Defects Discovered by Type Discovered Pre-Release Defects by Common Process Detected			
		Pre-Release Defects <ul style="list-style-type: none"> # Pre-Release Defects by Type & Severity # Pre-Release Defects by Discovery Phase & Severity # Pre-Release Defects by Origin Phase & Severity 	O-01 O-07 Used to measure the quality of project deliverables Collect and Analyze	R – As they occur PT – Minimum requirement for analyzing is monthly OS – Required monthly Product Review	Project Level by Common Process OS – Quantity Closed by Type, Severity by month PA - per Work Product Review	Source: Work Product Re Defects Log Storage: R, PT & PA – RioSC Project Tracking Report OS – PreSage: Monthly metrics	Execute	Advancing


The Objective ID and Measures defined in the Performance & Quality – Goals & Objectives...

....are tied to the Measurement Plan

Repository to support metrics collection

Project Tracking Reports (PTR):

- Work product designed to support metrics **collection** and **tracking** at project level, through the definition of appropriate tables for each process area selected for monitoring:

- Effort 
- Schedule
- Quality
- Staff
- Changes
- Defects
- Costs
- Application
- Issues
- Work Product Reviews
- Configuration Mgmt
- Tests

	Sep	Oct	Nov	Dec	Total effort	Estimated Effort	% Difference
Total Project Effort	3046,35	2920,75	1563,34	4293,98	25533,83	19967,50	28%
PCS - Provide Client Support	47,67	28,50	20,50	23,08	620,58	350,00	77%
MSO - Monitor System Operations	96,17	54,33	33,83	52,00	626,57	480,00	31%
CORCT - Perform Minor Changes - Corrective					0,00		
PERFCT - Perform Minor Changes - Perfective					0,00		
ADAPT - Perform Minor Changes - Adaptive					0,00		
MINENH - Perform Minor Changes - Enhancement	1595,75	1153,92	520,67	102,50	11100,34	10300,00	8%
OST - Ongoing Support - Perform Temporary Fix		0,50	0,50	1,50	2,50	10,00	75%
RL - Release Application	281,25	29,83	12,50	4,83	927,58	266,00	249%
RLFAT - Release Application - FAT	139,75	35,00	5,50	11,00	225,75	222,00	2%
PI - Impl Appl - Monitor Prod Appl (Post Imp)					0,00		
IM - Implement Application	8,00	357,83	15,00	4,00	882,83	460,00	92%
TR - Project-Related Travel					0,00		
TN - Project-Related Training	119,08	340,67	330,00	533,08	3505,17	1540,00	114%
Work Management (WM)	496,42	507,00	305,92	514,75	5596,01	1064,50	20%
% WM Effort	16%	18%	32%	40%			
PL - Plan Project Work		3,00	1,00	0,50	104,00	473,50	78%
PLRS - Plan project Work - Refine Scope & Approach					5,00	20	75%
EX - Execute Project Plan	496,42	534,00	504,92	514,25	5487,01	3571	54%
MS - Manage Suppliers					0,00		
Total Review Effort	135,84	213,00	60,42	5,91	731,25	1505,00	51%
WM Review Effort	6,50	0,58	0,00	0,66	19,16	51,00	62%
ADREV - Perform Minor Changes Adaptive Review					0,00		
CORREV - Perform Minor Changes Corrective Review					0,00		
MNREV - Perform Minor Changes Enhancement Review	129,34	212,42	60,42	5,25	712,09	1400	49%
PERREV - Perform Minor Changes Perfective Review					0,00		

Repository to support metrics collection

- Enable the tracking of each applicable organizational objective associated to the project

Objective ID (EN=Enterprise O=Organizational C=Client P=Project Specific)	Goal	Enterprise Objectives	Organizational Objective	The Measures defined in the Performance & Quality – Goals & Objectives...	Measures
O-04	Focus on increasing the amount of managed work projects and collaborative Best Shore delivery model in order to establish better relationships with our partners, minimize the communication and productivity issues and make better use of our CMM /CMMI /ISO capabilities.	EN-04 Meet client commitments of quality, cost and schedule. EN-11 / EN-18 Compare delivered services favorably to industry benchmarking data using data collected in the metrics repository (using historical data).	increase utilization ratio (project direct effort)	level of quality.	Effort by Common Process/Phase Planned vs Actual FTE % Variance Planned vs Actual FTE Planned vs Actual Peak Staff % Variance Planned vs Actual Peak Staff Effort/FTE Ratio Open and Closed Issues (Cumulative) % Issues Closed Aging Issues Configuration Item Tracking CI Changed / CM Effort Ratio

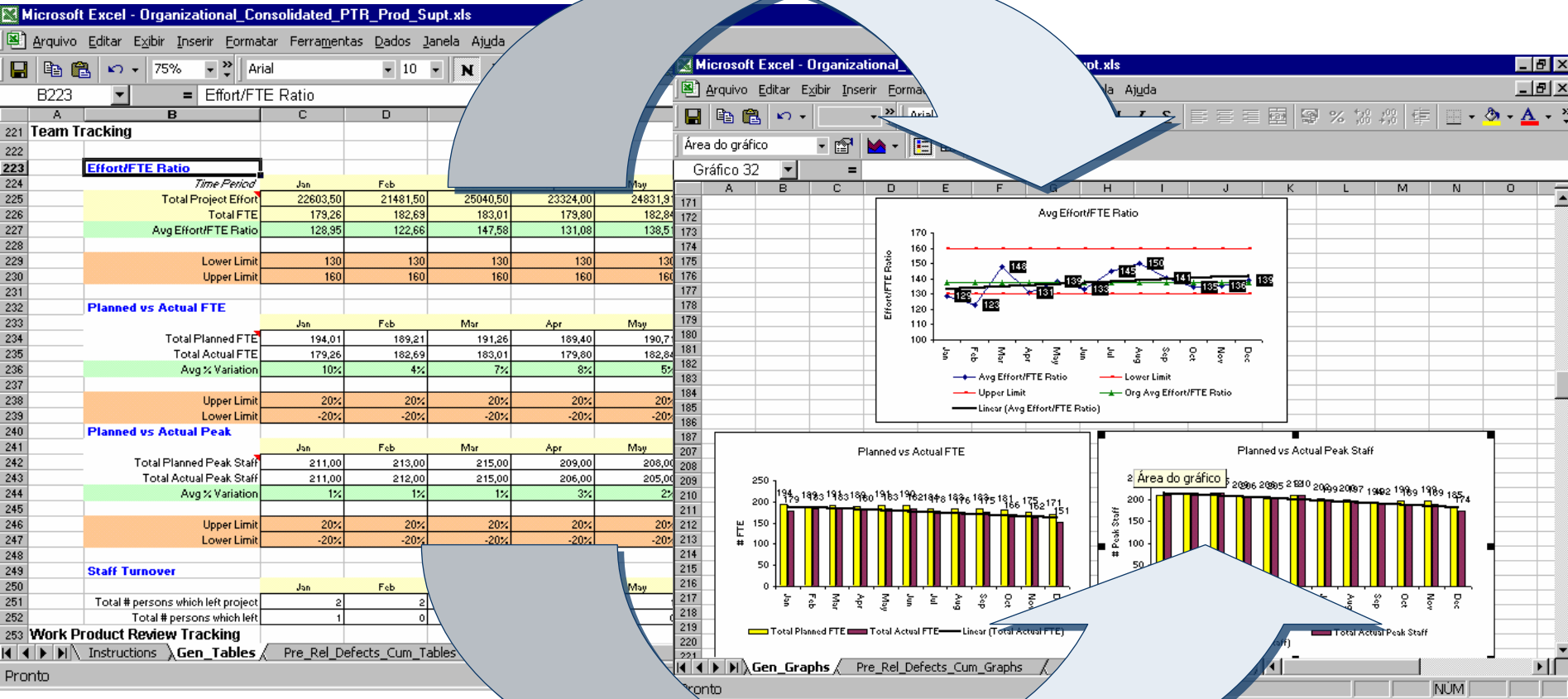
Effort/FTE Ratio

Time Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Total Project Effort	733,00	1033,00	1971,5	2180,50	2224,00	2542,74	2972,58	3080,09	3018,35	2920,75
Total FTE	5,00	7,20	12,40	13,75	14,30	16,80	18,80	19,40	20,80	19,15
Effort/FTE Ratio	146,60	143,47	158,99	158,58	155,52	151,35	158,12	158,77	145,11	152,52
Lower Limit	130	130	130	130	130	130	130	130	130	130
Upper Limit	160	160	160	160	160	160	160	160	160	160

....can be tracked in the Project Tracking Reports

Repository to support metrics collection

- Provide graphical data display, through implementation of automatic links with the tables



Repository to support metrics collection

- Enable collection of metrics at CR level, for maintenance type of projects

Estimates

Allows the record of general CR information, such as Appl CR Id, Description – Type, Business Area/Function – Primary Languages

Appl CR Id	Appl CR Description	Appl CR Type	Estimated Effort - Create Implementation Plan - Review	Estimated Effort - Release Application - Review	Estimated Effort - Implement Application	Estimated Effort - Implement Application - Review
1 CR001	RCF Projeto Racionalização	Enhancement	9,0		7,5	
2 CR001	xxxx	Enhancement				
3 CR002	MSV - Racionalização de tra	Enhancement				
4 CR002	xxxx	Enhancement				
5 CR003	Lan&Jorge CA1 igual PAG	Enhancement	9,0			
6 CR003	RA Livro Físico ISS CD-Rom	Enhancement				
7 CR004	GA Inventário Físico de Pcs	Enhancement	1,0			
8 CR004	xxxx	Enhancement				
9 CR005	Lan / Transferencia arquivos	Enhancement	32,0			
10 CR005	xxxx	Enhancement				
11 CR006	GA Inventário Físico de Pcs	Enhancement	1,0			
12 CR006	xxxx	Enhancement				
13 CR007	xxxx	Enhancement				
14 CR007	Alteração do Status RP com	Enhancement	10,0			
15 CR008	DM / Reconfiguração de fil	Enhancement	6,0			
16 CR008	Projeto Clientes - Interface	Enhancement	4,3			
17 CR009	Incluir saldo do EK na F111	Enhancement	4,5			
18 CR009	xxxx	Enhancement				

Actuals

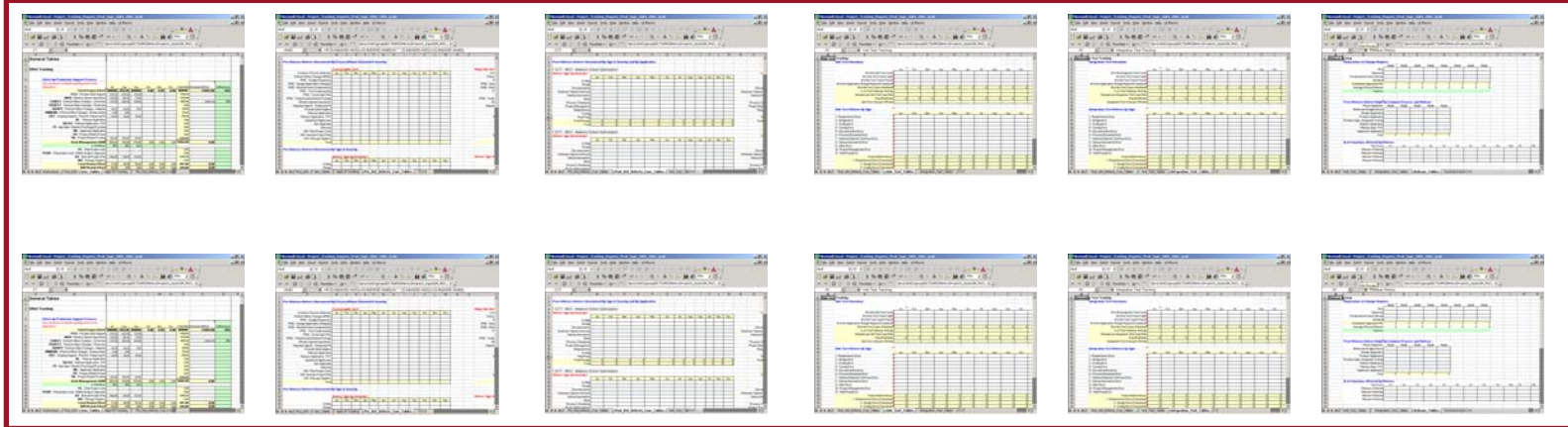
Allows the record of Actual information for Effort, Staff FTE - Size (SLOC, FP, Other Alternate Size), Start Date - End Date, Duration

Actual Effort - Create Implementation Plan - Review	Actual Effort - Release Application - Review	Actual Effort - Implement Application - Review	Actual Effort - Implement Application - Review	Actual Effort - Implement Application - Review	Actual Effort - Implement Application - Review	Actual Effort - Total	Actual # FTE	Actual # SLOC	Actual # FP
		9,0		7,5		39,5			
						0,0			
						0,0			
		9,0		3,0		28,0			
						0,0			
		1,0		1,0		16,0	1,0		
						0,0			
		21,0		3,0		99,0			
						0,0			
		1,0		1,0		16,0	1,0		
						0,0			
						0,0			
		23,5		2,0		61,5	1,0		
		6,0		4,0		28,0	1,0		
		4,3				38,5	1,0		
						25,5	1,0		
						0,0			

Metrics consolidation process

Gen_Tables Pre_Rel_Defects_Cum_Tables Post_Rel_Defects_Cum_Tables Unit_Test_Tables Integration_Test_Tables Release_Tables (PS only)

Project Tracking Reports-Project 1



Project Tracking Reports-Project 2

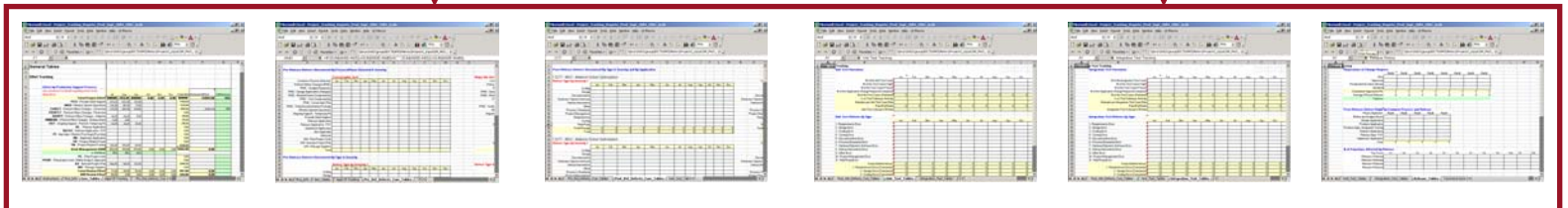
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Project Tracking Reports-Project N

Consolidation Process for Prod Supt work type

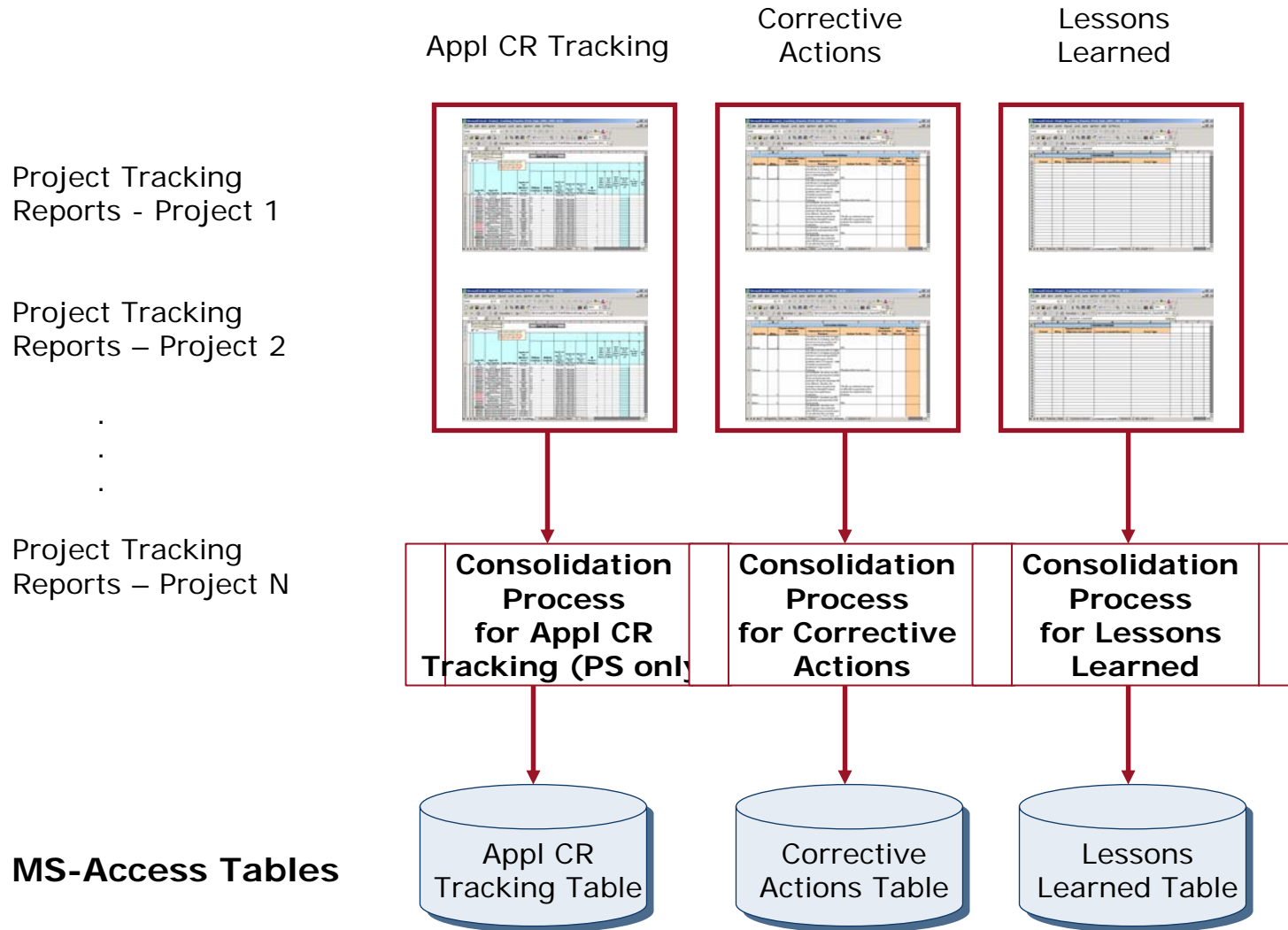
Consolidation Process for Dev+ work type

Organizational Consolidated Tracking Reports



Gen_Tables Pre_Rel_Defects_Cum_Tables Post_Rel_Defects_Cum_Tables Unit_Test_Tables Integration_Test_Tables Release_Tables (PS only)

Metrics consolidation process



Method to support metrics analysis

- Metrics Analysis Guidelines document has the purpose to define the analysis guidelines to be performed at organizational and project levels, for each associated metrics report, enabling the monitoring of the organizational objectives defined in Performance and Quality - Goals and Objectives.
- The read and understanding of this document is recommended to project metrics contacts, team leaders and project managers who have the primary responsibility to monitor project progress based on metrics analysis reports.

Method to support metrics analysis

Scope: Define the scope where the analysis procedure is applicable, if at organizational and/or project levels.

Significance: Provide a description of the report and the possible explanations or answers to specific questions which could be determined during the analysis.

Organizational Objective: Identification of the organizational objective monitored by the report

Scope	Organizational Level	Project Level
Significance	<p>The effort / FTE ratio measure tracks the amount of effort the staff is working on the project. The measure compares the effort applied by the project team against this standard to determine if they are expending more or less effort than normal on the project.</p> <p>The effort applied to a project provides an indication to the overall health of the project. The planned and actual curves to help the project manager and team assess if adequate labor is planned for the project, if the actual expenditure of effort-hours is in accordance with the plan, and if the effort being applied to the project is enough to achieve the desired schedule. Some variance can be expected between the planned amount of effort and the actual amount of effort expended.</p> <p>The effort measure, by itself, does not provide information on the staffing level, productivity of the staff and realism of the project plan. Comparing the actual effort hours applied to the normal working period translates the effort applied on the project into this information. Project teams working overtime to meet commitments are usually a result of unrealistic plans, understaffing, or productivity levels not matching the estimate. Projects under-using the staff or productivity levels exceeding the estimate have a gap between the actual hours and the overtime threshold where the threshold is higher. Variances from the threshold should be analyzed in combination with schedule and output metrics to determine the impact on present and future performance.</p> <p>This report can help answer questions regarding:</p> <ul style="list-style-type: none"> • Are resources working longer than normal hours? • Is the project staffed according to plan? • Is additional staff being assigned to the project? • Are development resources being applied according to plan? • Are the committed milestone dates realistic? • Is the effort estimate realistic? • Is the project progressing according to plan? • Is the project's productivity meeting the estimate? 	
Organizational Objective	O-04 Increase utilization ratio (project-direct effort)	
Project Type	-	Production Support, Dev+
Frequency	Semi-Annual	Monthly
Data Sources (Input)	Project Tracking Reports,	CTTS, Staffing Plan,
Data Elements	Effort, Staff FTE	
Algorithm	Ratio = Total Effort / Total FTE	
Thresholds	See definition at Organizational Measurement Plan, section Analysis Triggers	
Storage (Output)	Organizational_Consolidated_PTR_Prod_Supt.xls Organizational_Consolidated_PTR_DEV+.xls	Project Tracking Reports
Created by	Site Metrics SME	Project Metrics Contact
Analyzed by	Site Metrics SME and PPIG	Project Metrics Contact, Project Manager and/or Team Leaders
Distributed to	SC Leadership, Project Managers, Team Leaders, Project Metrics Contacts, selected Team Members, PPI, PSO	Delivery Leaders, Project Managers, Team Leaders, Project Metrics Contacts, Team Members, Site Metrics SME.

Project Type: Determine which type of projects are applicable to the analysis (valid only to project level analysis)

Algorithm: Indicate the formulas used during the analysis

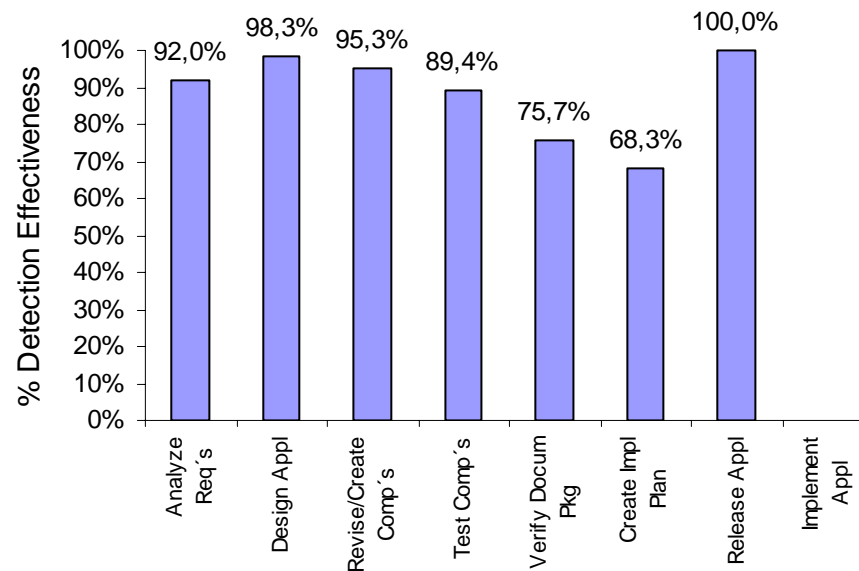
Function(s) responsible(s) to provide the result of the analysis, to review the results, determining conclusions, issues and further investigations needed and Stakeholders defined to receive the communication of the analysis results

Some performance indicators selected for analysis

- Defect Detection Effectiveness
- Application Serviceability
- Effort/FTE Ratio
- Application Support Rate (SLOC or Function Points)
- Post-Release Defect Density (KSLOC or Function Points)
- Application Change Request (CR) Analysis - Effort and SLOC Correlation

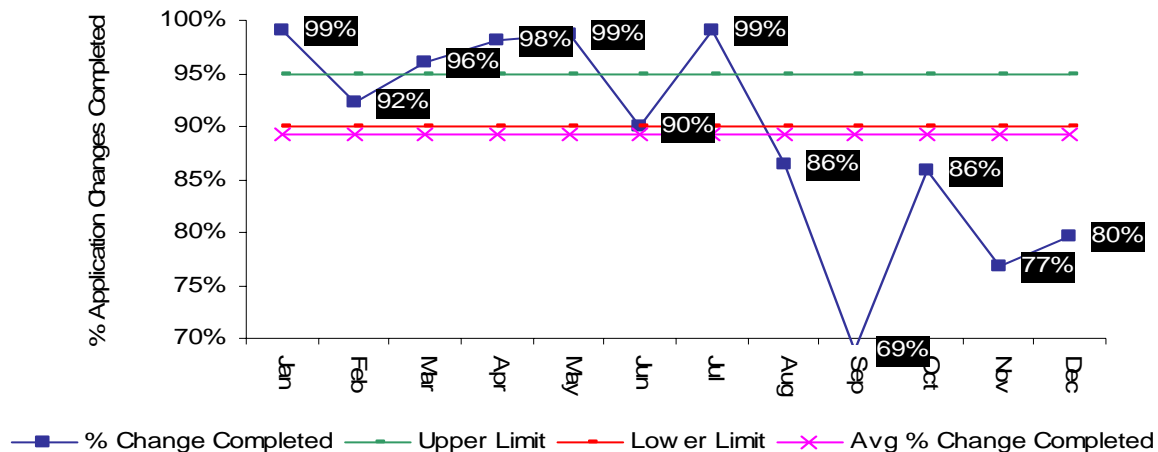
Some performance indicators selected for analysis

- Defect Detection Effectiveness
 - Significance: The defect detection effectiveness measure tracks the rate of efficiency of the defect detection activities by project phase/activity
 - Algorithm: % Defect Detection Effectiveness by Common Process/Phase = Total defects detected in each phase or activity / Total defects introduced up to the phase or activity regarded
 - Scope: Maintenance and Development projects + Organization



Some performance indicators selected for analysis

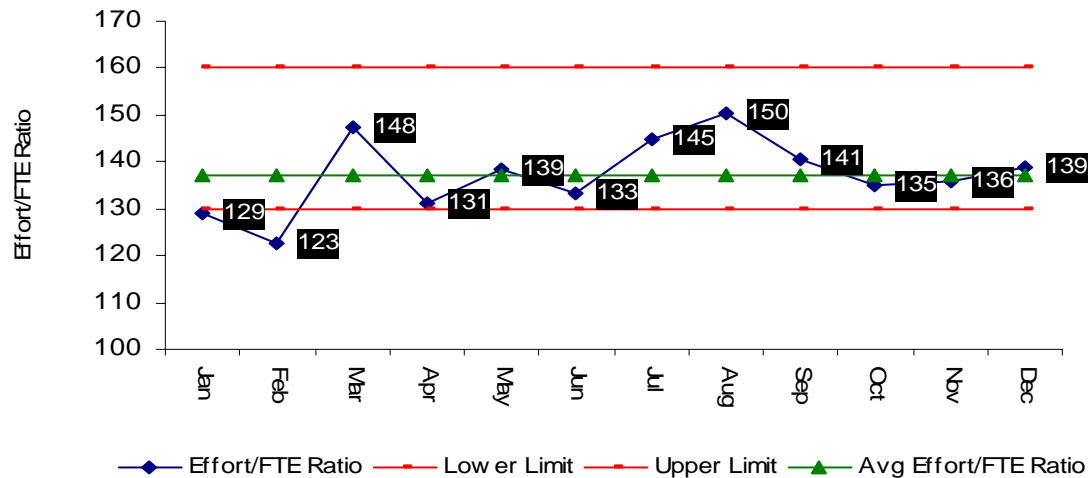
- Application Serviceability
 - Significance: The application serviceability measure tracks the ability of the project to implement planned application changes.
 - Algorithm: Application Serviceability = (Actual Committed CRs Completed / # of CRs Committed to Complete) * 100
 - Scope: Maintenance projects + Organization



Some performance indicators selected for analysis

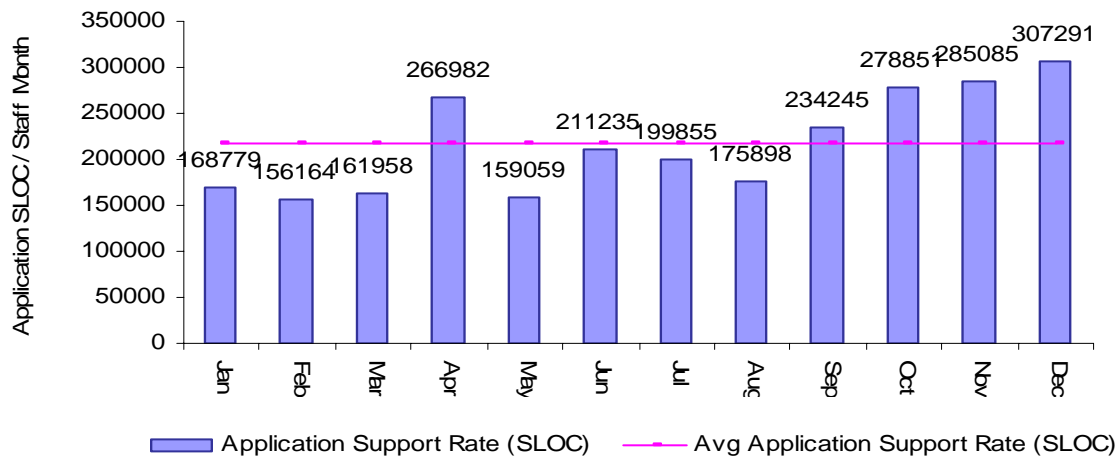
- Effort/FTE Ratio

- Significance: The effort / FTE ratio measure tracks the amount of effort the staff is working on the project.
- Algorithm: $\text{Ratio} = \text{Total Actual Effort} / \text{Total Actual FTE}$
- Scope: Maintenance and Development projects + Organization



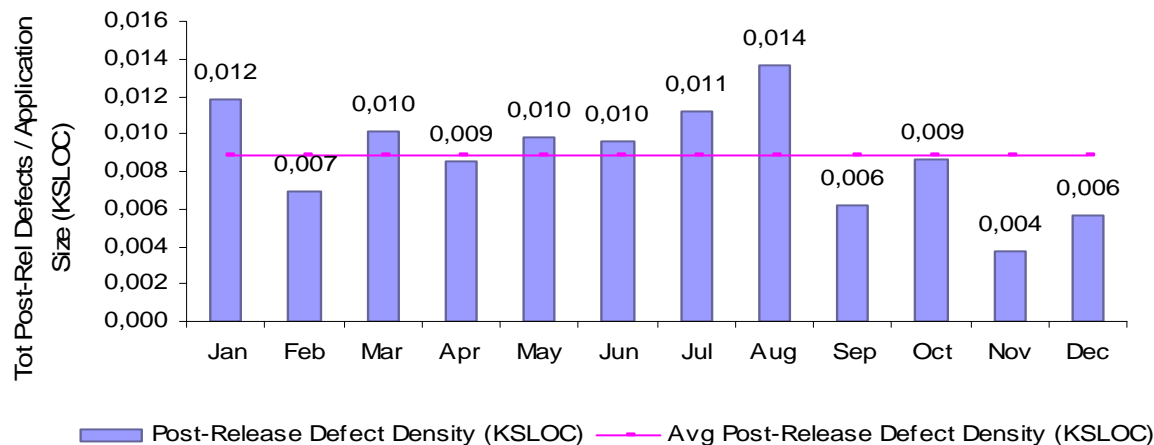
Some performance indicators selected for analysis

- Application Support Rate (SLOC or Function Points)
 - Significance: Demonstrate the performance of Production Support projects in terms of their application support capacity, measured in Function Points (FP) and/or SLOC basis
 - Algorithm: Staff Month = Total Effort Hours / 130 ; Application Support Rate = (Total Application SLOC/FP / Staff Month)
 - Scope: Maintenance projects + Organization



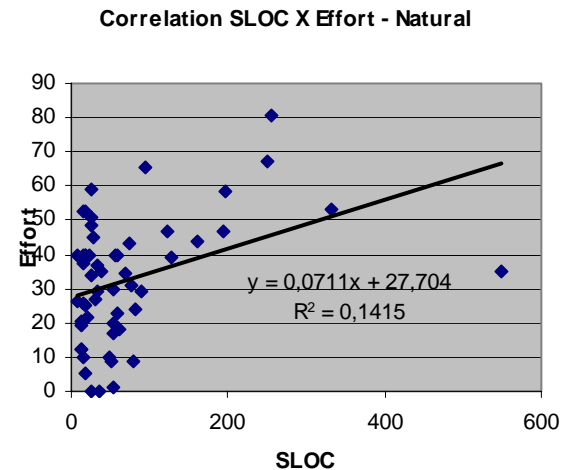
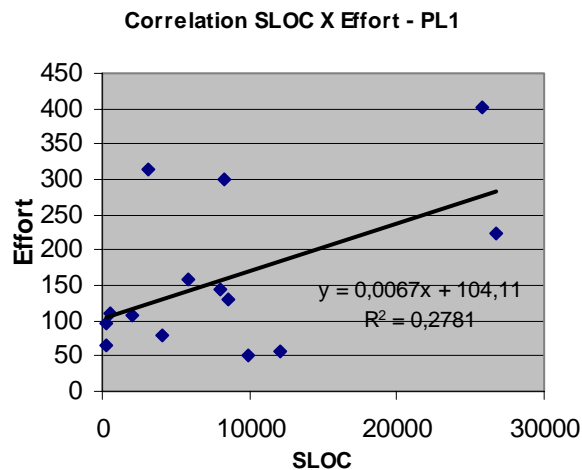
Some performance indicators selected for analysis

- Post-Release Defect Density (KSLOC or Function Points)
 - Significance: Demonstrate the stability of the application supported by a Production Support projects in terms of their post-release defect density, measured in Function Points (FP) and/or SLOC basis
 - Algorithm: Post-Release Defects Density = ((Total Application Defects Detected*1000) /Total Application KSLOC/FP)
 - Scope: Maintenance projects + Organization



Some performance indicators selected for analysis

- Application Change Request (CR) Analysis - Effort and SLOC Correlation
 - Significance: Measure degree of statistical correlation between the actual size in number of modules and the amount of actual effort spent in the CR. Provide a mechanism, through the trend line equation, to estimate effort (Y) given an amount of estimated number of modules (X), applied to a similar environment. The R^2 factor provides the statistical degree of correlation between X and Y variables.
 - Algorithm: None
 - Scope: Maintenance projects + Organization



Benefits of the implementation

- At project level:
 - Standardization of metrics collection and analysis
 - Increase the knowledge in metrics analysis
 - Clarification of the targets that must be achieved, based on the association of metrics to objectives
- At organizational level:
 - Reduction of effort spent to create a organizational metrics analysis report from 250 to 50 hours
 - Ability to create 2 to3 additional occurrences of organizational metrics analysis report (rather than only one), raising the tangible benefit of the initiative.
 - Ability to project managers to access organizational metrics data, enabling benchmarking with project's performance.
 - No costs incurred related to hardware or software license acquisition to implement the initiative – only labor hours spent.

Questions



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