Analysis and Quality in Measurement Reporting

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- Measurements
  - The Implications
  - The Project Measurements Coordinator
    - Role and Responsibilities
- Quality Performance Index
  - What is QPI?
  - Creating QPI
  - Implementing QPI

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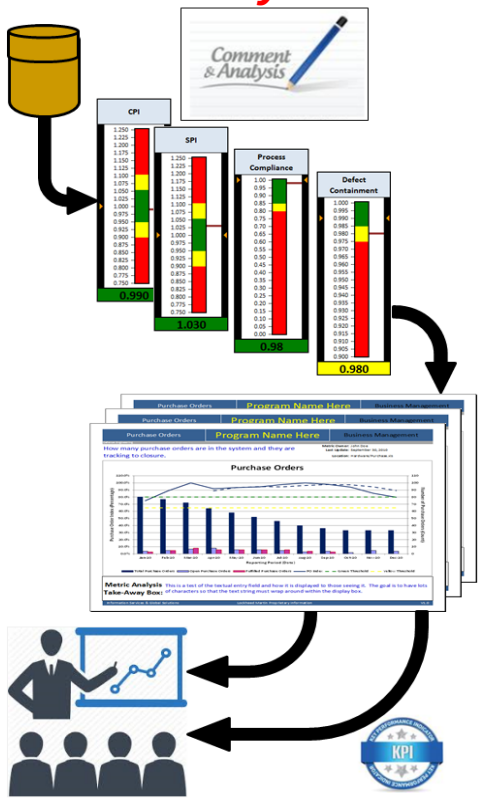
Presentation Introduction

The program measurement coordinator has a critical and serious role in performing activities and tasks within the world of analytics that can greatly benefit the program management team with their ability to manage the development and delivery of their contractual obligation. The program measurement coordinator can effectively understand this if they understand their subspace of Measurements within the world of Analytics and with the inclusion of QPI (Quality Performance Index).



This presentation will

1) ***Define the elements and components of Measurements and the role of the program measurement coordinator -- and --***
2) ***Introduce a new indicator known as QPI (Quality Performance Index) to demonstrate and illustrate how the theoretical concepts of effectively measuring the quality component of the delivery work product is critical for this success.***

NOTE: Audience participation is encouraged and expected with questions and lively discussions to edify the overall experience of the presentation to pursue new studies and for future presentations.

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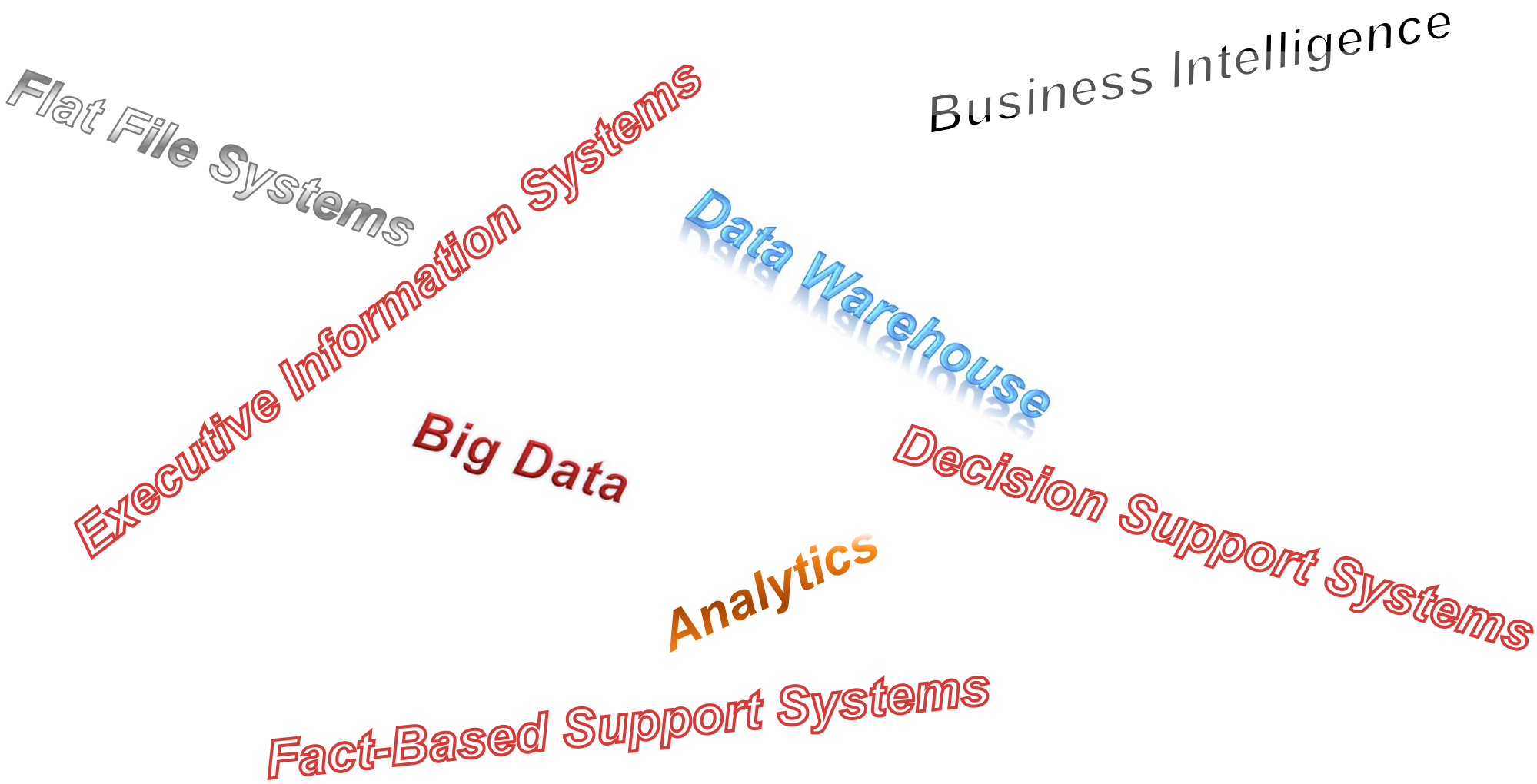
Analytics – Description



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Analytics – Description

Business Intelligence *1958*

Decision Support Systems *1970*

Executive Information Systems *1980*

Fact-Based Support Systems *1990*

Flat File Systems *1970*

Data Warehouse *1988*

Big Data *2001*

"Statistics"
Analytics *2007*

is a multidimensional discipline

- ***Descriptive – Textual explanation***
- ***Diagnostic – Root cause analysis***
- ***Predictive – Forward looking***
- ***Prescriptive – Recommendations***

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Analytics – Description

- Full Name: Big Data Analytics
- An evolving, maturing science that focuses on the studying and understanding the relationship of collected data and information
- “Big data” refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze.
- “Analytics” refers to the use of software-based algorithms and statistics to derive meaning from data.
- “Big Data Analytics” implies to the process of collecting, organizing and analyzing large sets of data to discover patterns and other useful information.

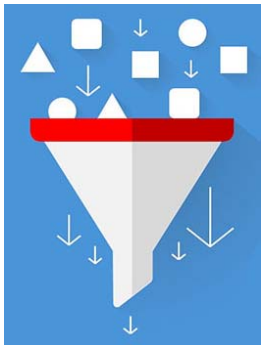
Analytics – Description

- Big data analytics helps companies, departments, teams, and programs to better understand their collected data and identify the most important elements for the current and future business decisions.
- Has many implications, applications, and markets/segments
  - Business: Finance, Supply Chain, Workforce, Risk, Customer, etc.
  - Fraud Detection: Banking, Credit Cards, Internet Security/Firewalls, etc.
  - Military, Secret Service, Police, etc.: Profiling, Deterrence, Prevention
  - Medical: Medicine, Remedies, Cures, Diets, Avoidance, etc.
- Words commonly used in its definition include
  - Collection
  - Sources
  - Data
  - Information
  - Analysis
  - Patterns
  - Insight
  - Recommendations
  - Future
  - Decisions
  - Performance
  - Improve

and more…

Analytics – Definition

- Generic Definition: Analytics is the gathering of information among a host of different sources which is carefully studied and analyzed to discover, find and detect patterns, associations, and relationships to gain new insights to propose recommendations into making decisions to improve the future outcomes, performance and/or results of one's own interest.



- Implication: The program measurement coordinator should do more than create and maintain the program's metrics/indicators and be a facilitator of organizing the collection and reporting of program's past performance data. S/he should also provide an independent study and analysis of the program data to better understand the value of the collected data, find new relevant data relationships and associations, identify additional data elements for more essential reporting, and help guide the program management team to make decisions to improve the team's progress and results.

To be discussed later in the presentation

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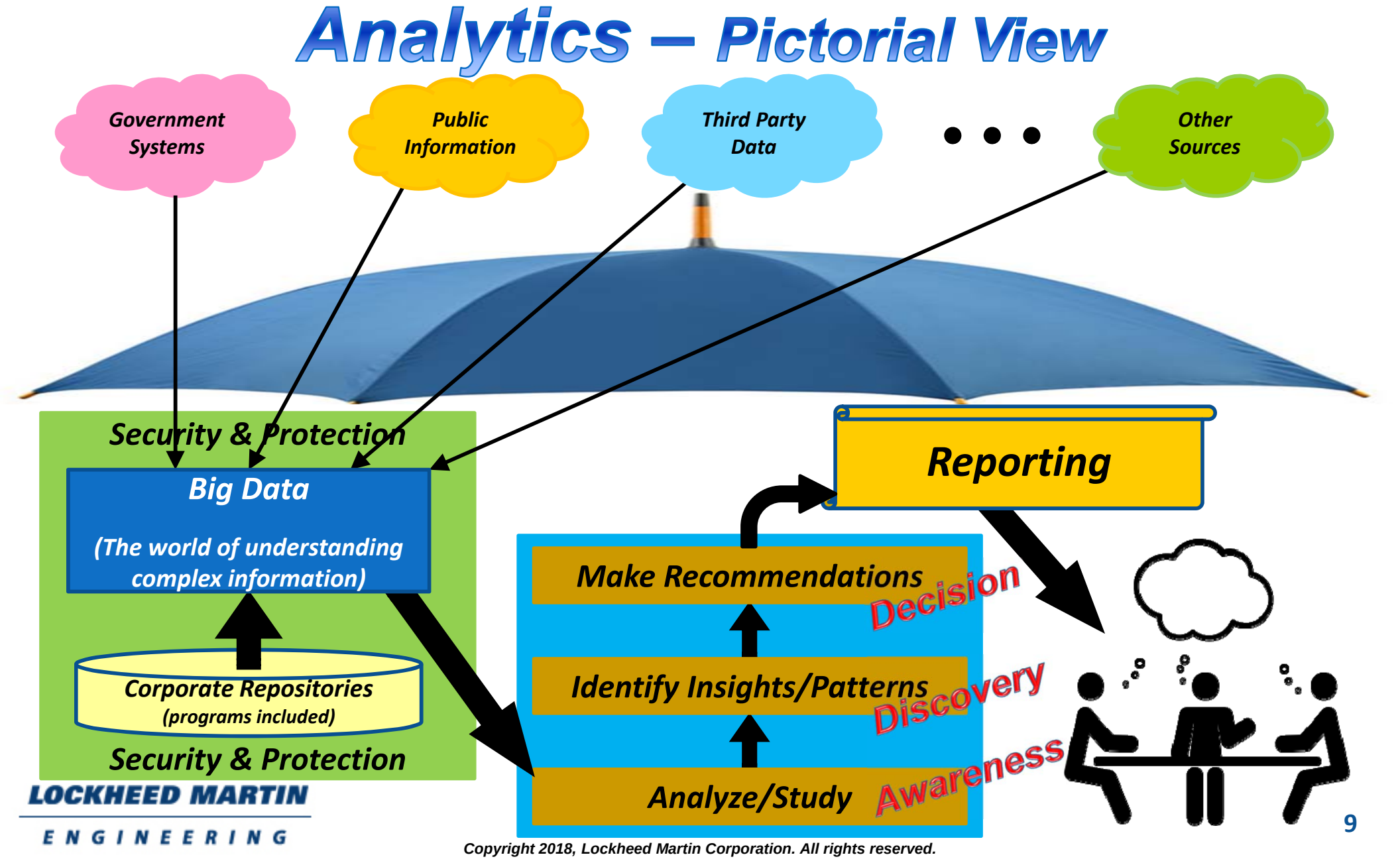
Analysis and Quality in Measurement Reporting



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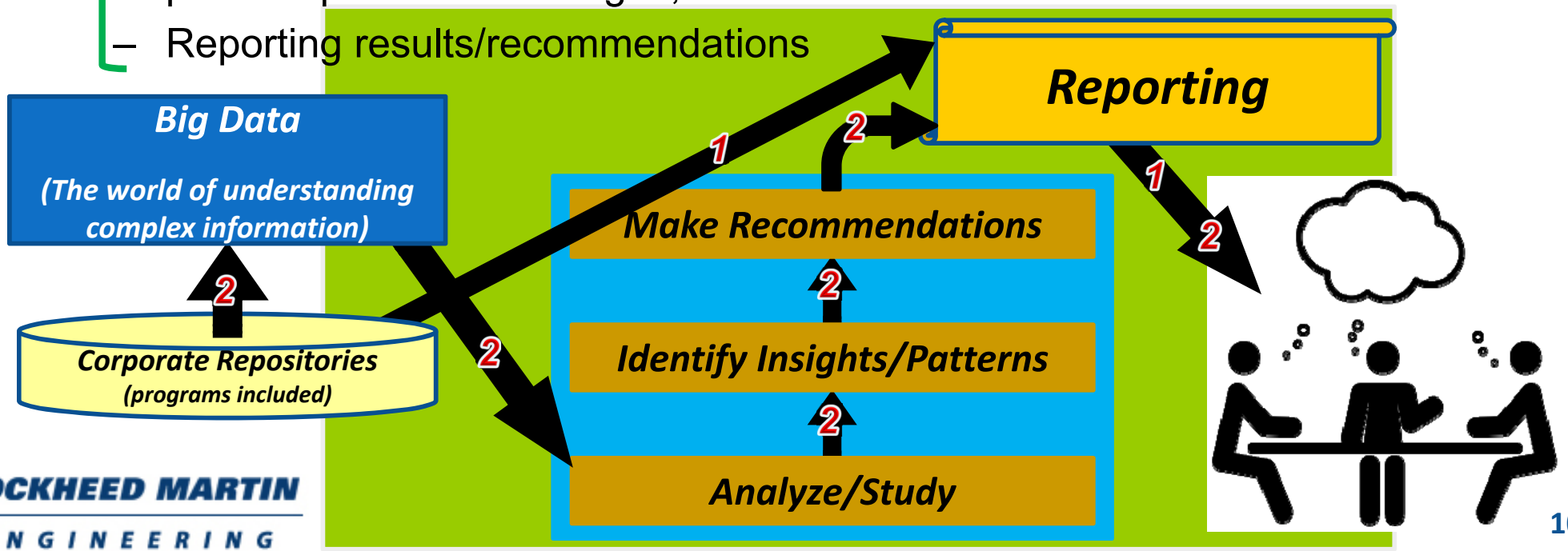
Analytics – The Measurement Subspace

- Includes
  - 1 – Reporting the past performance results to the key decision makers
  - 2 – Identifying data to be collected – internal and external to the company
  - 2 – Analyzing/studying data to understand its purpose, intent, and meaning
  - 2 – Discover/identify data relationship patterns and new insights
  - 2 – Propose recommendations for future studies, analysis, data, reporting, process/procedure changes, etc.
  - 1 – Reporting results/recommendations



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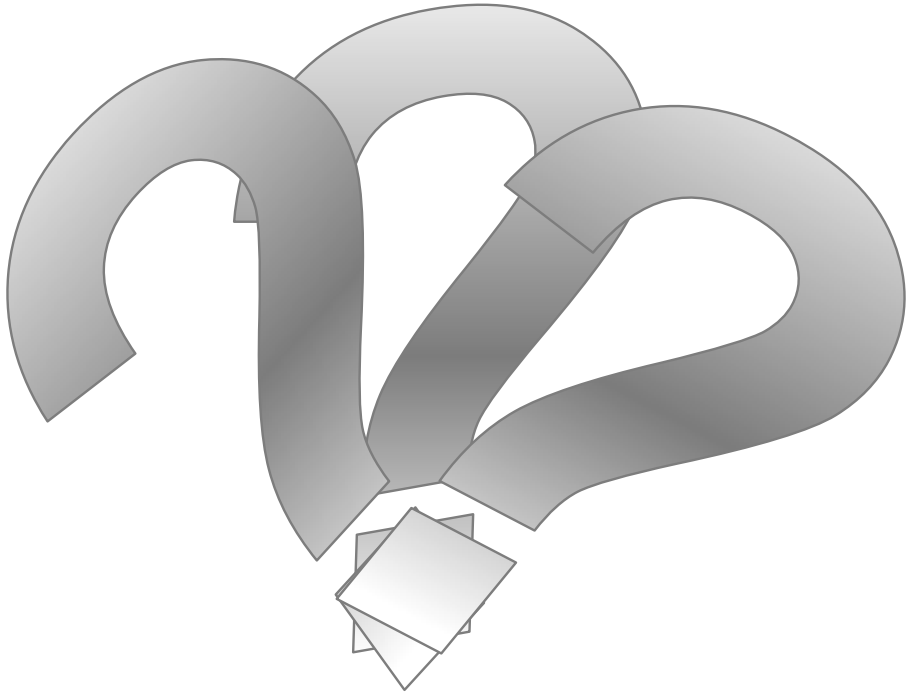
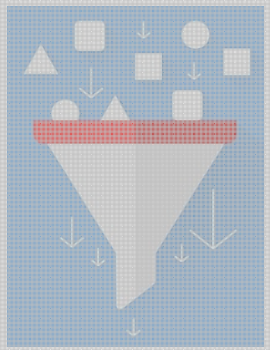
Questions?



Measurements – Analytics Implications

- Generic Definition: Analytics is the gathering of information among a host of different sources which is carefully studied and analyzed to discover, find and detect patterns, associations, and relationships to gain new insights to propose recommendations into making decisions to improve the future outcomes, performance and/or results of one's own interest.



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Measurements – PMC R&R

- Includes
  - 1 – Reporting the past performance results to the key decision makers
  - 2 – Identifying data to be collected – internal and external to the company
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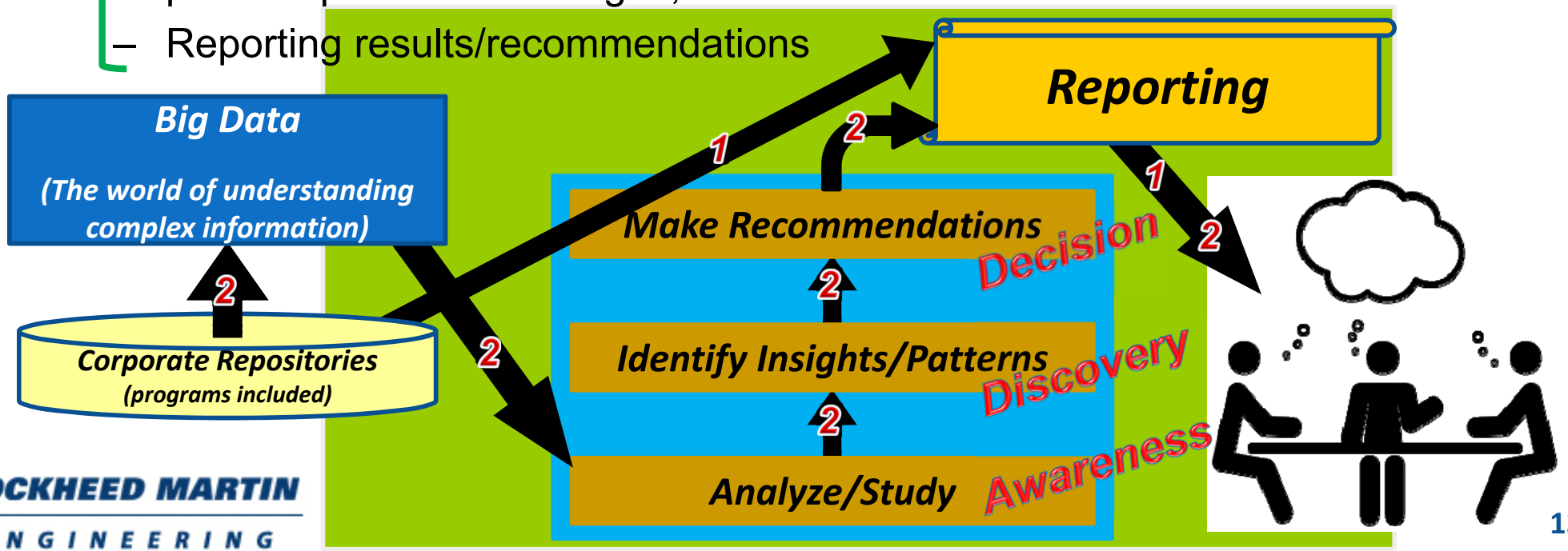

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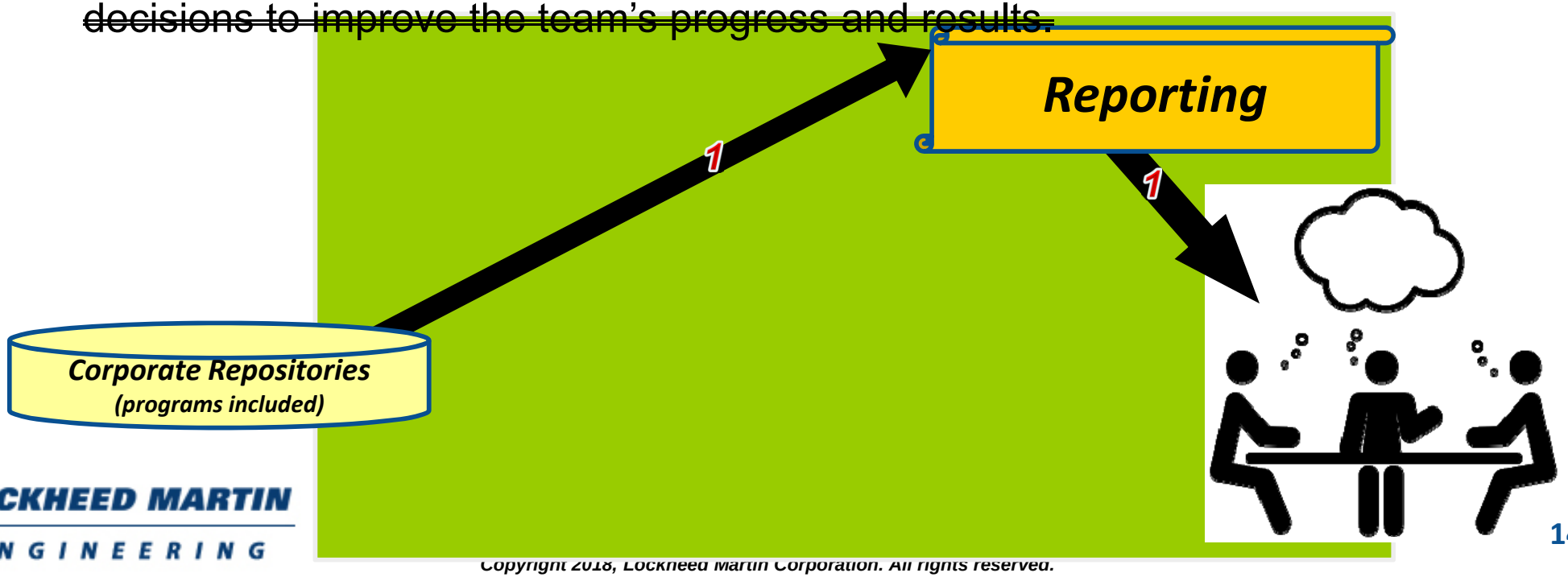
Does Measurements – PMC R&R

Implication: The program measurement coordinator should ~~do more than~~ creates and maintains the program's metrics/indicators and is a facilitator of organizing the collection and reporting of program's past performance data. ~~S/he should also provide an independent study and analysis of the program data to better understand the value of the collected data, find new relevant data relationships and associations, identify additional data elements for more essential reporting, and help guide the program management team to make decisions to improve the team's progress and results.~~



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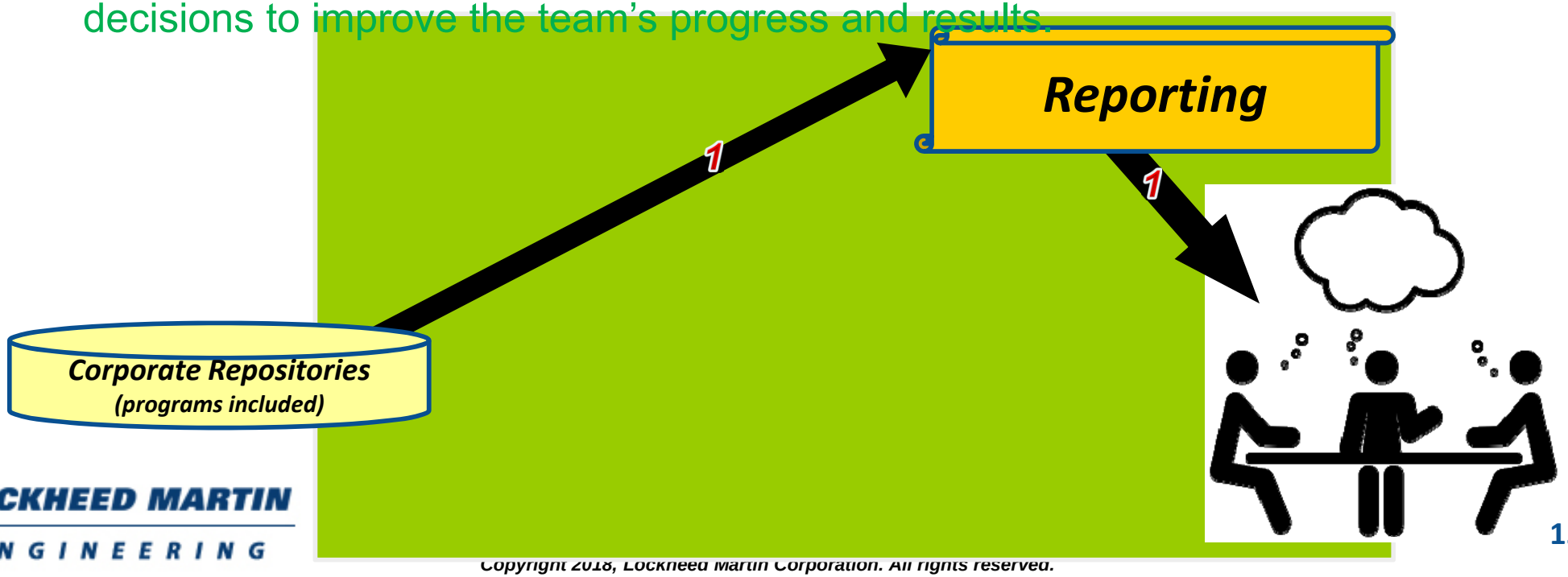
Also Measurements – PMC R&R

- Implication: The program measurement coordinator should ~~do more than creates and maintains the program's metrics/indicators and is a facilitator of organizing the collection and reporting of program's past performance data. S/he should~~ also provide an independent study and analysis of the program data to better understand the value of the collected data, find new relevant data relationships and associations, identify additional data elements for more essential reporting, and help guide the program management team to make decisions to improve the team's progress and results.



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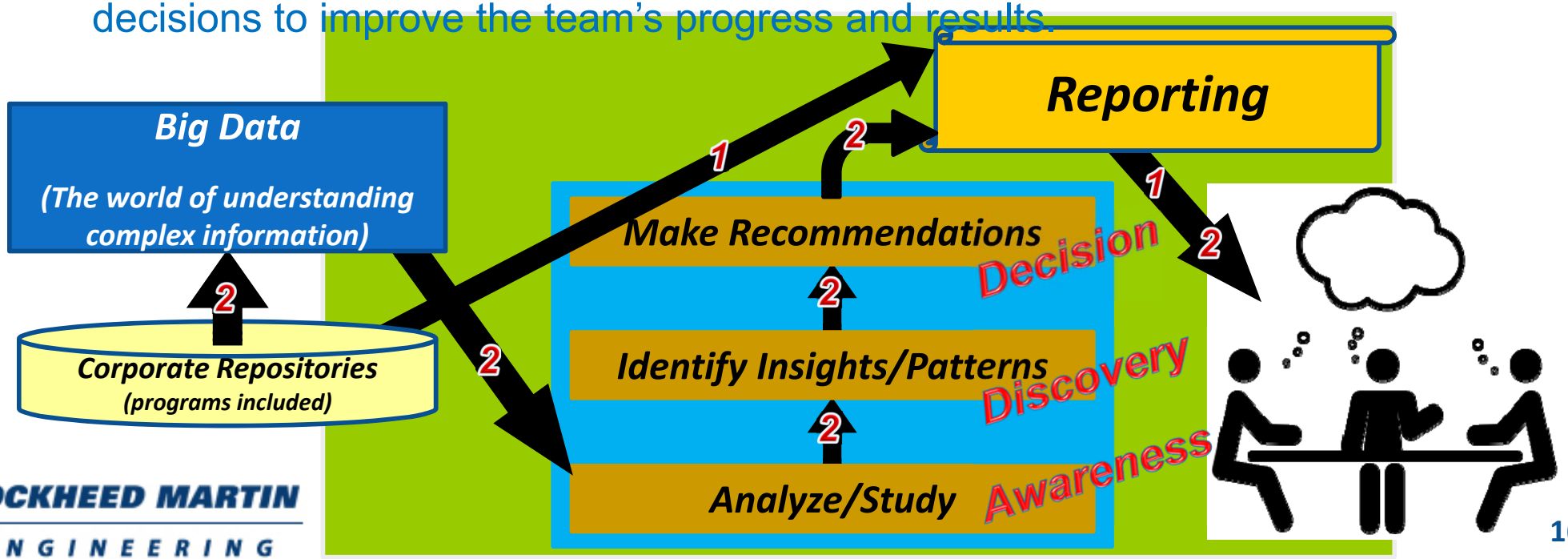
Both Measurements – PMC R&R

Implication: The program measurement coordinator should ~~do more than~~ create and maintains the program's metrics/indicators and is a facilitator of organizing the collection and reporting of program's past performance data, ~~S/he should also~~ provide an independent study and analysis of the program data to better understand the value of the collected data, find new relevant data relationships and associations, identify additional data elements for more essential reporting, and help guide the program management team to make decisions to improve the team's progress and results.

1 and 2



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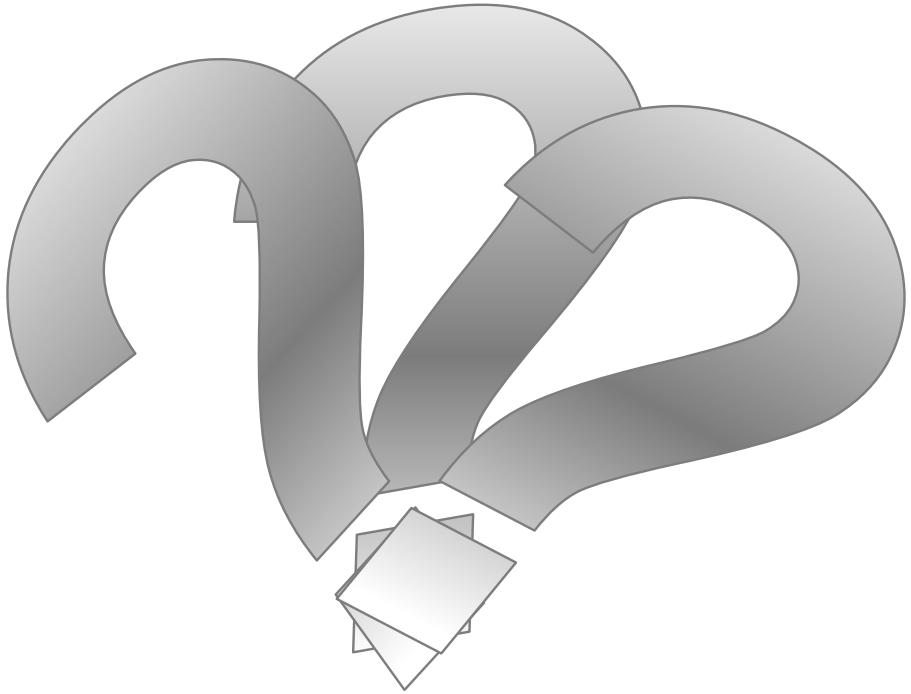
Questions?



What is QPI? – An Essential Indicator

The development of any product comprises essentially of four elements: Requirements, Cost, Schedule and Quality

Indicator Types	Root Issue
Cost	Cost (i.e. Cost to complete)
Customer Satisfaction	Worth, Goodness, Confidence (i.e. Quality)
Process Effectiveness	Quality
Process Efficiency	Quality
Product Growth	Requirements
Product Stability	Requirements
Product Quality	Quality
Risks and Opportunities	Possible Impacts (i.e. Quality)
Schedule	Schedule (i.e. Duration to complete)
System Performance	Reliability, Worth, Response (i.e. Quality)

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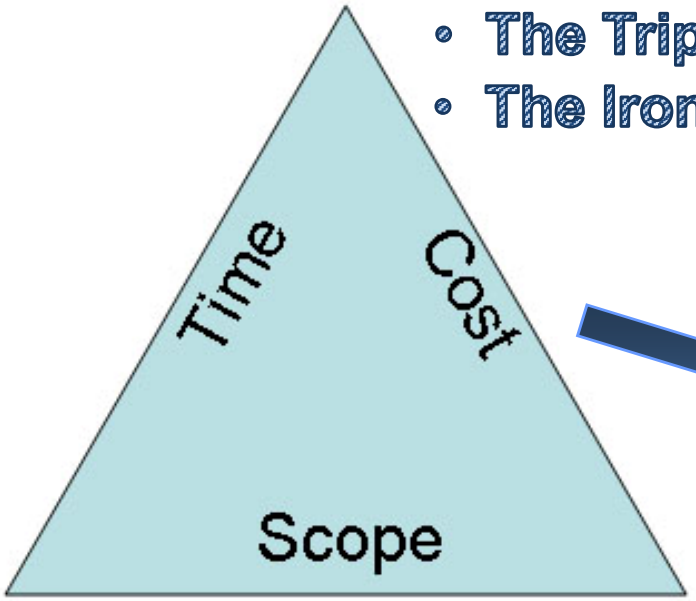
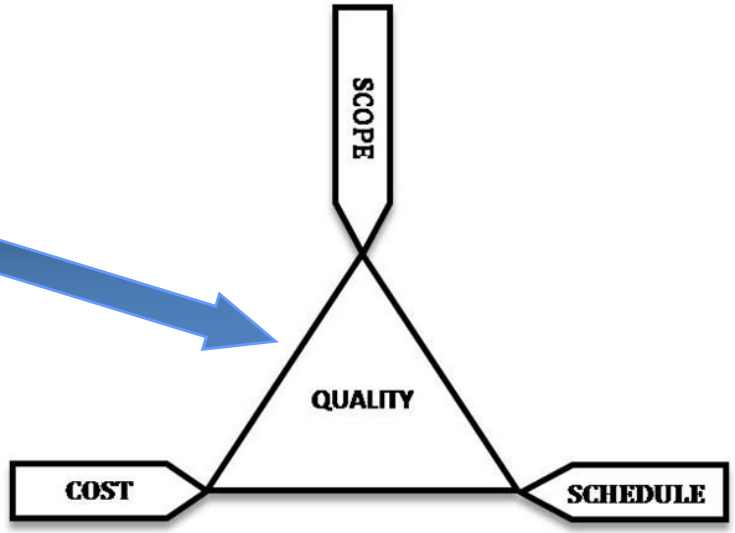
What is QPI? – Difficult to Measure

Project Management Triangle

- The Triple Constraint
- The Iron Triangle



In the 1970s, Dr. Martin Barnes, an engineering expert in the UK, created the "cost-time-scope triangle" which we are all familiar with. The triangle is also known as the Triple Constraint and Iron Triangle.



Problems started as people had different definitions of the "quality" side of the triangle. Dr. Barnes recognized this and attempted to redefine the triangle which continues to evolve today.

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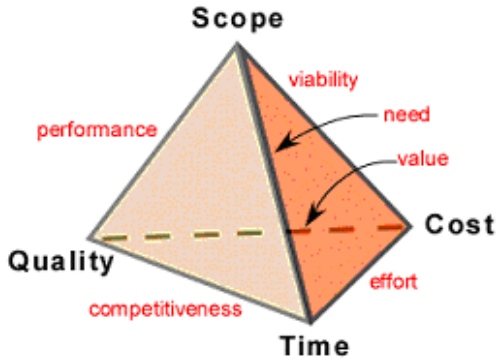
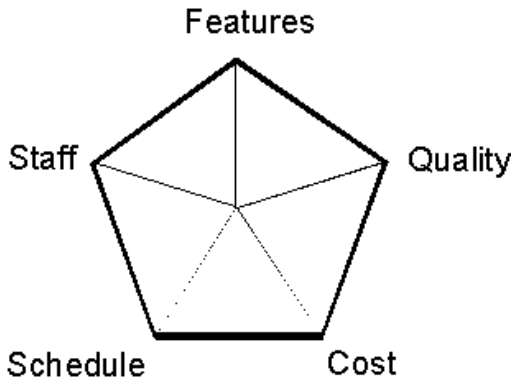
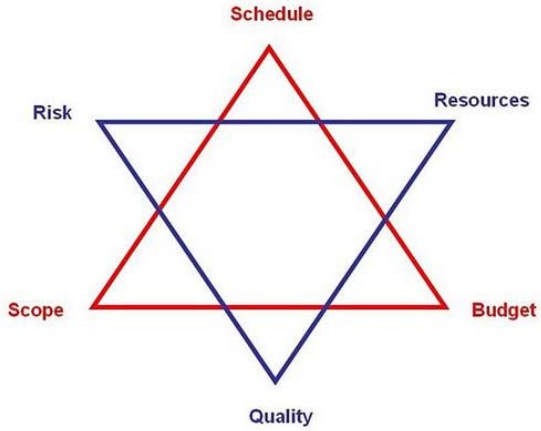
What is QPI? – Difficult to Measure







Efforts to incorporate the Quality element or attribute into the "Iron Triangle" has occurred since 1970s with no widely accepted standard.

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What is QPI? – Describing Quality

- *Applies to software and hardware development programs*
- *Quantitatively measures the efficiency of Quality (goodness, worth, reliability, value, safety, usefulness, etc.) infused/integrated into program's solution*
- *Enables programs to manage the progress of the level of their Quality*
- *Examples:*
  - *Certified level of performance, reliability, capability, etc.*
  - *Warrantee of error free operations for a period of time*
  - *100% Guarantee of satisfaction*

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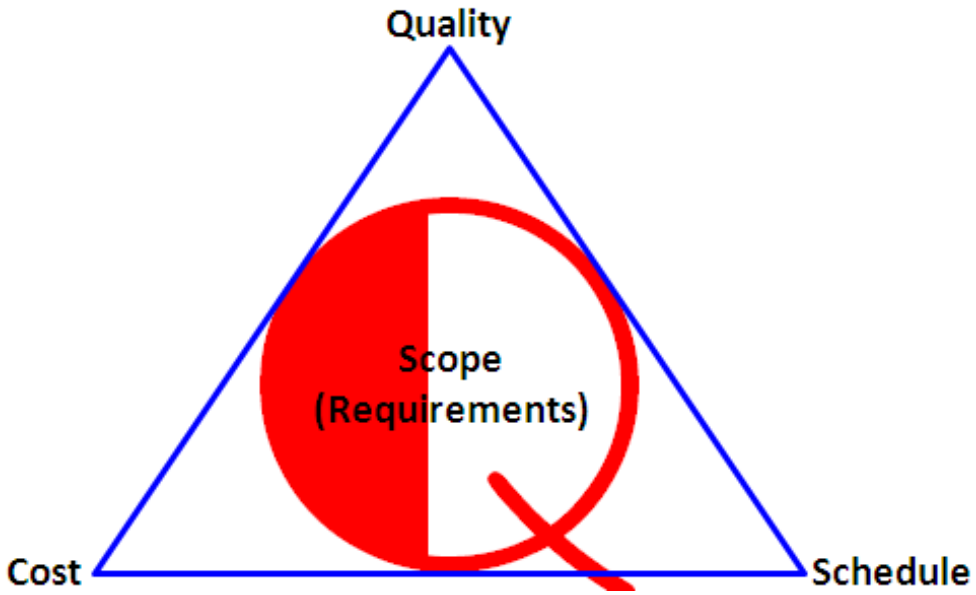
Creating QPI – Framework

- ***Quality** becomes one of the three key factors that a program **must** manage*
- ***Scope** is a program **constraint** instead of an adjustment point to manage – it must be solidified at the start or during the development and release period*
- *The Iron Q Triangle redefines the traditional "Iron Triangle" by incorporating QPI as control factor to manage, and inscribes the program's scope (features, functions, and requirements) into the center of the triangle. The inscribed circle establishes the size of the equilateral triangle.*



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Creating QPI – Definition

Defining QPI

QPI measures the quality efficiency or completeness on a program. It is the ratio of earned quality (EQ) to actual effort of quality performed (AEQP).

QPI = EQ divided by AEQP (1)

A QPI value …

- Greater than one ➔ Favorable quality condition
- Equal to one ➔ Expected quality condition
- Less than one ➔ Unfavorable quality condition

Quantitatively,

$$QPI = \frac{EQ}{AEQP} \quad (2)$$

$$EQ = \sum_{Start}^{Current} AEQP\ (Completed) \quad (3)$$

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Creating QPI – Definition

Total Program Performance comprises of CPi, SPi, and QPi

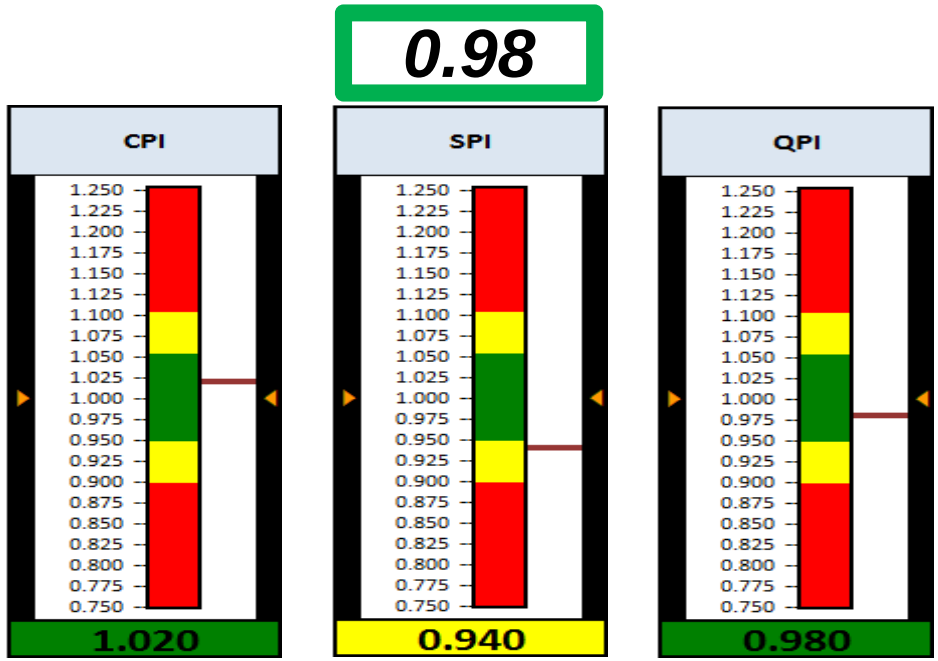
$$TPP = W_{CPI}\,CPi + W_{SPI}\,SPi + W_{QPI}\,QPi$$

Where

$$W_{CPI} + W_{SPI} + W_{QPI} = 1$$

$$W_{CPI} = W_{SPI} = W_{QPI} = 1/3 \text{ or } 0.\overline{3} \text{ (default)}$$

Total Program Performance



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Implementing QPI

Work in progress

Activity Centric
(CPI & SPI)

Metric Centric

QPI

Product Centric

?

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Questions?

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Thank You

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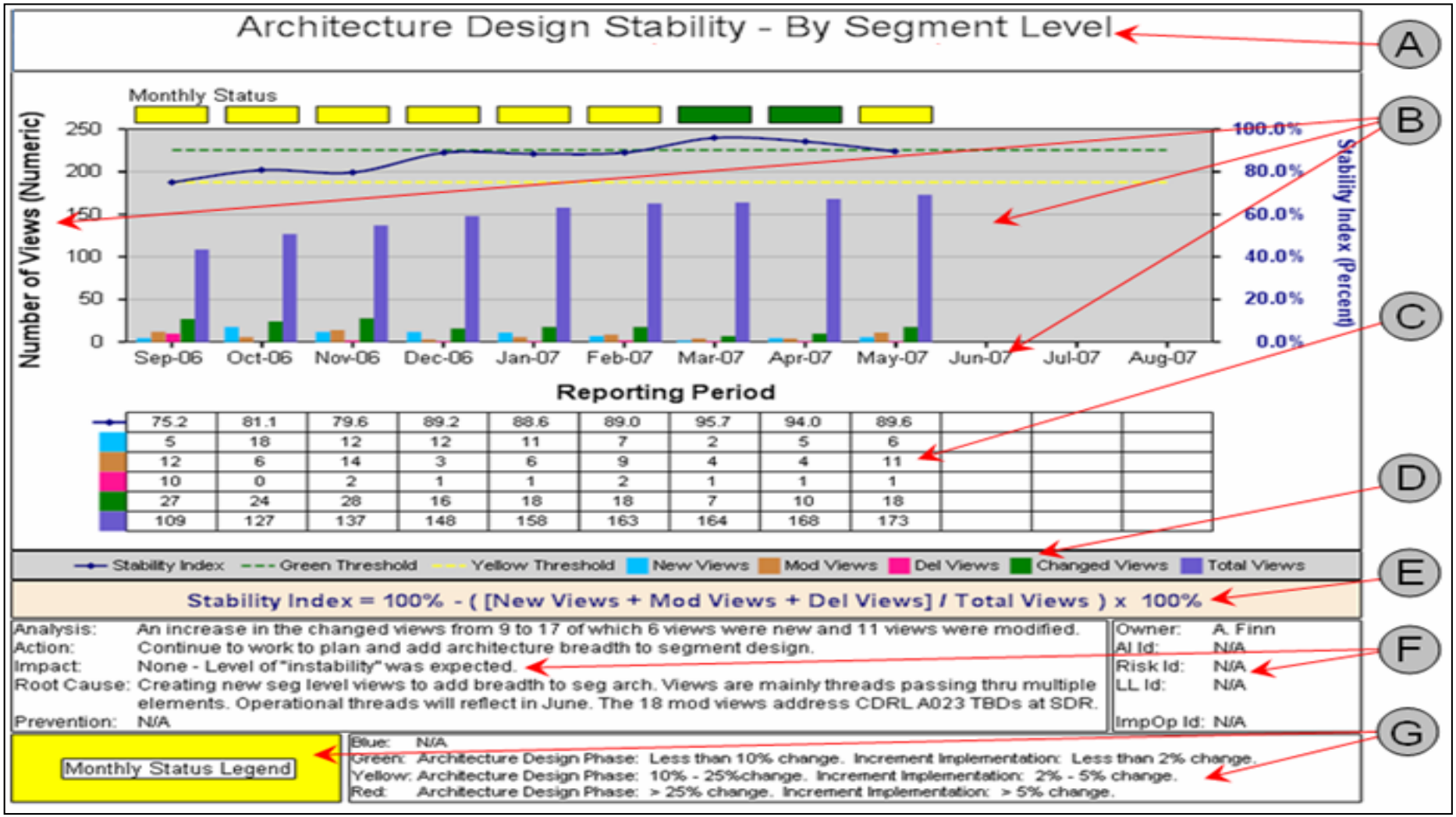
Supplemental Information

The Indicator – The Status Report



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The Indicator – The Status Report (Cond't)

Every Reporting Indicator is to contain the following attributes:

A. Report Title
B. Chart with clearly labeled horizontal and vertical axis
   - Horizontal axis to be a monthly time series display 12 months. Most charts show 9 previous months of history and 3 months forward looking for trending or predictive modeling.
   - Vertical axis may have one or two labels. All charts must have a Index Value (IV) axis which is displayed on the left side for single label charts and on the right side for double label charts.
   - Thresholds – Green and Yellow thresholds are mandatory and Blue is optional for all charts with an IV equation definition. Non IV equation charts are considered informational charts.
C. Measurement data table
D. Legend that clearly identified the names of all chart data values
E. Index Value (IV) equation definition
F. Analysis and Action Plan description fields
G. Reporting status with color status legend

The Indicator – The Status Report Hierarchy

Features	Measure/Measurement	Metric	Indicator
Attributes	• The process of measuring • A quantitative numeric value • Compare to standard/scale	• Calculated or derived values • Combination of one or more measures • A specific calculated or derived value is rated /evaluated	• A specific calculated or derived value is normalized into a Index Value (IV) • IV is compared to percent goals and/or thresholds
Description	• A measure is a quantified numeric value that is compared against an established defined standard.	• A metric is a meaningful combination of one or more measures that can be used for informed decision making.	• An indicator is a indexed metric value that is set to a prescribed state range.
Dimensions	• One Dimensional	• Two Dimensional (i.e. series of points)	• Two Dimensional + greater accuracy
Examples	• Source data (i.e. raw data) • A measured point in time • Planned effort, actual effort, planned duration, actual duration, number of defects, size, etc.	• A series of computed/measured points • Simple analysis is easily permitted (i.e. values are compared to set thresholds) • Effort variance, schedule variance, defect density, productivity, etc.	• A series of computed/derived points • More complex analysis is permitted (i.e. values are compared to derived limits or thresholds) • Effort variance Index, schedule variance index, defect density index, productivity index, etc.
Specific Example	• Distance (value) • Knowing a far one has travelled	• Velocity (rate with direction) • Calculated or derived value • Can estimate future distance travel with prior performance data	• Acceleration (change in velocity) • Complex calculated or derived value • Greater precision of future results at a specific point in time

The Indicator – The Status Report Hierarchy

Indicator

Additional Attributes include:

- **Index Value**
- **Changed percentage comparison**
- **One or more Thresholds / Goals comparison factors that increases the accuracy of the analysis**

KPI

The indicator is considered a Key Performance Indicator if it provides actionable information that is use to drive our programs and business.

Metric

Backward Looking

Leading

- **Uses past performance data and trend line**
- **Estimates future performance**

Lagging

- **Compares results with plan**
- **Uses past performance data**
- **Can identify what caused success and failure**

Forward Looking

Future values are supplied by users or Measurement POC (Point of Contact)

Measure

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The Indicator – The Status Report Types

Present/Current	Future
Backward Looking Charts • Lagging – compares past performance data results against planned	Backward Looking Charts • Leading – uses past performance data to create a future trend line that estimates the future performance/behavior/results
	Forward Looking Charts • Planned – compares user supplies future values to current and estimated derived or calculated values
Use: Identify causes of failures Detect factors leading to success	Use: Identify potential future failures Predict necessary changes

The Indicator – External References

Measure, Metric, Indicator
http://it.toolbox.com/blogs/dw-cents/measures-metrics-and-indicators-23543

Levels of Measurements
http://www.socialresearchmethods.net/kb/measlevl.php

About the Presenter – Salvatore R Bruno

Salvatore Bruno has more than 30 years experience in systems development, consulting and leadership of enterprise technology solutions for the defense contracting, telecommunications, and consulting industries. He is a leading authority on the creation and use of metrics. He has developed more than 300 unique metric measurements as well as the processes to automate data entry and extraction activities. Mr. Bruno has also created innovative measurement programs, such as the Scalometer and Statoport, and invented new measurement concepts like QPI (Quality Performance Index).

As the Engineering Process and Measurement Group Lead for Lockheed Martin's Labs and Technical Services (L&TS), he is responsible for overseeing process measurement and improvement to enhance program management throughout the organization. Prior to L&TS, Mr. Bruno supported 100+ programs with measurement practices and procedures and process improvements for the Information Systems and Global Solutions - Defense Organization.

Before Lockheed Martin, Mr. Bruno was a software engineer at Lawrence Livermore National Laboratory, a project manager at Pacific Bell, and held various management positions at technology consulting companies such as Embarcadero Systems Corporation, InfoGain, and Idapta. He has an M.S. in Systems Management from University of Denver as well as a B.S. in Mathematics and Computer Science from California State University, Hayward.

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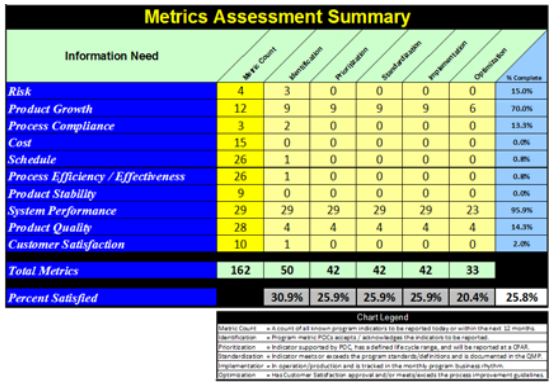
Artifacts and References

Metrics Maturity Stoplight Chart

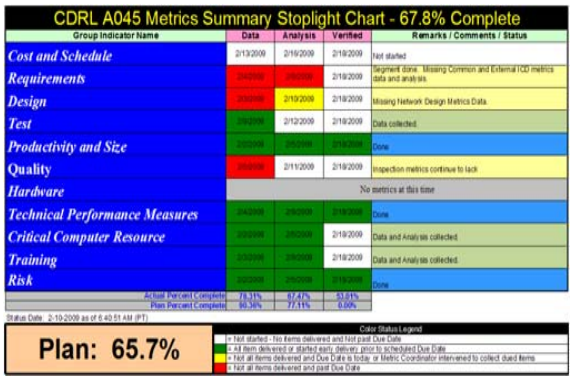


Metrics Assessment Summary

Information Need	Metric Count	Identification	Prioritization	Standardization	Implementation	Optimization	% Complete
Risk	4	3	0	0	0	0	15.0%
Product Growth	12	9	9	9	9	6	70.0%
Process Compliance	3	2	0	0	0	0	13.3%
Cost	15	0	0	0	0	0	0.0%
Schedule	26	1	0	0	0	0	0.8%
Process Efficiency / Effectiveness	26	1	0	0	0	0	0.8%
Product Stability	9	0	0	0	0	0	0.0%
System Performance	29	29	29	29	29	23	95.9%
Product Quality	28	4	4	4	4	4	14.3%
Customer Satisfaction	10	1	0	0	0	0	2.0%
Total Metrics	162	50	42	42	42	33	
Percent Satisfied		30.9%	25.9%	25.9%	25.9%	20.4%	25.8%

Chart Legend

Monthly Metrics Business Rhythm Stoplight Chart



CDRL A045 Metrics Summary Stoplight Chart - 67.8% Complete

Group Indicator Name	Data	Analysis	Verified	Remarks / Comments / Status
Cost and Schedule	2/13/2009	2/19/2009	2/19/2009	Not started
Requirements	2/4/2009	2/6/2009	2/19/2009	Segment done. Missing Common and External TCD metrics data and analysis.
Design	2/3/2009	2/19/2009	2/19/2009	Missing Network Design Metrics Data.
Test	2/6/2009	2/12/2009	2/19/2009	Data collected.
Productivity and Size	2/2/2009	2/6/2009	2/19/2009	Done
Quality	2/6/2009	2/11/2009	2/19/2009	Inspection metrics continue to lack
Hardware	No metrics at this time			
Technical Performance Measures	2/4/2009	2/6/2009	2/19/2009	Done
Critical Computer Resource	2/2/2009	2/6/2009	2/19/2009	Data and Analysis collected.
Training	2/2/2009	2/6/2009	2/19/2009	Data and Analysis collected.
Risk	2/2/2009	2/6/2009	2/19/2009	Done
Actual Percent Complete	78.3%	67.4%	53.8%	
Plan Percent Complete	90.3%	77.1%	0.0%	

Status Date 2-10-2009 as of 6:40:51 AM (PT)

Plan: 65.7%

Color Status Legend

QPI – Quality Performance Index

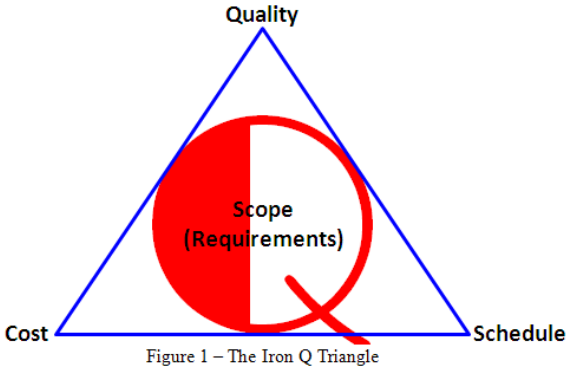
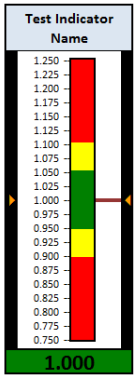


Figure 1 – The Iron Q Triangle

Statoport

Scalometer



Websites

Program Measurement Coordinators
https://eo-sharepoint-usonly-m.external.lmco.com/sites/P_M_C/SitePages/Home.aspx

OneSource Application
https://eo-sharepoint-usonly-m.external.lmco.com/sites/OneSource/SitePages/Home.aspx

Mindfray
http://www.mindfray.com/

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