



SE1

Integrating Systems Engineering (SE) and Program Performance Management (PPM) to Increase the Probability of Delivering Needed Capabilities for Project/Program Success

Glen B. Alleman
Tuesday 20 August 2019
1:10PM – 1:50PM



PROJECT AND PROGRAM MANAGEMENT SYMPOSIUM
 • Better Management • Better Projects



Quotes and References Attributed in Thursday's Workshop

Sobering Thoughts About Managing Complex Systems



NEW SYSTEMS MEAN NEW PROBLEMS

Unconstrained System – a collection of component systems, simple or complex, managed, operated, developed, funded, maintained, and sustained independently of its overarching principal system that creates a new capability.

Complex System – a collection of large, multifaceted, and interrelated component systems that are dependent on the entirety of the principal system for management, operations, development, funding, maintenance, and sustainment.
Complex systems are non-deterministic, adaptive, holistic, and with nonlinear interfaces between attributes.

IN COMPLEX SYSTEMS, MALFUNCTION AND EVEN TOTAL NON-FUNCTION MAY NOT BE DETECTABLE FOR LONG PERIODS, IF EVER

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Systems Engineering and Project Performance Management Both Needed For Success

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Connecting the dots between Systems Engineering and Project Performance Management starts with Shared Data and Processes

PGCS 2019 Key Note, Canberra Australia

Seeing the Three Phases of *Project as a Whole* is the Foundation of Systems Thinking

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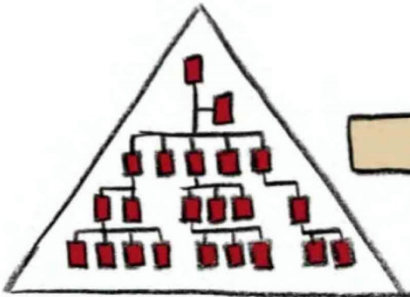
Systems Thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns rather than static 'snapshots.' Systems Thinking is a discipline for seeing the 'structures' that underlie complex situations. [182]

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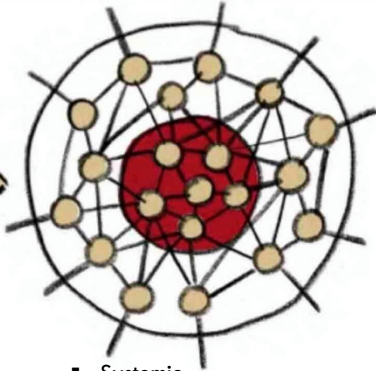
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Introduction

Transformation Context of SE + PPM



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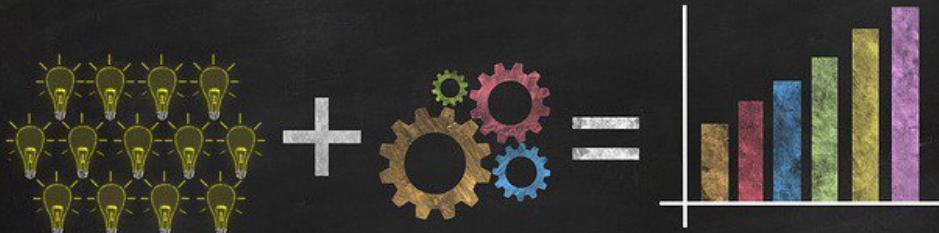


- Mechanistic
- Differentiated
- Work the people
- Top-Down, Managed
- In Parallel
- Efficiency Oriented

- Systemic
- Integrated team based
- Work the work
- Outside-In, Lead
- Each Other, for Each Other
- Complexity, Robust

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For each Idea on Integrating Systems Engineering and Project Management,
We Need to Assess the Idea with Measures of Effectiveness and Measures of Performance, to see How These Increases the Probability of Project Success



We need both Efficiency (Cost, Schedule, Requirements) and Efficacy (Capabilities, Effectiveness, and Performance) of the Project Success

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Introduction

Roles of PPM and SE

Systems Engineer

- Focused on the Business Solutions that deliver Capabilities
 - What are they?
 - How are they assembled?
- Responsible for defining, designing, and delivering this solution that meets:
 - Measures of Effectiveness and Performance ^[105]
 - Measures of Performance Key Performance Parameters
 - Key System Attributes

Project Manager

- Focused on the Business Requirements
 - When are these needed?
 - How much will they cost?
- Responsible for designing and operating the control system that manages the work associated with the solution that meets:
 - Technical Performance Measures (TPM)
 - Quantifiable Backup Data (QBD)

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Introduction

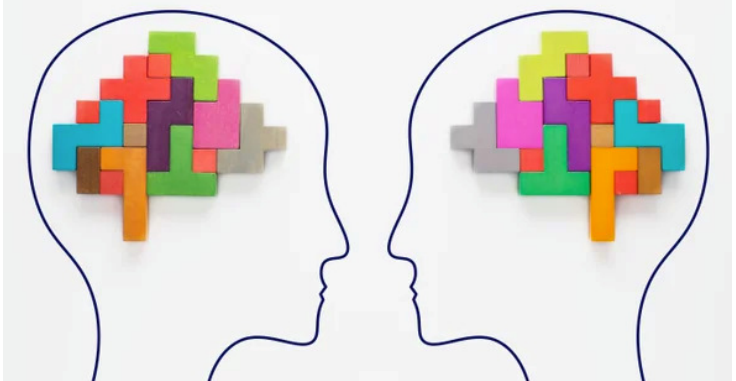
Integrating Systems Engineering and Project Performance Management

Project Performance Manager

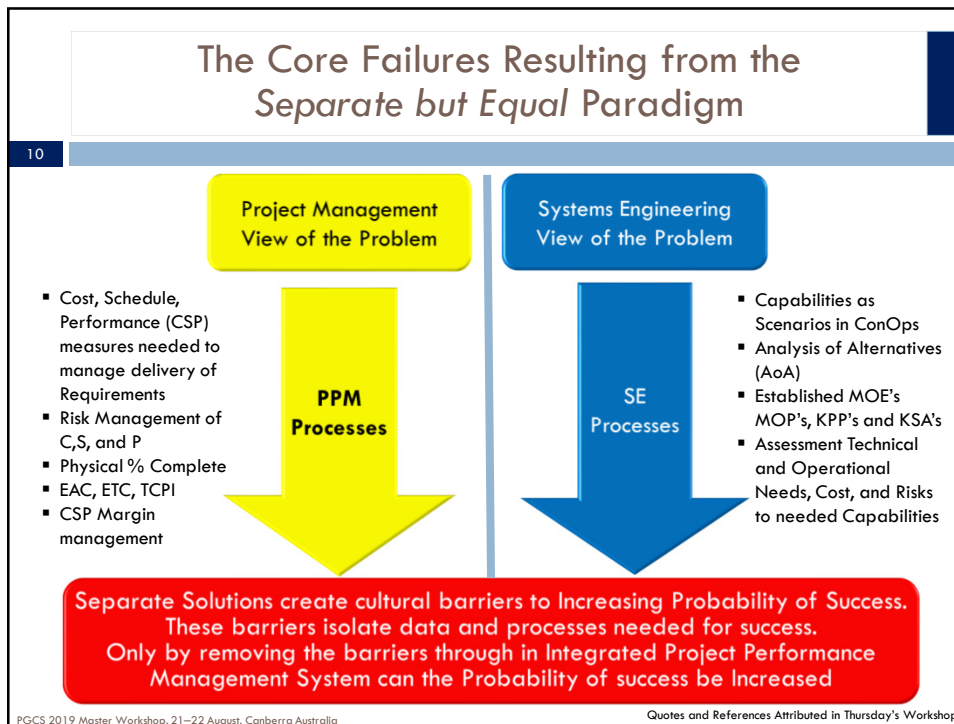
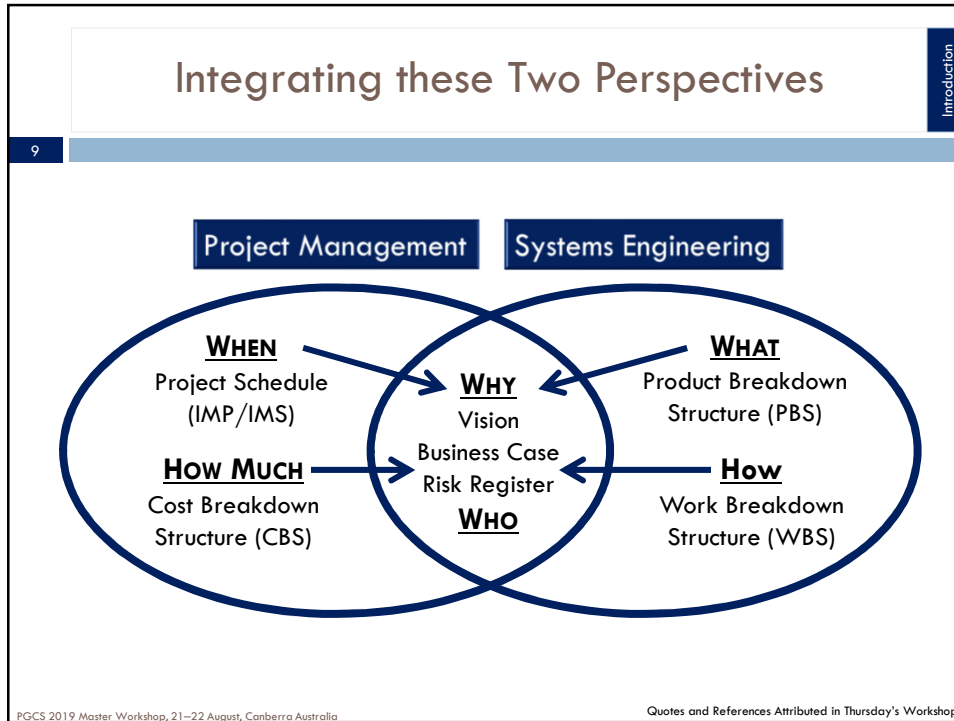
- Focused on Business Requirements
 - How Much and When
- Responsible for designing and operating the project control system to manage work that produces the system

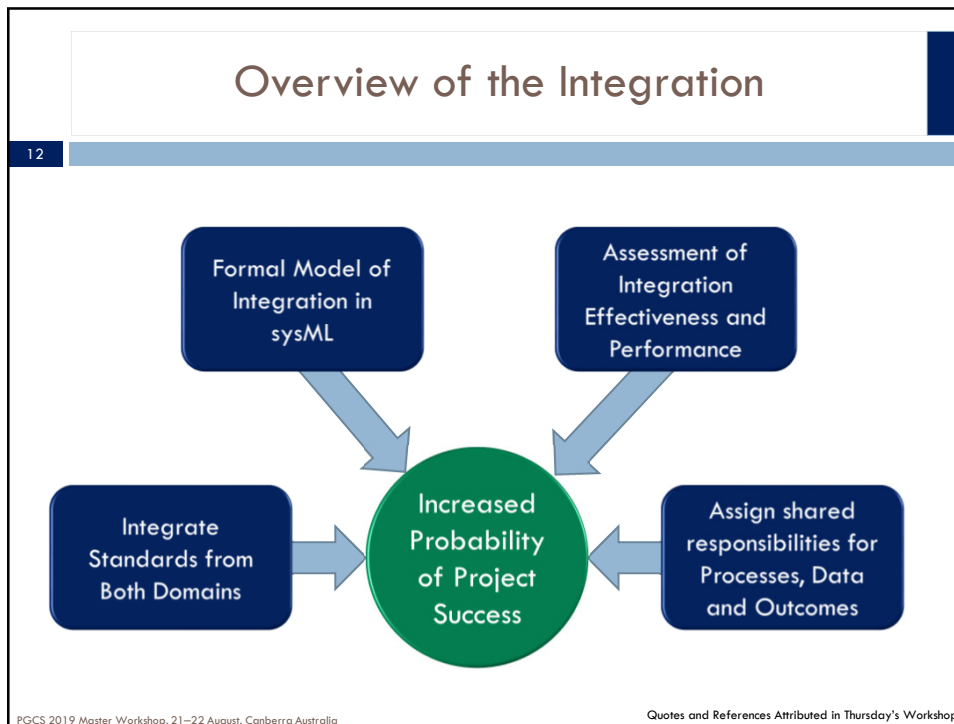
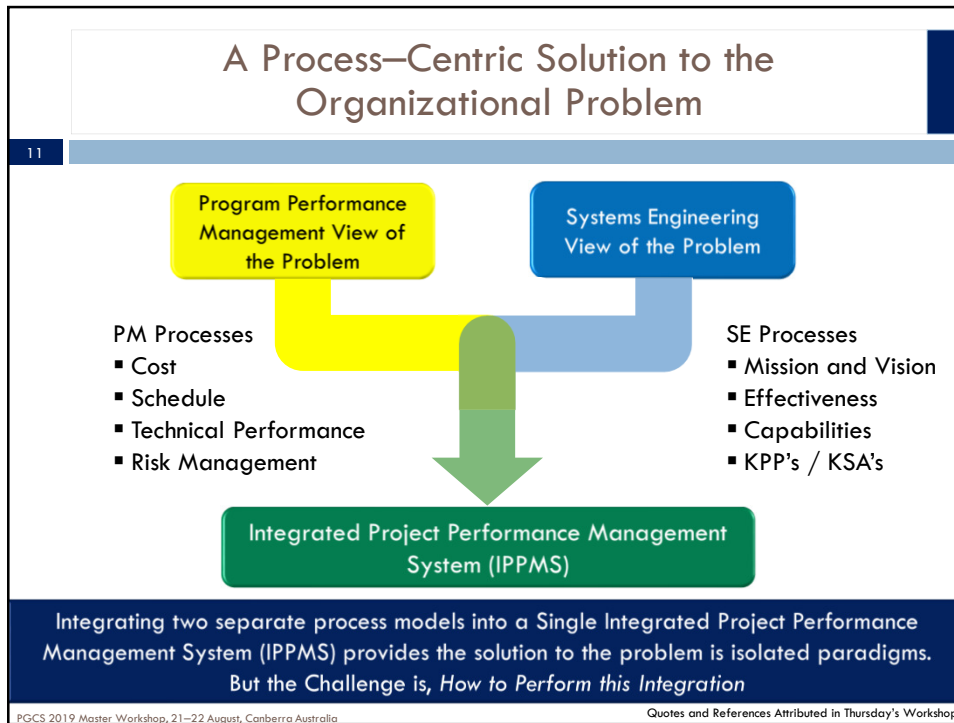
Systems Engineer

- Focused on Business Requirements
 - How Much and When
- Focused on Business Solution
 - What and How
- Responsible for Defining, Designing, and Delivering the Solution



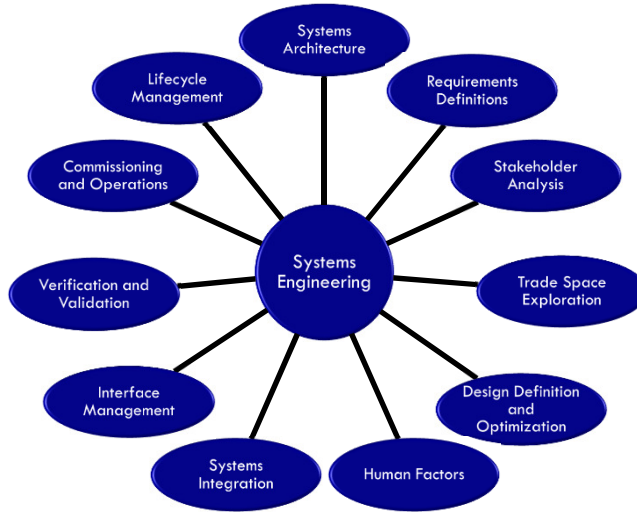
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The World of *Engineered Systems*

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The World of Project Management

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Motivation for Integrating SE and PPM starts with 4 Known Root Causes of Project Failure

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Unrealistic Performance Expectations, with missing Measures of Effectiveness (MOE) and Measures of Performance (MOP).

Unrealistic Cost and Schedule estimates, based on inadequate risk adjusted growth models.

Inadequate assessment of risk and unmitigated exposure to these risks without proper handling plans.

Unanticipated technical issues without alternative plans and solutions to maintain effectiveness of the product or service.

"Borrowed" with permission from Mr. Gary Bliss, Director Performance Assessment and Root Cause Analyses, Office of Assistant Secretary of Defense for Acquisition, Technology, and Logistics.

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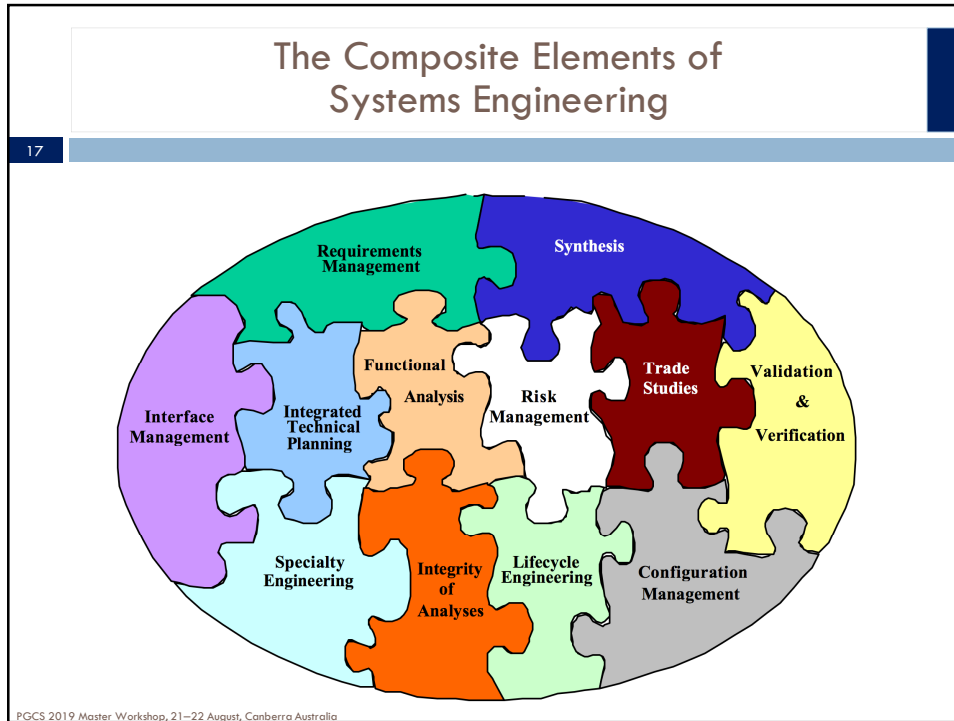
System Engineering *Connects the Dots* Between all the Project Information

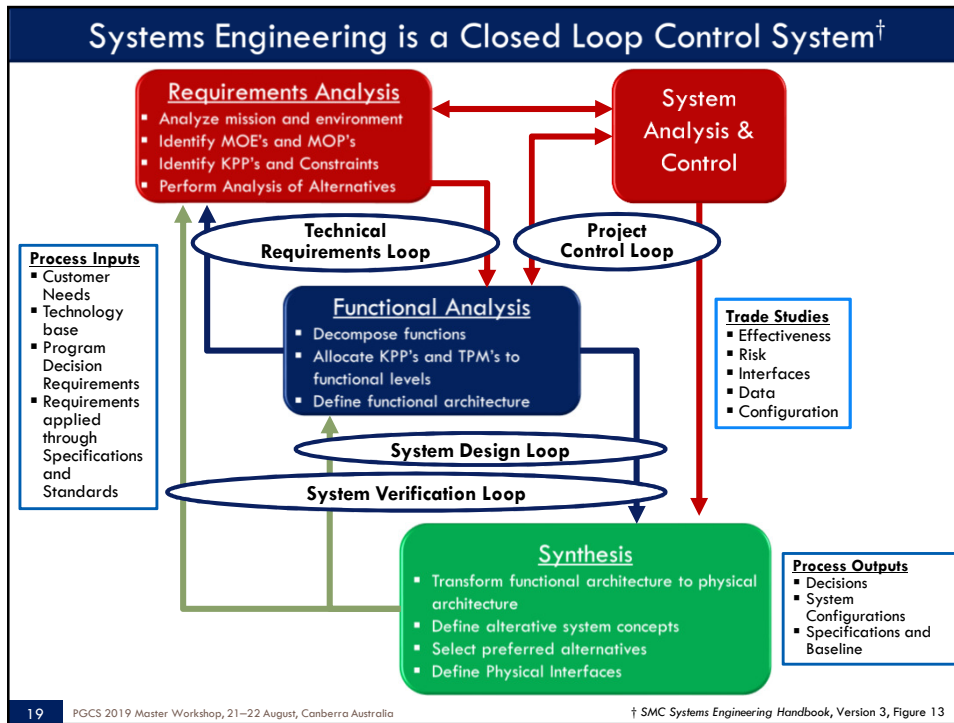
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- Stakeholder Needs
- Use Cases
- Operational Scenarios
- Stakeholder Requirements
- System Requirement
- Interfaces
- System Architectures
- Verification Objectives
- Test Cases

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Summary of These Concepts

SE Principles

Requirements Analysis Loop	System Analysis and Control Loop	Verification Loop	Synthesis
<ul style="list-style-type: none"> <input type="checkbox"/> Mission and Environment Analysis <input type="checkbox"/> Performance Requirements and Design Constraints Definition and Refinement <input type="checkbox"/> Functional Requirements Identification 	<ul style="list-style-type: none"> <input type="checkbox"/> Progress Measurements <input type="checkbox"/> Performance Analysis <input type="checkbox"/> Control and Manage <input type="checkbox"/> Select Preferred Alternatives 	<ul style="list-style-type: none"> <input type="checkbox"/> Lower Level Decomposition <input type="checkbox"/> Define, Refine, and Integrated Functional Architecture <input type="checkbox"/> Allocate Requirements to all Functional Levels <input type="checkbox"/> Define, Refine Internal and External Interfaces 	<ul style="list-style-type: none"> <input type="checkbox"/> Transform Architecture from Functional to Physical <input type="checkbox"/> Define Alternate Product and Process Solution <input type="checkbox"/> Define Alternate System Concepts, CI's, System Elements <input type="checkbox"/> Define, Refine Internal and External Interfaces

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The objective of Systems Engineering is to assure the system is designed, built, and operated to accomplish its purpose in the most cost-effective way possible, considering performance, cost, schedule and risk.

A *system* is a collection of different elements that together produce results not obtainable by the elements alone.

Systems Engineering is the art and science of developing an operable system capable of meeting requirements within imposed constraints.

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SMC Systems Engineering Handbook, Version 3

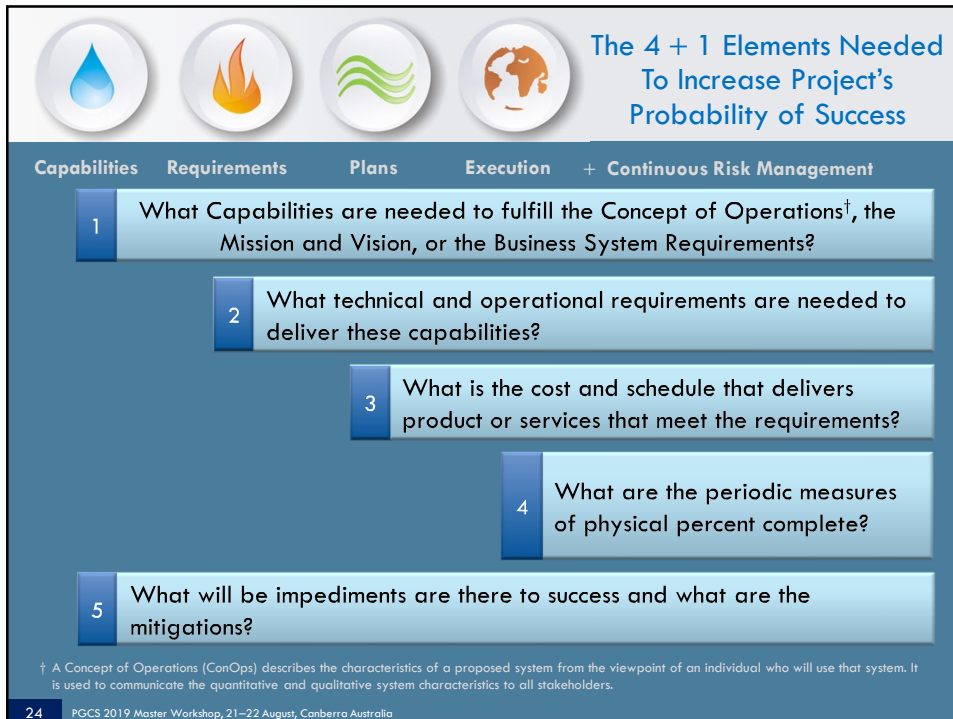
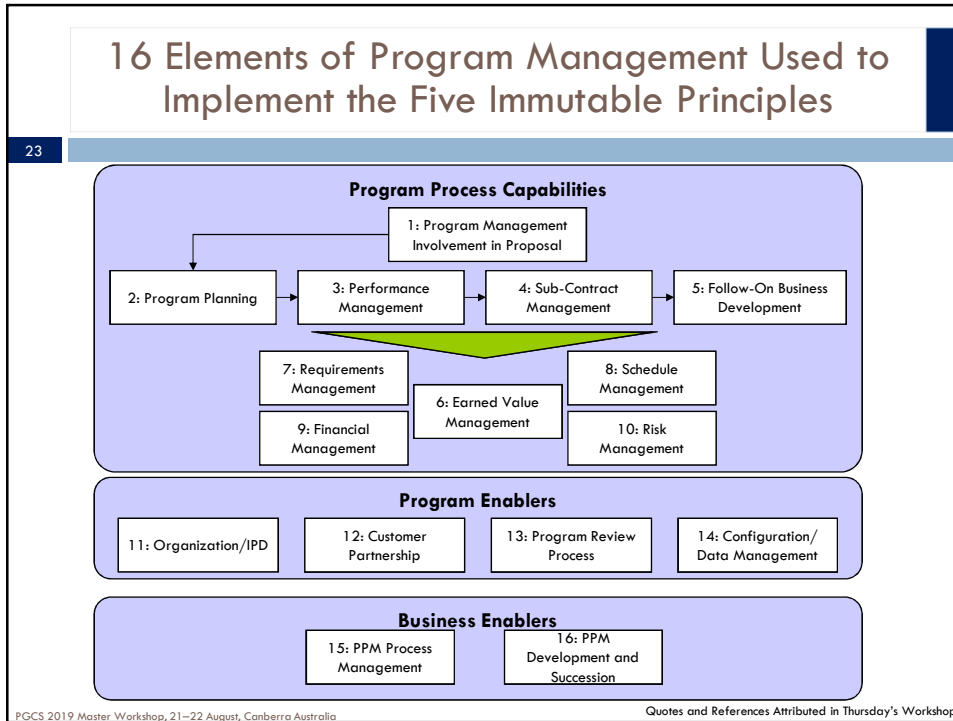
All Successful Projects Require Credible Answers To These 5 Immutable Principles ^[59] ...



1. What Does **DONE** Look Like?
2. How Do We Get to **DONE**?
3. Is There Enough Time, Money, and Resources, To Get to **DONE**?
4. What Impediments Will Be Encountered Along The Way to **DONE**?
5. What Units of Measure are used to confirm Progress To Plan Toward **DONE**?

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The Notional Project

Notional Project

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- We work for an Unmanned Aerial Vehicle (UAV) firm entering the ranching and farming marketplace.
- We know how to build complex equipment, including flying machines, electronics, and training systems for government agencies.
- We now want to do the same for farmers and ranchers.

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