International Council on Systems Engineering
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Integrated Product Development shared management by Systems Engineers and Project Managers

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Context

- IW2023 PM-SE Integration WG
- Strategic Technical Management
- Pain Points
- Lifecycle Development Approaches
- A life cycle from a PM's POV (Project Start-Project End) is defined differently than from the SE's POV (system concept to system retirement).
- But there is a "shared space" where SEs and PMs must collaborate…'' INCOSE Hdbk

Introduction

- Templates list the responsibilities of SE and PM.
- Processes with shared responsibility.
- But how should the involvement of each specialist be in these processes?
- How do we define roles and responsibilities in the development of a product?
- How should SE and PM interact to properly manage activities in shared processes?

Integrated Product Development

- IPD integrates processes, planning, organization and facilitating tools (software and techniques).
- The practice of IPD aims to ensure that the entire scope is considered integrally, simultaneously and efficiently, throughout the development effort. (Araujo, 2000)
- "A structured way to maximize the contribution of people, processes and tools to achieve product optimization" Holmberg (2000), Saab

Systems Engineer's POV focus

- SE processes clarify needs and document in CONOPS and OPSCON to record functional requirements.
- Needs are transcribed into requirements allocated to product systems, proposed architecture, and conceptual design definition.
- Consider the entire system lifecycle, as well as evaluate technological challenges and vendors to support a make-or-buy decision. INCOSE (2023)

Project Manager's POV focus

- Planning, execution, monitoring, control and closure of projects. (Srivastava & Kaufman, 2023)
- Program performance and delivery benefits, including high-level financial and budget requirements.
- Fast track methodology: Begin a component design before the entire program design has been completed. Prioritizing an activity that brings clear benefits.
- Definition of the program, delivery of program benefits, and termination of the program. (Rebentisch, 2017).

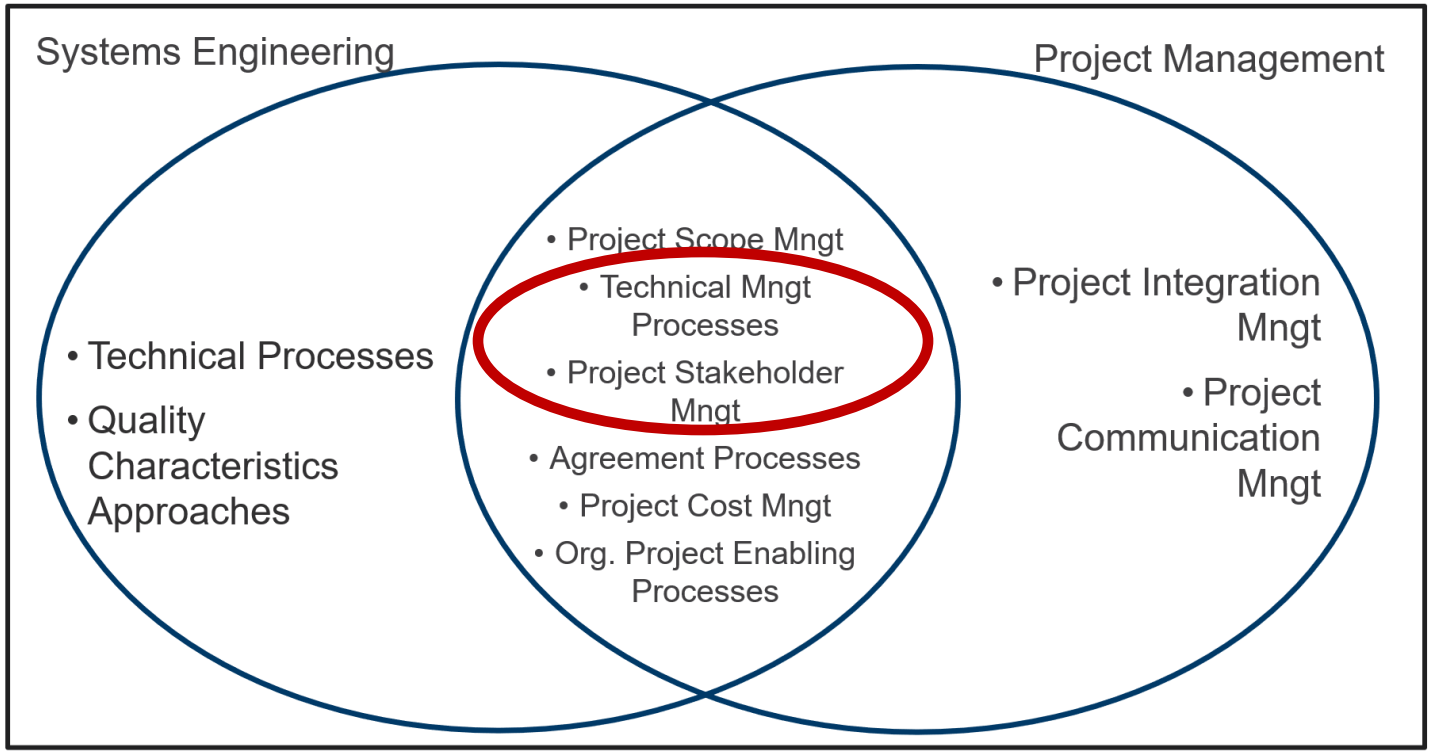
Benefits of shared space

- Integration should occur since the initial stage of the program and continue throughout the program. (Rebentisch, 2017).
- Fosters collaboration and trust (Rebentisch).
- In line with the set of environmental, social, and governance standards.
- PM and SE work together defining the system life cycle and planning the key decision gates to meet their specific needs. (Rebentisch, 2017).

Benefits of shared space

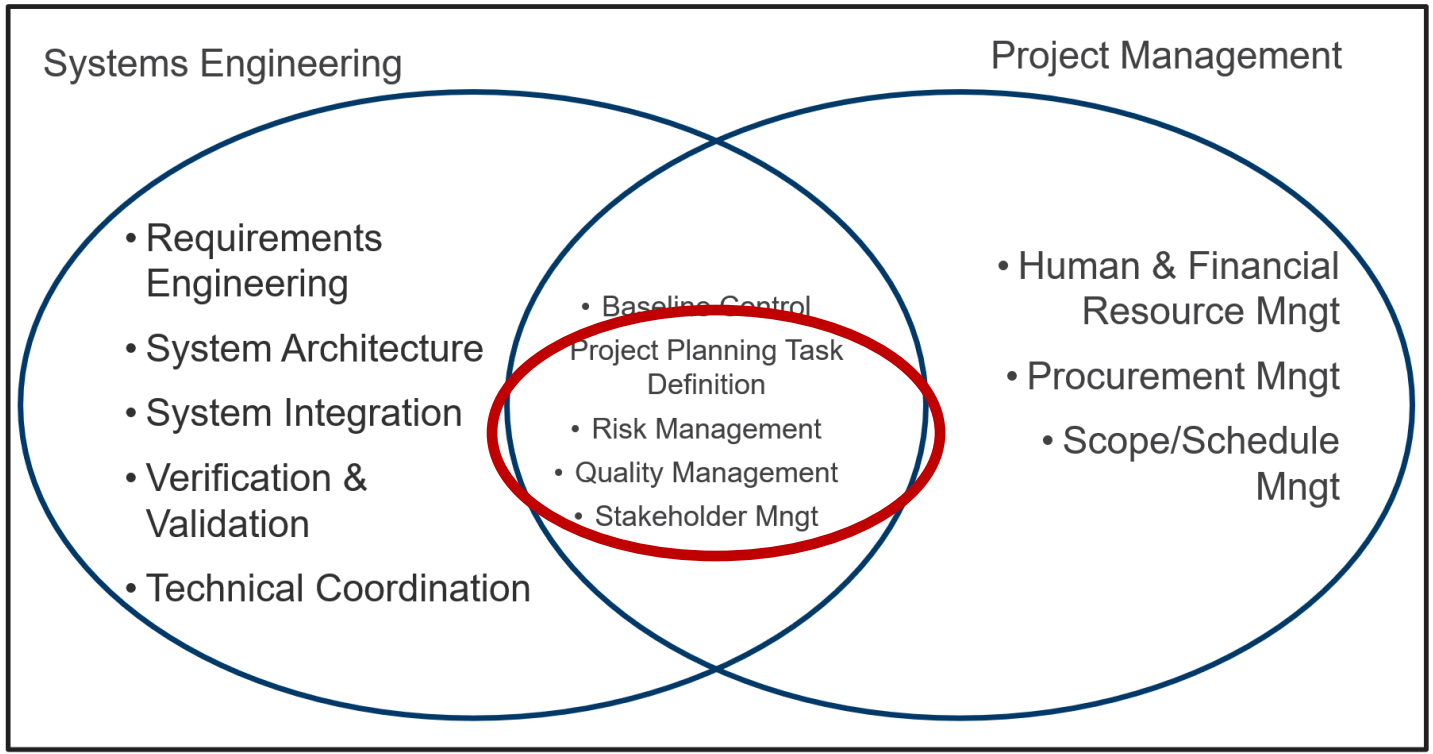
- Create a shared set of goals, clear roles, respect the value of the role and contribution of others,
- Value and promote "collaboration" over competition. (Rebentisch, 2017)
- Developing a cohesive organizational culture helps employees share goals beyond critical boundaries,
- Improve clarity around the organization's "big picture." (Rebentisch, 2017)

Shared space Models



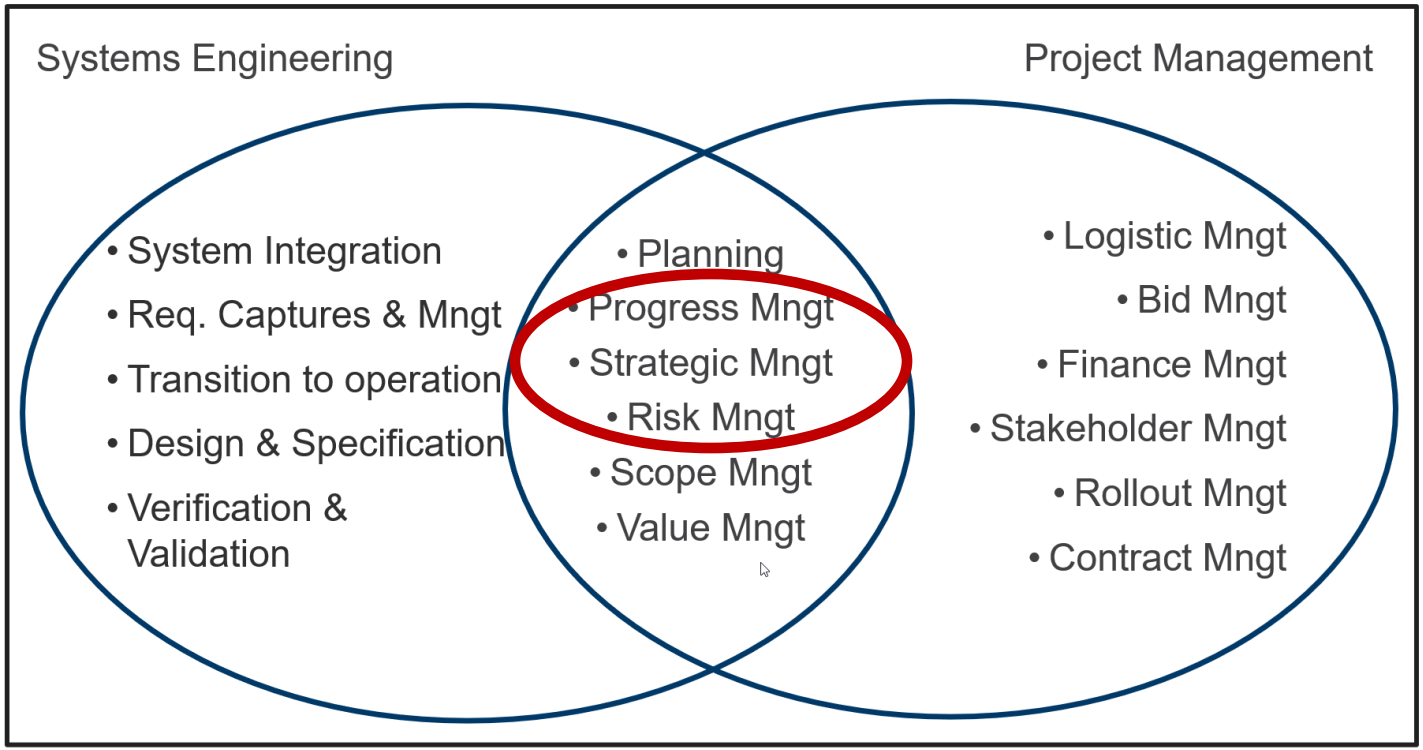
Shared Space SE & PM (adapted from INCOSE 2023)

Shared space Models



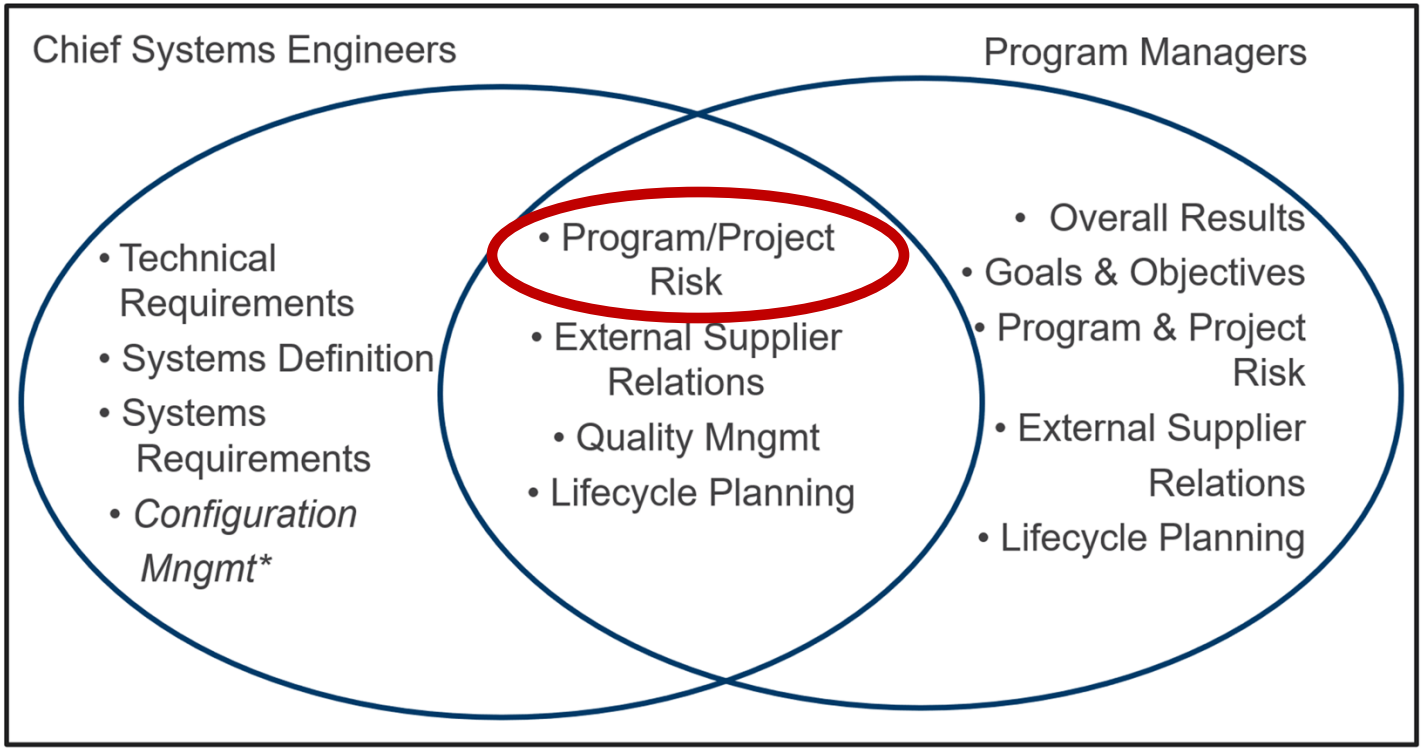
Shared Space SE & PM (adapted from Hahn & Hodges, 2019)

Shared space Models



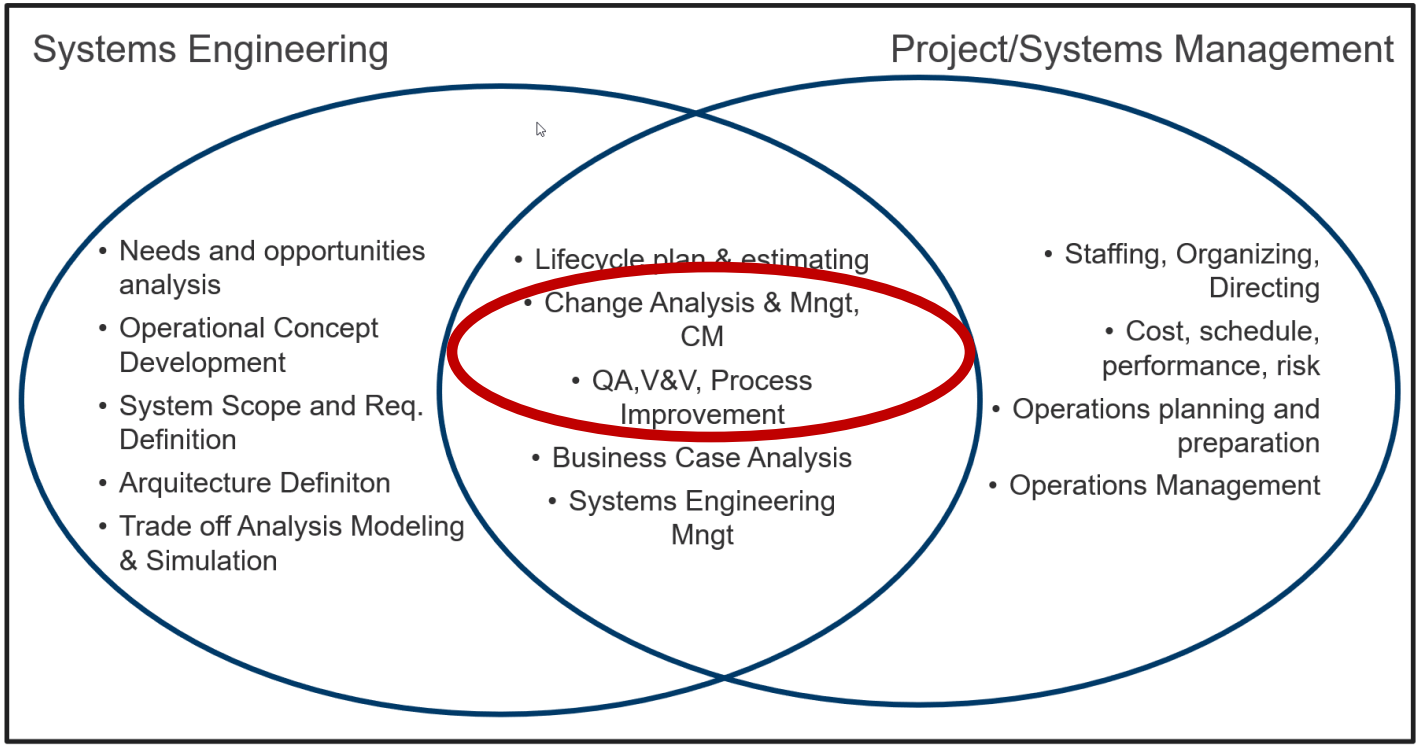
Shared Space SE & PM (adapted from Srivastava & Kaufman, 2023)

Shared space Models



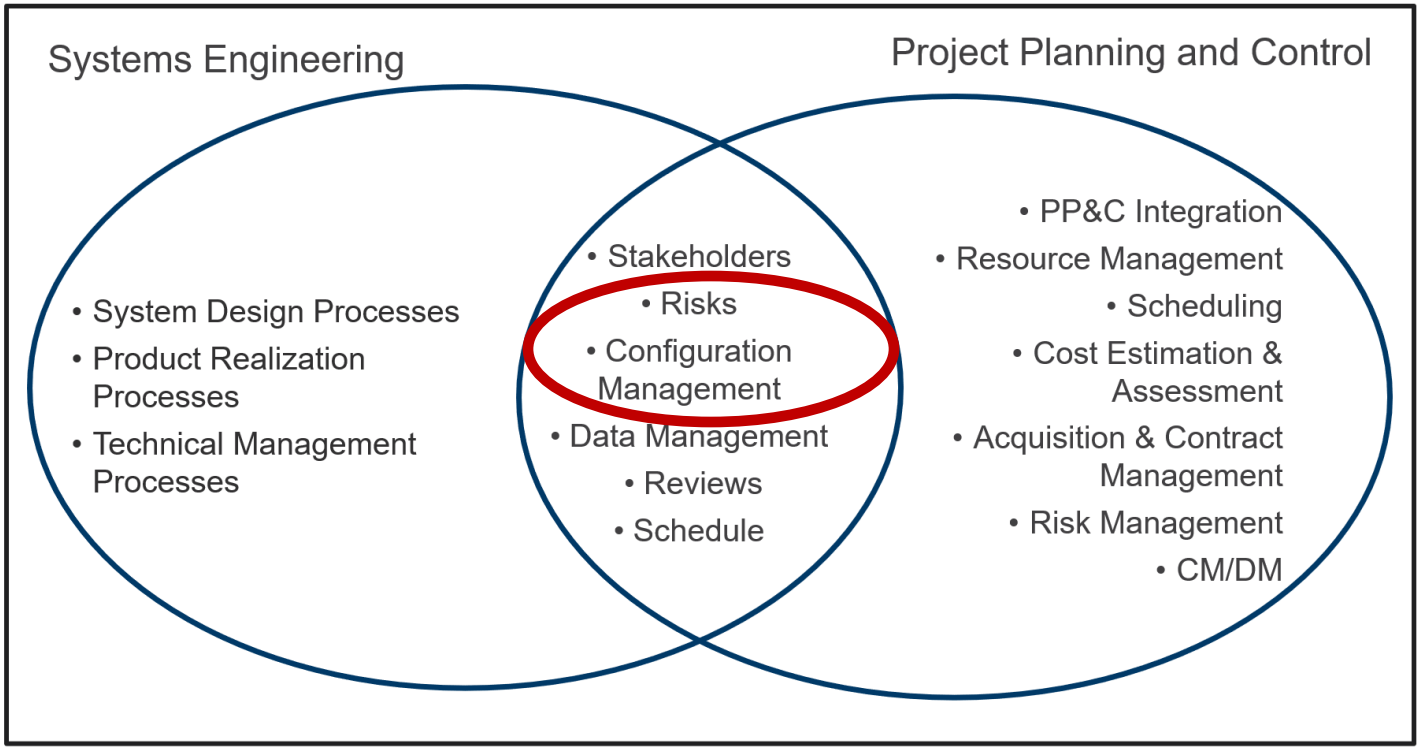
Shared Space SE & PM (adapted from Conforto et al., 2013)

Shared space Models



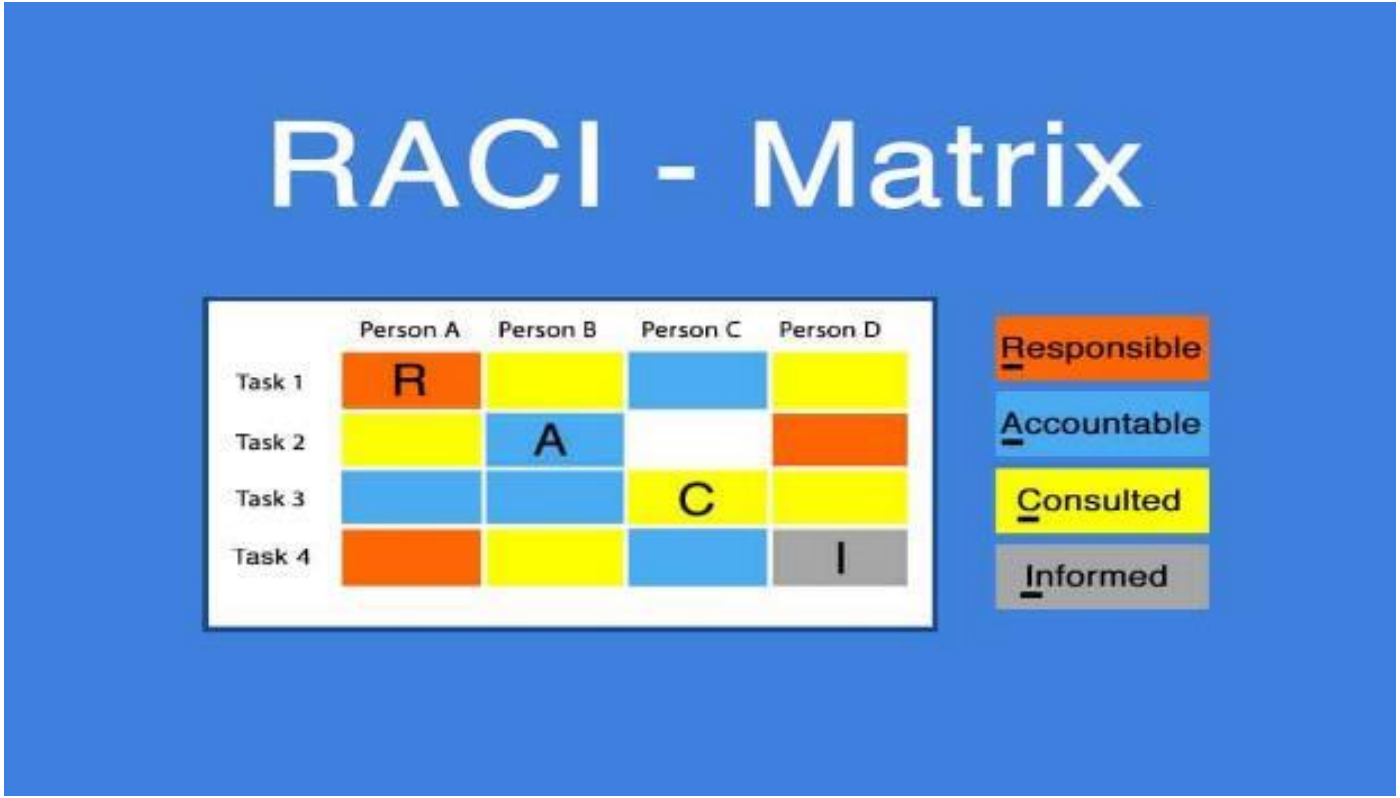
Shared Space SE & PM (adapted from SEBoK, 2024)

Shared space Models



Shared Space SE & PM (adapted from NASA, 2016)

Role and Responsibility Matrix Template



Role and Responsibility Matrix Template

- R = Responsible – person who coordinates or leads the activity.
- A = Accountable - the person who will sign off on the work and judge its completion and how it meets quality standards.
- C = Consulted - the person who has the ability or knowledge needed to complete the work.
- I = Informed - people who must be kept informed of the work, but not necessarily consulted.

Role and Responsibility Matrix Template

RASCI Matrix:

- S = Supportive – person who can support and carry out part of the activity. Usually has an interest in the result of the activity aligned with the interest of the Responsible.

Role and Responsibility Matrix Template

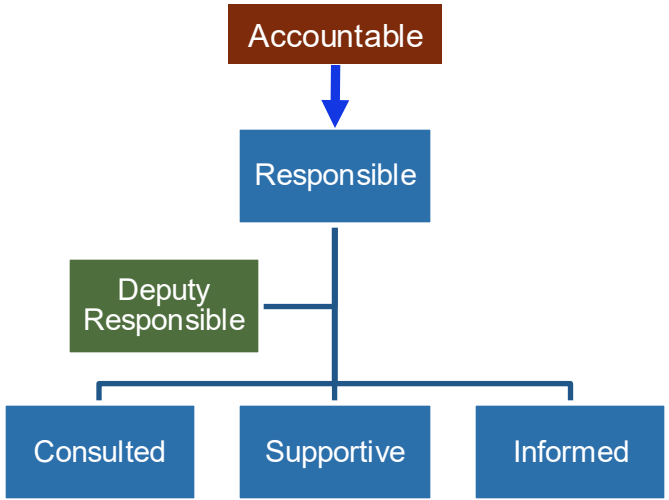
- What happens to an activity that is equally assigned to two assignees?

Conflicts!!

Ineffective leadership

Role and Responsibility Matrix Template

- Therefore, the matrix was expanded with the creation of a new definition:
- RASCID Matrix:
- D = Deputy Responsible – person who is not the coordinator or leader of the activity, but is responsible for part of it and must act in strict coordination with the Responsible.



Summary of SE&PM shared space responsibilities

Processes	INCOSE SE HDBK V.5	Los Alamos / Sandia	Tensions and Oppor-tunities PM-SE	Survey report	SEBOK V2.11	NASA SE HDBK
Requirements Engineering	SE	SE	SE	SE	SE	SE
System Architecture	SE	SE		SE	SE	SE
Technical Coordination		SE				SE
Systems Integration		SE	SE		SE	SE
V & V	SE	SE	SE		SHARED	SE
Design and Specification	SE		SE	SE		SE
Transition to Operation	SE		SE			SE
Planning	SHARED	SHARED	SHARED	SHARED	SHARED	PM
Baseline Control/ Config Mngt	SHARED	SHARED		SE	SHARED	SHARED
Risk Management	SHARED	SHARED	SHARED	SHARED	PM	SHARED
Quality Management	SHARED	SHARED		SHARED		
Stakeholder Management	SHARED	SHARED	PM			SHARED
Financial Resource allocation and Mngmt	SHARED	PM	PM	PM	PM	PM
Procurement Management (BID)	SHARED	PM	PM	SHARED		PM
Scope Management	SHARED	PM	SHARED	PM		
Schedule Management	SHARED	PM			PM	SHARED
Contract Management			PM	PM		PM

RASCID MATRIX

Responsibility predominantly of the SE

Processes	Literature Indication	RASCID Indication	Systems Engineering	Chief Engineer	Project Manager	Program Manager	Area Specialist	Area Specialist Leader
Requirements Engineering	SE	SE	R	A	S	I	S	I
System Architecture	SE	SE/ Specialist	R	A	C	I	D	S
Technical Coordination	SE	SE	R	A	S	I	S	C
Systems Integration	SE	SE	R	A	S	I	S	C
V & V	SE	SE/ Specialist	R	A	S	I	D	S
Design and Specification	SE	SE	R	A	S	C	S	C

RASCID MATRIX

Responsibility predominantly of the PM

Processes	Literature Indication	RASCID Indication	Systems Engineering	Chief Engineer	Project Manager	Program Manager	Area Specialist	Area Specialist Leader
Financial Resource Mngt	PM	PM	S	I	R	A	I	-
Procurement Management (BID)	PM	PM/ Specialist	S	I	R	A/C	D	S
Schedule Management	PM	PM	S	I	R	A	C	-
Supplier Contract Management	PM	PM/ Specialist	S	-	R	A	D	S
Main Contract Management		PROGRAM/PM	S	I	D	A/R	S	C

RASCID MATRIX

Shared responsibility

Processes	Literature Indication	RASCID Indication	Systems Engineering	Chief Engineer	Project Manager	Program Manager	Area Specialist	Area Specialist Leader
Transition to Operation	SE	SE/PM	R	I	D	A	S	S
Planning	SHARED	PM/SE	D	I	R	A	S	I
Baseline Control/ Config Mngt	SHARED	PM Specialist /SE	D	-	A	I	S	R
Technical Risk Management	SHARED	SE/PM	R	A	D	I	S	C
Program Risk Management		PM	S	I	R	A	S	-
Quality Management	SHARED	PM Specialist /SE	D	C	A	I	R	S
Stakeholder Management	SHARED	PM/SE	D	I	R	A	-	-
Scope Management	SHARED	PM/SE	D	C	R	A/C	S	-

Shared space

Processes	Literature Indication	RASCID Indication	Systems Engineering	Chief Engineer	Project Manager	Program Manager	Area Specialist	Area Specialist Leader
Planning	SHARED	PM/SE	D	I	R	A	S	I

SEMP

Systems Engineering Management Plan

Systems Development Processes Plan

Shared space

Processes	Literature Indication	RASCID Indication	Systems Engineering	Chief Engineer	Project Manager	Program Manager	Area Specialist	Area Specialist Leader
Stakeholder Management	SHARED	PM/SE	D	I	R	A	-	-

Stakeholder Management is one of the most critical processes for PM and SE.

Communication!

Conclusions

- The inclusion of Deputy Responsible made it possible to **correct a gap** in the RACI/RASCI responsibility matrix;
- The use of the RASCID matrix **improves the understanding** and definition of roles and responsibilities of shared processes in the integration of SE and PM;
- The **matrix generated can be customized** according to the needs of each project to optimize integration and efficiently take advantage of the skills of each area to assign responsibilities.

Key References

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Let’s connect

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