

# Performance Measurement for Maritime Systems and Beyond

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**Diagnosing the Marine Transportation System: Measuring Performance and Targeting Improvement**

# Agenda

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- ❑ The Problem
- ❑ The Vision
- ❑ The *AID* Methodology
- ❑ Methodology Components
- ❑ Executing the Plan
- ❑ Introductory Example
- ❑ Marine Transportation System Example
- ❑ Lessons Learned

# The Problem

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- ❑ The past two decades have witnessed development and deployment of enterprise performance measurement systems (PMSs such as Balanced Scorecard and Performance Prism) far superior in scope to their predecessors
- ❑ New systems, for example, include notions such as customer satisfaction that complement traditional financially-driven systems
- ❑ Most PMSs still address *current* and *generalized* enterprise performance, ignoring future-oriented perspectives and instead focusing only on assessments of current state

# The Vision

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Much might be gained from an approach with which users can develop and deploy enterprise-specific PMSs needed to address enterprise-specific problems for any of the following purposes:

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## Enterprise Assessment, Improvement, and Design (AID) PMS Purposes

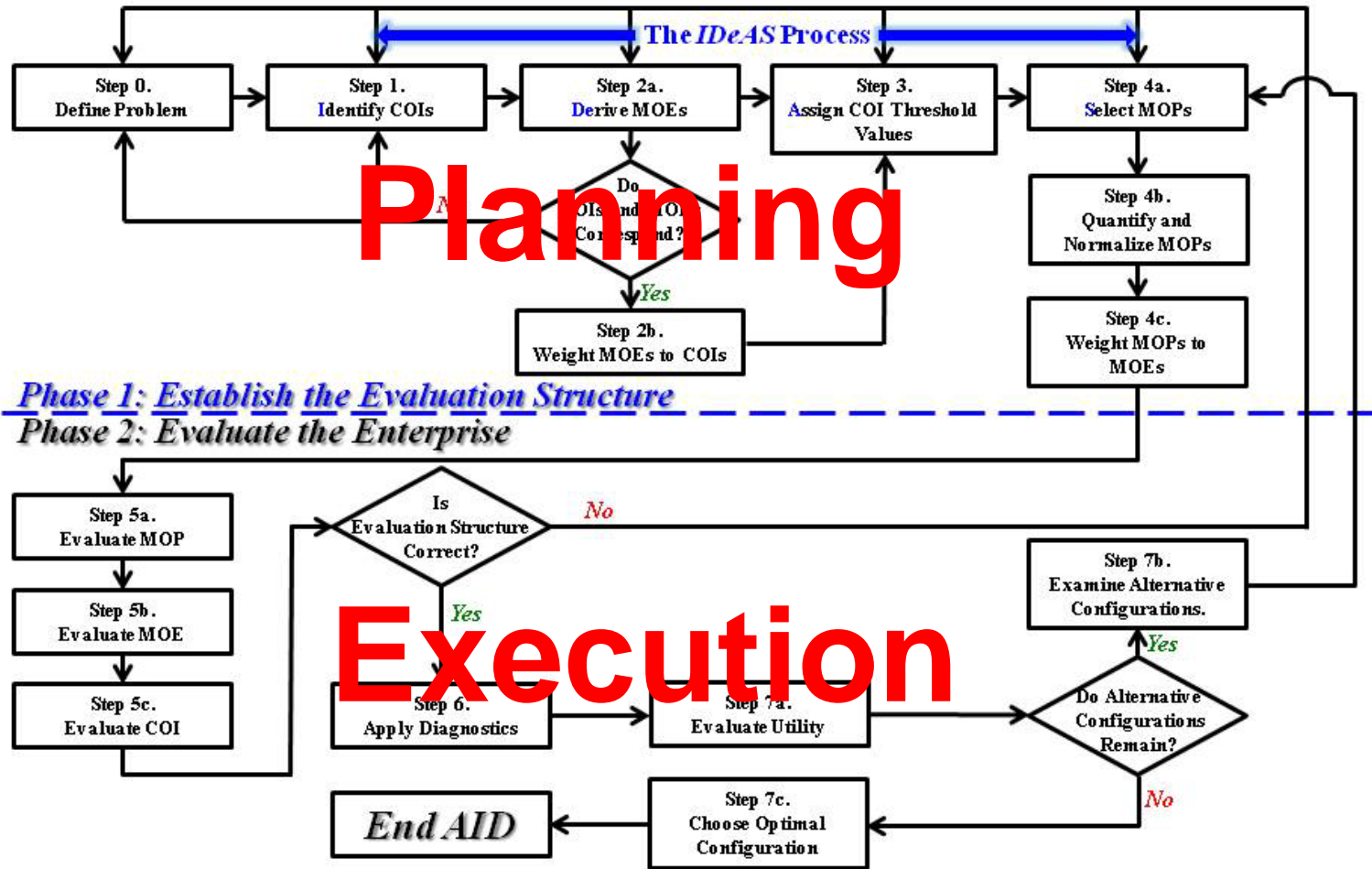
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Purpose	Description
<b>Assessment</b>	Evaluations of current enterprise performance with respect to stakeholder intent.
<b>Improvement</b>	Enhanced performance, likewise with respect to stakeholder intent, generated by evaluations of current enterprise configurations and associated processes versus those of projected alternatives.
<b>Design</b>	Wholly new combinations of enterprise configuration and process generated in response to stakeholder intent.

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Methodology details found in Hester, P.T., and Meyers, T. (2012). *Enterprise AID: A performance measurement system for enterprise assessment, improvement, and design* (NCSOSE-TR-12-001). Norfolk, VA: National Centers for System of Systems Engineering.

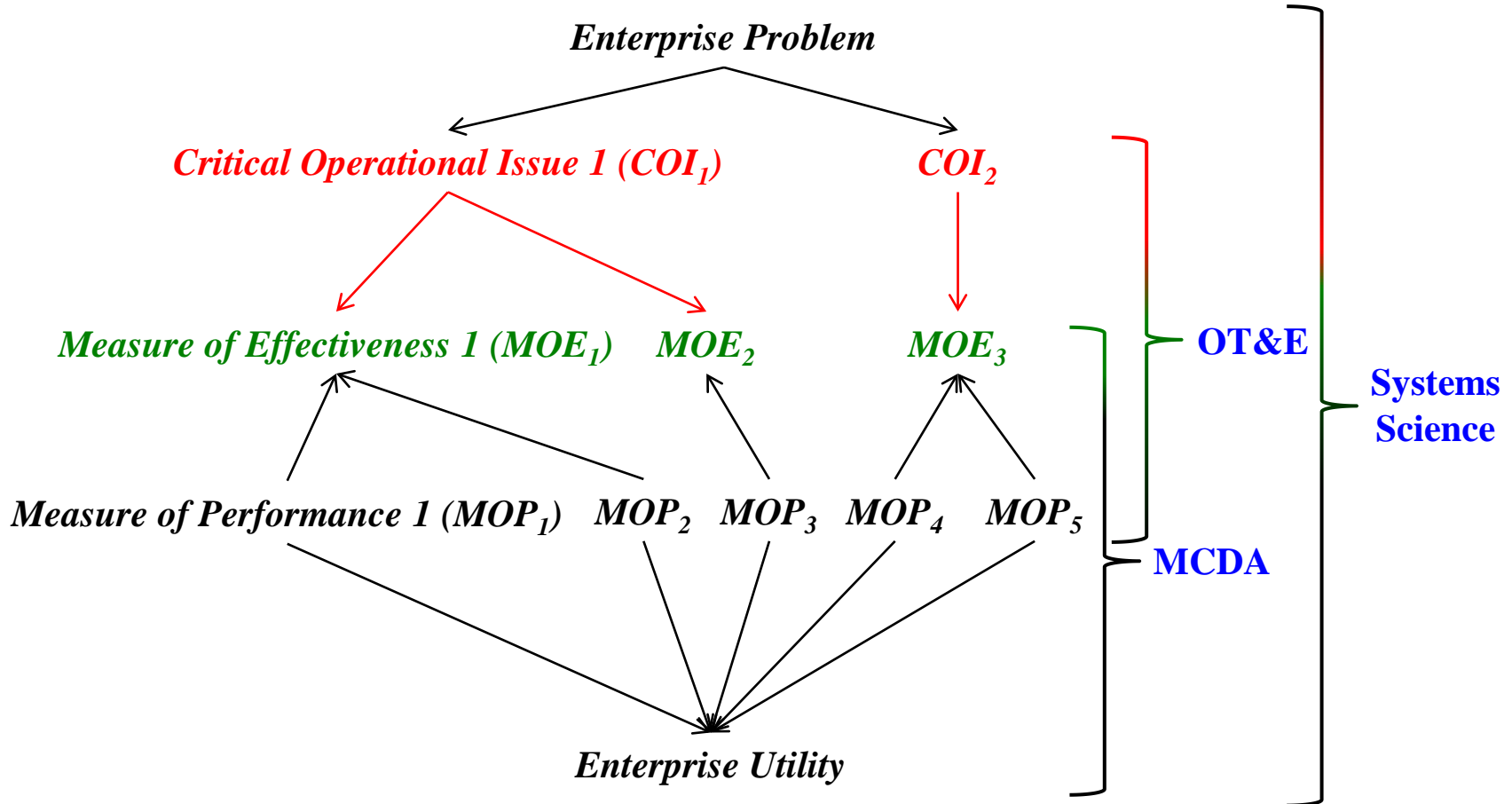
# The AID Methodology



Planning

Execution

# Methodology Components (Overview)



OT&E = Operational Test and Evaluation      MCDA = Multicriteria Decision Analysis

# Methodology Components (Systems Science)

Key Elements	Description
<b>Systems</b>	Collections of different elements that together produce results not obtainable by the elements alone.
<b>Complex Systems</b>	Sets of elements characterized by performance that emerges over time through interactions among the elements and between the system and its environment.
<b>Emergence</b>	A feature of systems that exhibit properties meaningful only within the context of the whole system, and not of its components.
<b>Emergent Properties</b>	Properties exhibited only by whole systems and not by any of those systems' components.

# Methodology Components (OT&E)

Key Elements	Description
<b>Critical Operational Issues</b>	Stakeholder needs identified in problems and that must be satisfied for problem resolution; emergent essentials of capability without which posited problem solutions must be judged as unacceptable on functional grounds.
<b>Measures of Effectiveness</b>	Standards derived by stakeholders from critical issues, independent of solutions proposed for issue resolution but representing emergent properties that induce rank orderings on the problem solutions that are proposed.
<b>Measures of Performance</b>	Evaluations of intrinsic functions of solutions proposed to resolve COIs, as measured against independently established effectiveness measures.

Definitions elaborated in Hester, P.T., and Meyers, T. (2012). *Enterprise AID: A performance measurement system for enterprise assessment, improvement, and design* (NCSOSE-TR-12-001). Norfolk, VA: National Centers for System of Systems Engineering.



# Methodology Components (MCDA)

A focus on the complex systems that are enterprises, as well as a strong dependence on eliciting the judgments of groups of individuals expert in particular enterprises and their needs, demands that the *AID* methodology respect certain pillars of what is broadly termed multicriteria decision analysis:

- ❑ **Scales of measurement** and, in particular, the ordinal and interval scales as classically defined by Stevens; and
- ❑ **Utility theory**, as originally codified by von Neumann and Morgenstern and later expanded with Savage's allowance for subjective evaluations and Keeney's endorsement of multiattribute utility functions.

# Executing the Plan

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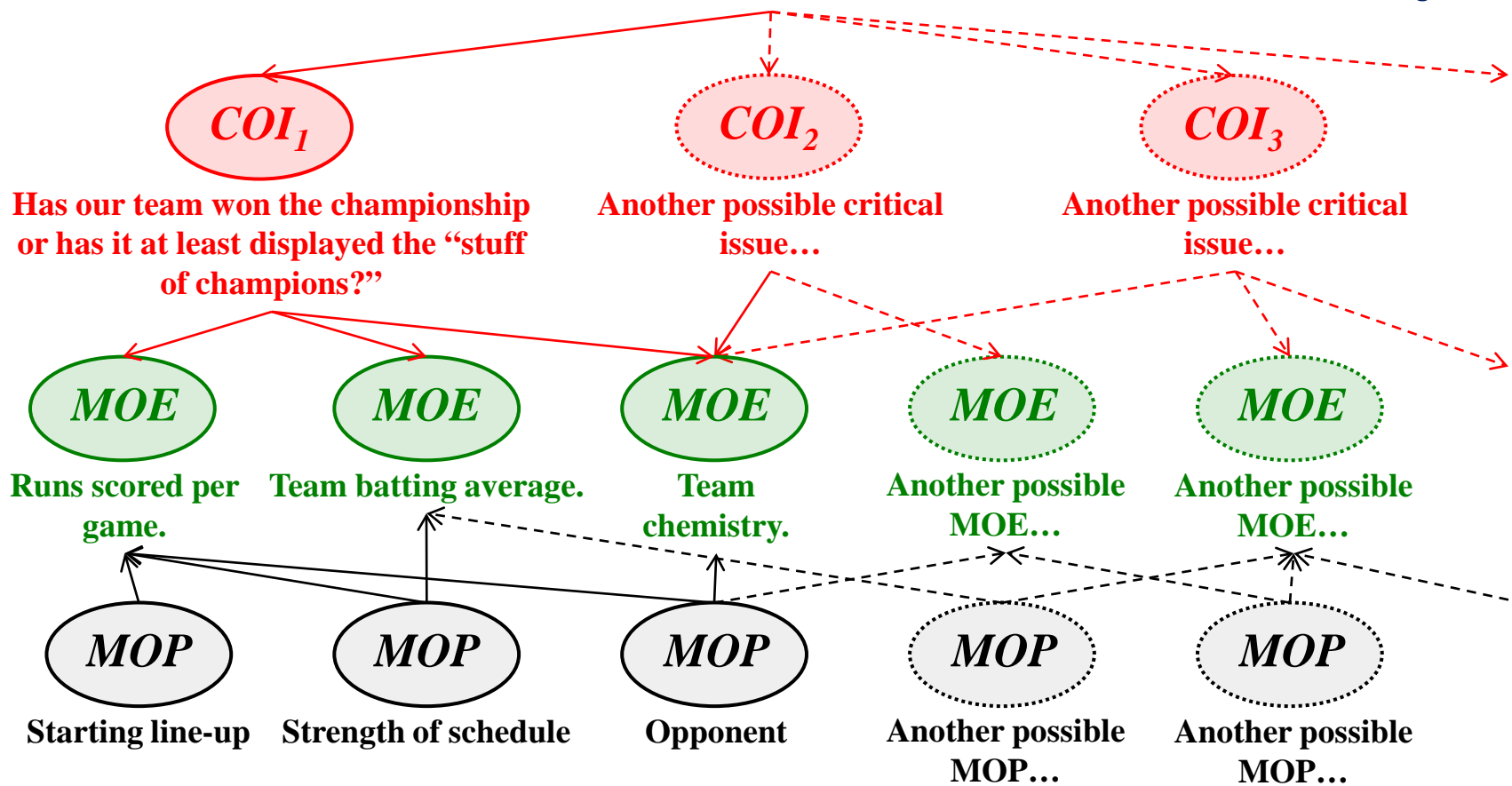
- ❑ Once stakeholders agree to a PMS structure, attention can turn to its execution
- ❑ A key feature of *AID* is the ability to diagnose any unresolved issues of enterprise performance
- ❑ Diagnostics may identify resolutions necessary for:
  - ❖ True deficiencies in enterprise performance
  - ❖ Deficiencies in evaluation structure (PMS) design
  - ❖ Improperly executing the PMS

# Introductory Example (America's Pastime)

## The Problem

A baseball team's rabid fan base wants "a winner."

Hester, P. T., Meyers, T. J., & Lin, J. W. (2012). Top-down versus bottom-up measurement: Why building a baseball team (or acquiring a system) using bottom-up stats is a really bad idea. *Defense AT&L*, Jul-Aug, 5-8.

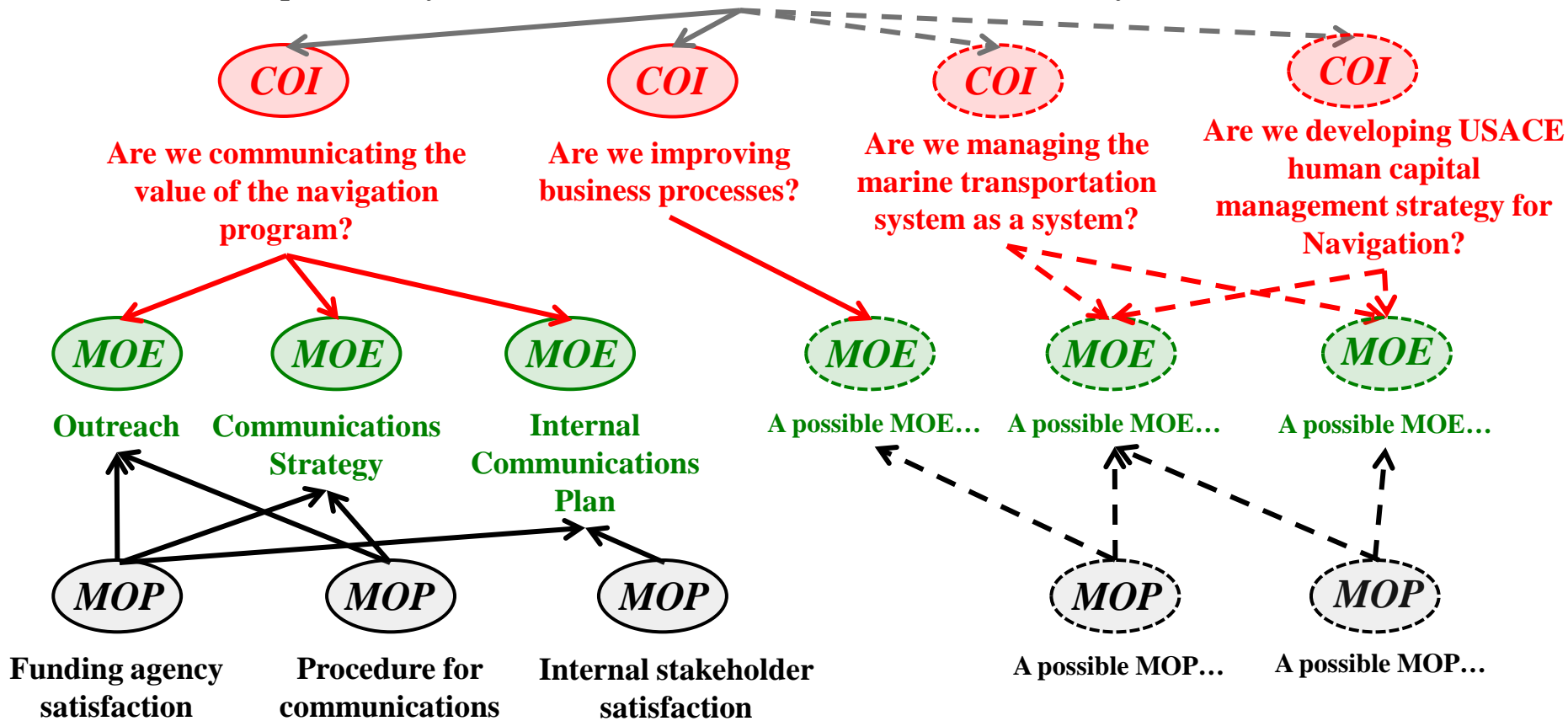


# Marine Transportation System Example

Adapted from USACE's *Navigation Strategic Vision* (February 2011)



**USACE Mission:** To provide safe, reliable, efficient, effective and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation.



# Lessons Learned

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- ❑ Problem statement identification and consensus is crucial
- ❑ Number of performance measures being tracked should be monitored carefully
- ❑ Visual aids are key to PMS development and situational awareness
- ❑ Simply having the conversation about an enterprise is often as valuable as the associated results
- ❑ PMSs require significant resources to set-up and maintain
- ❑ Well-constructed PMSs will serve as guides for future enterprise activities

Adapted from Hester, P.T. and Meyers, T.J. (2012). Lessons learned from designing a performance measurement system for a university research center. *Perspectives on Performance*, 9(3), 23-24.

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