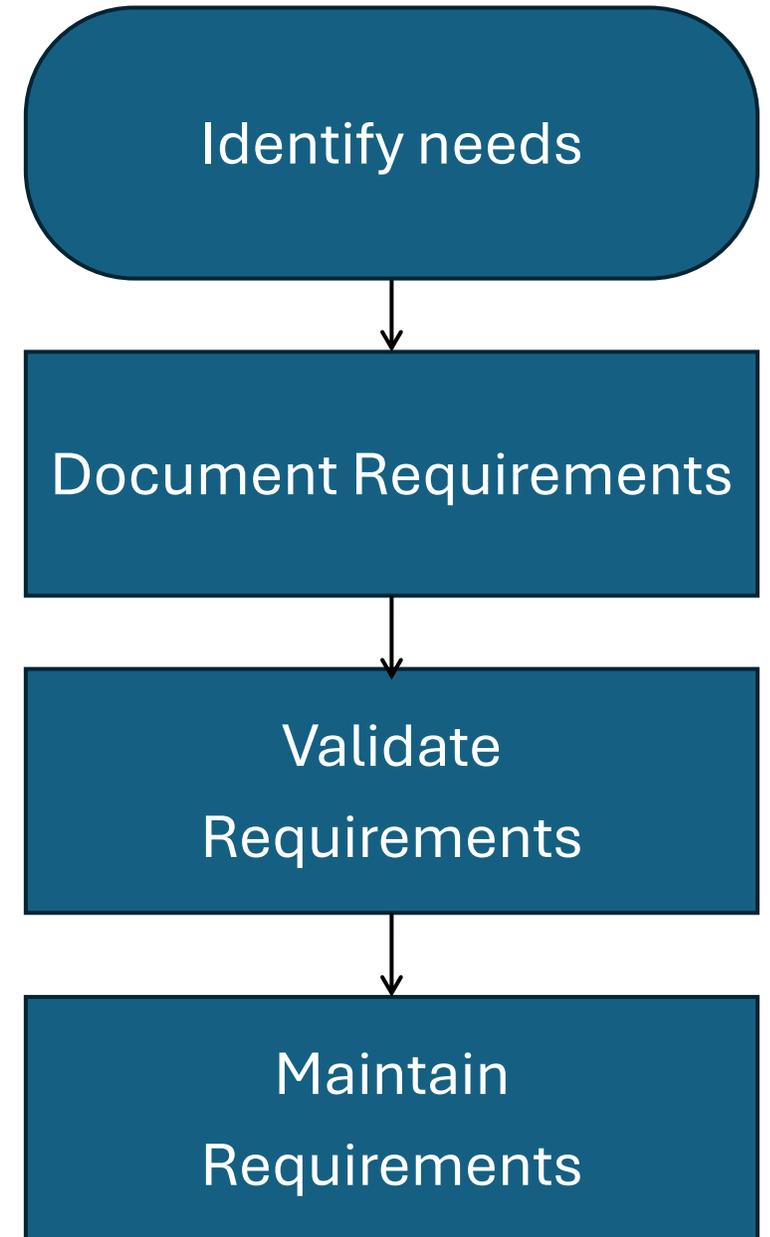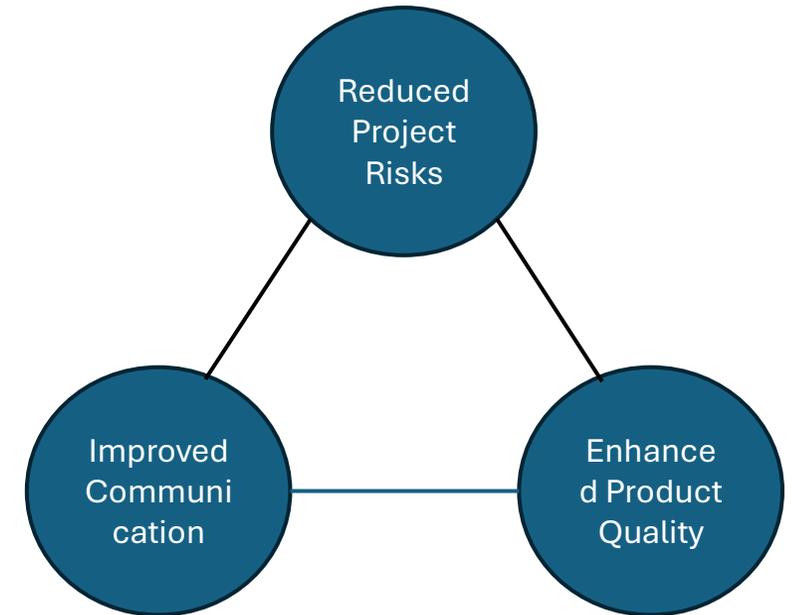# Introduction to Requirement Engineering

Requirement Engineering

- Requirement Engineering involves identifying, documenting, validating, and maintaining project requirements to ensure they align with stakeholder needs

Identify needs

↓

Document Requirements

↓

Validate Requirements

↓

Maintain Requirements

Importance of Requirement Engineering

- Effective Requirement Engineering ensures clear communication, minimizes risks, and improves product quality

Reduced Project Risks
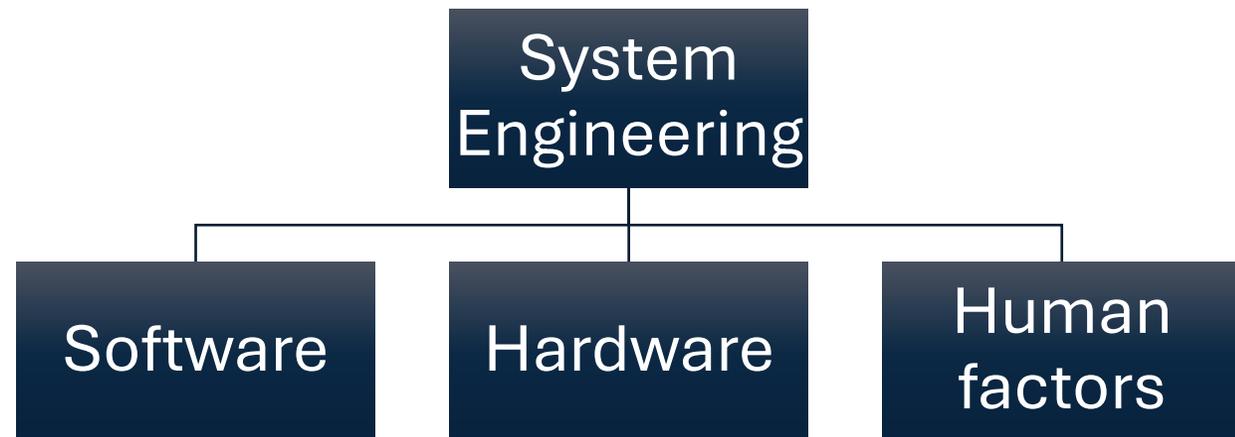
Improved Communication

Enhanced Product Quality

Each development model incorporates Requirement Engineering differently.

Product Development Lifecycles
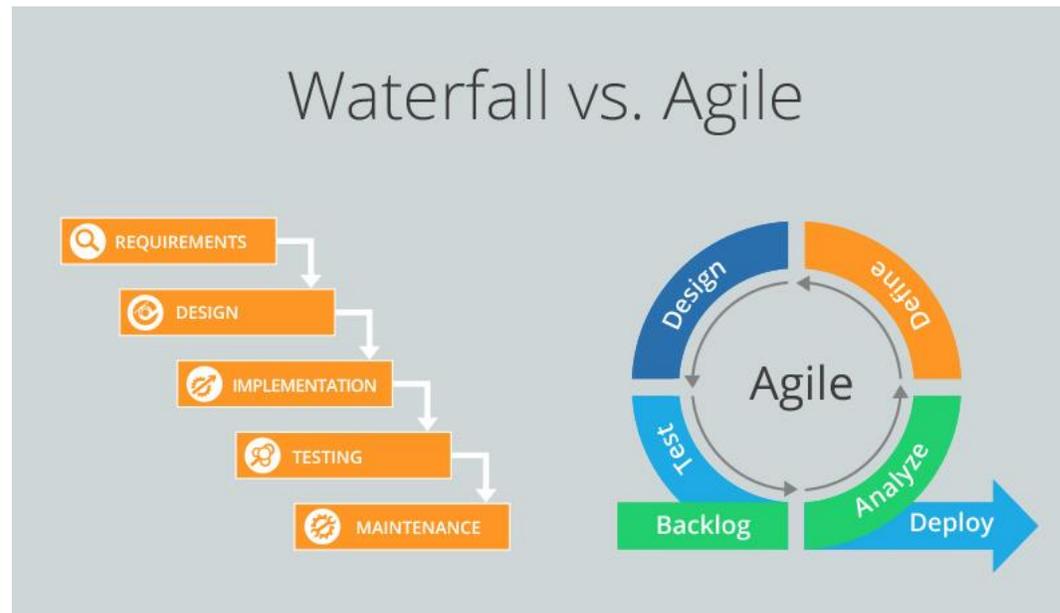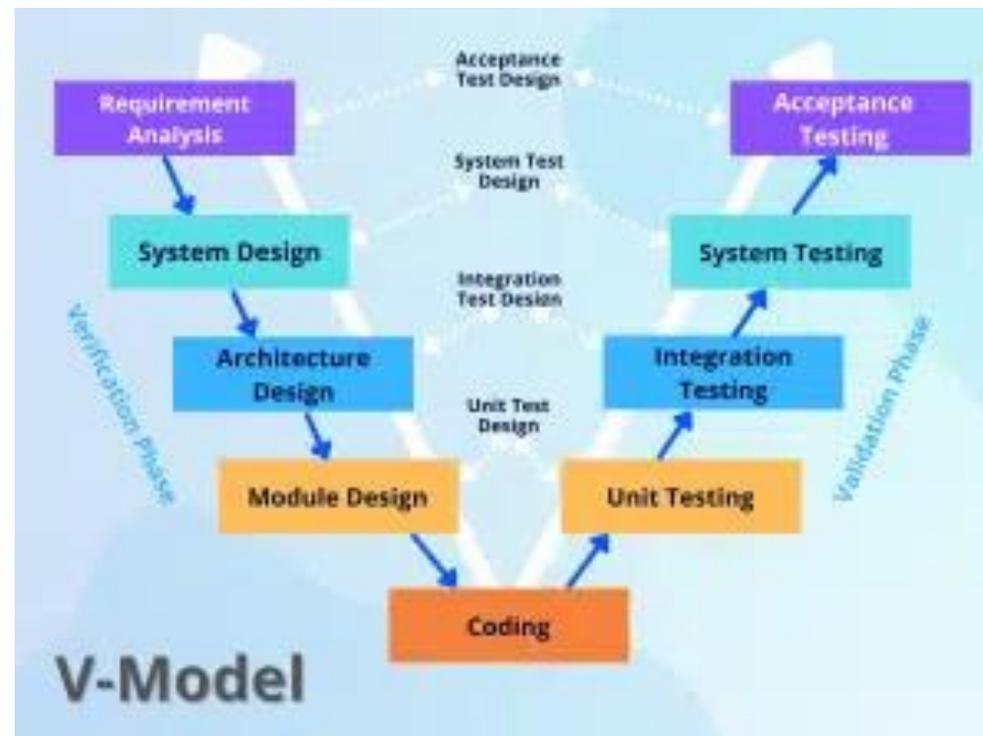
System Engineering

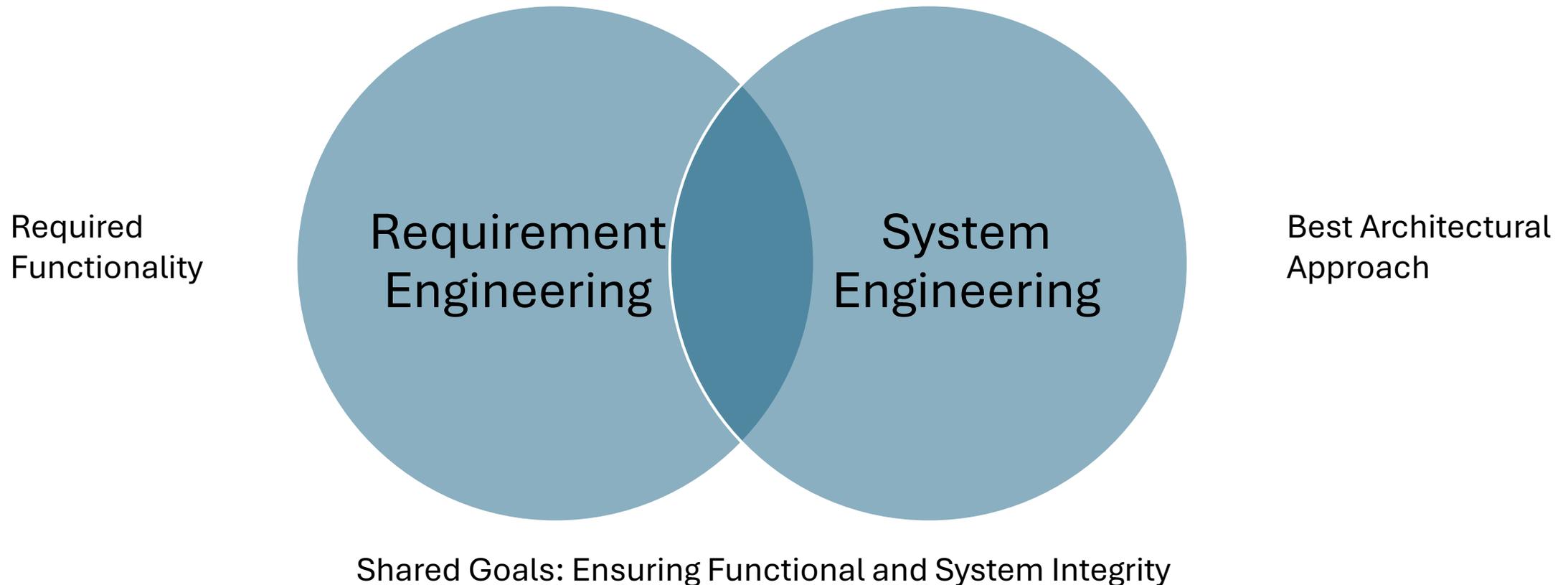- System Engineering integrates multiple disciplines like software, hardware, and human factors to create a coherent system

Relationship Between RE and SE

- RE and SE work together to define **what** needs to be built and **how** it will be built.

Required
Functionality

Requirement
Engineering

System
Engineering

Best Architectural
Approach

Shared Goals: Ensuring Functional and System Integrity

Project Management Principles

- Effective project management ensures that RE and SE activities are aligne~d with~ ~project goals and constraints~

The iron triangle of
project management

Schedule
(Time)

Quality

Scope

Budget
(Cost)

https://www.villanovau.com/articles/project-management/iron-triangle-project-management/

The Project Charter serves as the blueprint for project planning and execution.

Project Charter

PROJECT DESCRIPTION

Error-proof the hardware packaging operations to reduce the missing hardware rate from 3.3% to 1.2%. Error proofing will be accomplished by adding three new hardware packing stations to replace the existing manual stations.

BUSINESS NEED

(1) Missing hardware is an ongoing issue that affects customer satisfaction (2) the customer service team spends approximately $80K/yr in dealing with missing parts (customer calls, shipping costs, etc.)

OWNERSHIP & APPROVAL

Project Manager	Bob Thou	Project Champion	Bob Demorest	Approval Date	Pending
Project Number	PR210				

FINANCIALS & MILESTONES

Financials	Goal	Actual
Initial Investment	$ 425,000	
Net Present Value (5 yr)	$ 1,205,747	
ROI	82%	
IRR	94%	

Capital/Expense	Goal	Actual
Expense - 5 yr service contract for equip and leased data storage	$ 300,000	
Capital	$ 425,000	
Expense - 5 yr equipment lease	$ 1,000,000	

Milestones (Schedule)	Goal	Actual
Equipment Design	15-Feb	
Quotations / Equip Builder Select	1-Mar	
Equip Sign-Off	15-May	
Installation	1-Jun	

RESOURCES & RISKS

Internal Resources	Total Hours	Peak Hrs/Wk
John Smith (Design)	90	40
Mike Gorman (Design)	10	2
David Stone (Mkt Comm.)	15	2
Louis Clemens (A.M.E.)	5	2
Alan Carr (Sourcing)	20	8

External Services	Budget	Actual
Equip Builder (TBD)	$ 55,000	
Other		
Other		
Other		
Other		

Project Risks	Medium	High
Technical Feasibility		✓
Floor Space	✓	

Standards and Tools - ASPICE

Standards and tools provide best practices and support for RE, SE, and project management.
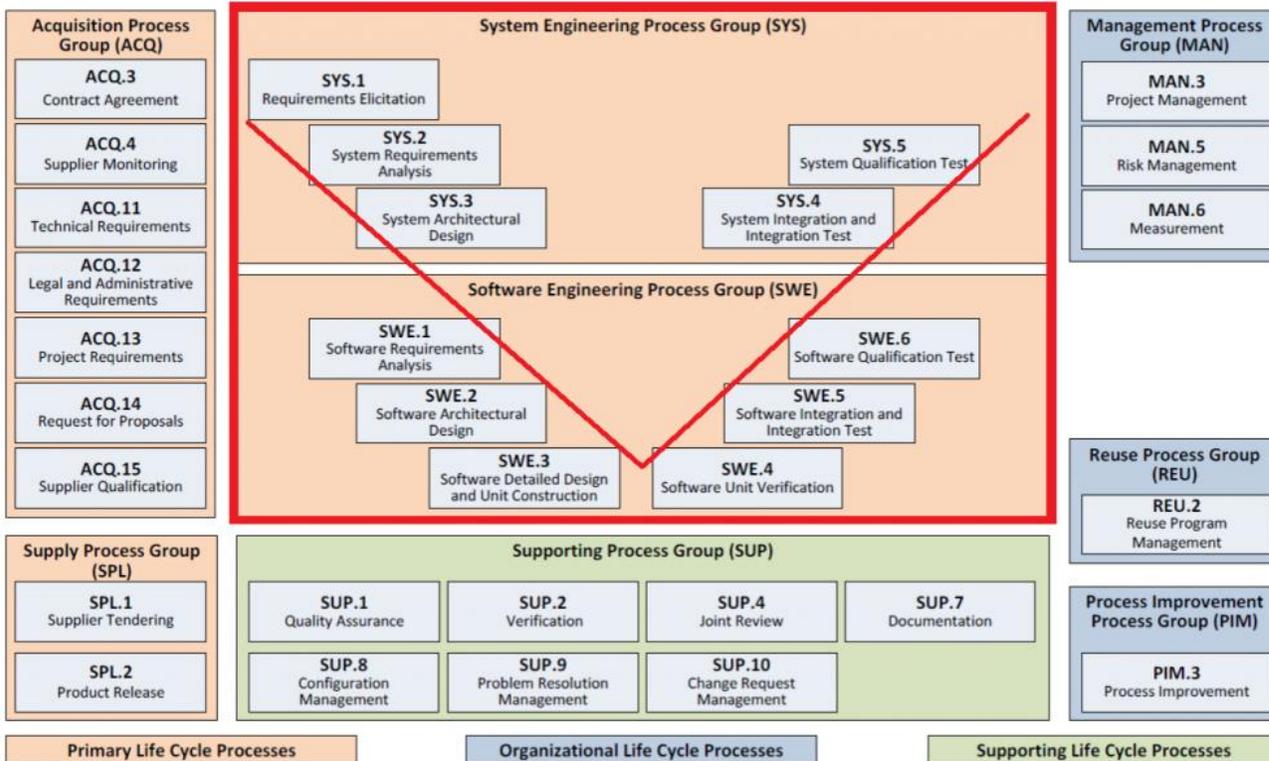
4.3.1. SYS.1 Requirements Elicitation

Process ID	SYS.1
Process name	**Requirements Elicitation**
Process purpose	The purpose of the Requirements Elicitation Process is to gather, process, and track evolving stakeholder needs and requirements throughout the lifecycle of the product and/or service so as to establish a requirements baseline that serves as the basis for defining the needed work products.
Process outcomes	As a result of successful implementation of this process: 1) continuing communication with the stakeholder is established; 2) agreed stakeholder requirements are defined and baselined; 3) a change mechanism is established to evaluate and incorporate changes to stakeholder requirements into the baselined requirements based on changing stakeholder needs; 4) a mechanism is established for continuous monitoring of stakeholder needs; 5) a mechanism is established for ensuring that customers can easily determine the status and disposition of their requests; and 6) changes arising from changing technology and stakeholder needs are identified, the associated risks assessed and their impact managed.
Base practices	**SYS.1.BP1: Obtain stakeholder requirements and requests.** Obtain and define stakeholder requirements and requests through direct solicitation of customer input and through review of customer business proposals (where relevant), target operating and hardware environment, and other documents bearing on customer requirements. [OUTCOME 1, 4] *NOTE 1: Requirements elicitation may involve the customer and the supplier.* *NOTE 2: The agreed stakeholder requirements and evaluation of any change may be based on feasibility studies and/or cost and time analyzes.* *NOTE 3: The information needed to keep traceability for each customer requirement has to be gathered and documented.*

These frameworks guide the structured application of RE, SE, and project management
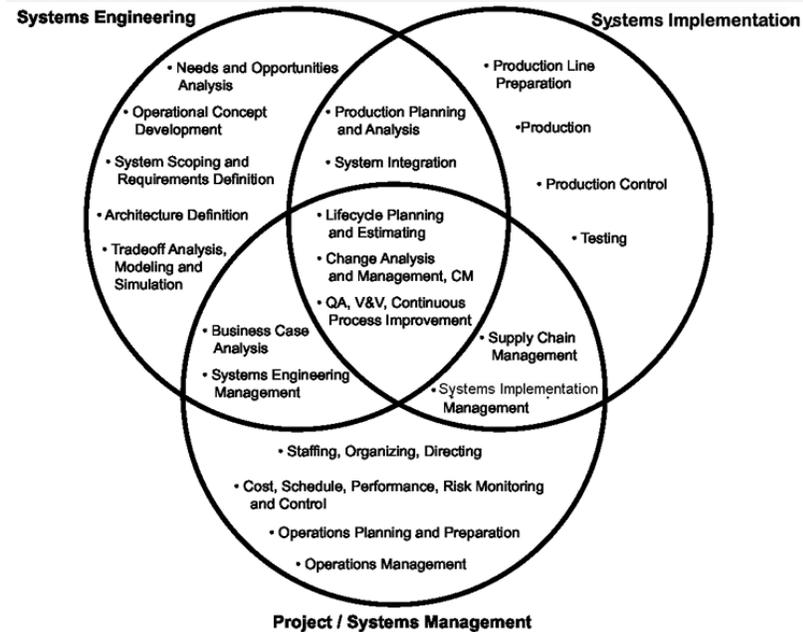
Standards and Tools - SEBoK, and PMBOK

Figure 3. System Boundaries of Systems Engineering, Systems Implementation, and Project/Systems Management. (SEBoK Original)
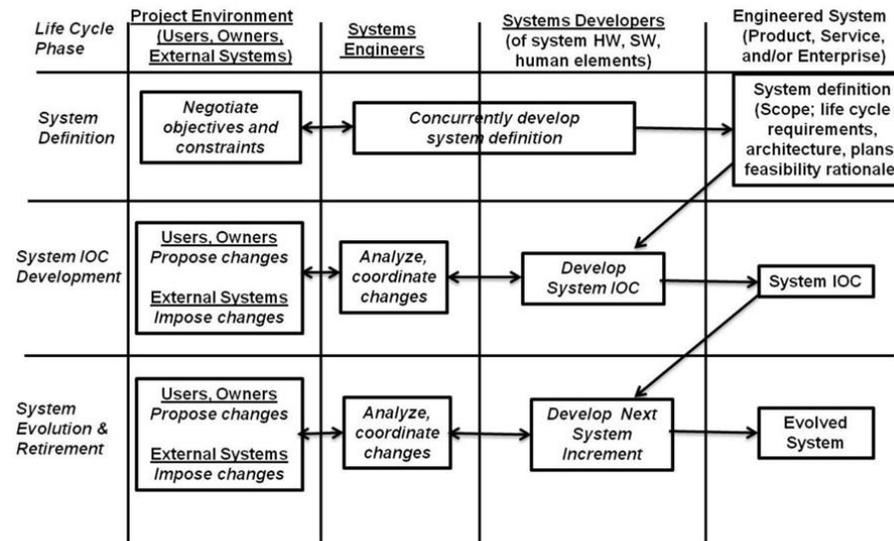

Figure 1. SE and Engineered System Project Life Cycle Context: Related Agents, Activities, and Artifacts. (SEBoK Original)

Standards and Tools - PMBOK

Process Groups / Knowledge Area	Initiating	Planning	Executing	Monitoring and Controlling	Closing
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Execution	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Collect Requirements 5.2 Define Scope 5.3 Create WBS		5.4 Verify Scope 5.5 Control Scope	
6. Project Time Management		6.1 Define Activities 6.2 Sequence Activities 6.3 Estimate Activity Resources 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Estimate Costs 7.2 Determine Budget		7.3 Control Costs	
8. Project Quality management		8.1 Plan Quality	8.2 Perform Quality Assurance	8.3 Perform Quality Control	
9. Project Human Resource Management		9.1 Develop Human Resource Plan	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management	10.1 Identify Stakeholders	10.2 Plan Communications	10.3 Distribute Information 10.4 Manage Stakeholder Expectations	10.5 Report Performance	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Monitor and Control Risks	
12. Project Procurement Management		12.1 Plan Procurements	12.2 Conduct Procurements	12.3 Administer Procurements	12.4 Close Procurements

Notes   Click on steps to see PMBOK v4 to Agile Mapping Notes

Jira and Confluence help
manage requirements and
documentation, facilitating
collaboration

Using
Atlassian
Tools for RE
and PM
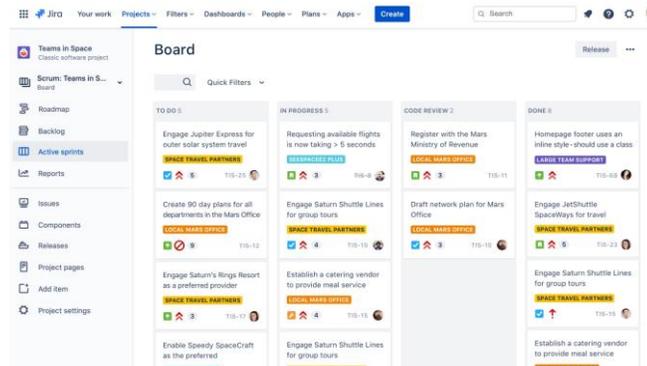
AI tools enhance efficiency in RE by automating repetitive tasks and improving document quality

How AI Supports Requirement Engineering

CATEGORY	TOOLS			
AI Bot	ChatGPT	Google Bard	Bing AI	Claude
Video Creation	Runway	HeyGen	Veed.io	Pictory
Images	Midjourney	DALL-E 3	Leonardo.ai	Firefly
Presentation	Tome	Slides.ai	Decktopus	Beautiful.ai
Research	Harpa	Perplexity	Glasp	ChatPDF
Prompt Writing	G-Prompter	OctiAI	Snack Prompt	PromptPal
Productivity	Taskade	Audio Pen	Notion AI	Xembly
Writing	EssayService.ai	Grammarly	Jasper AI	Wordtune

Course plan

- Week 1: Introduction to Requirement Engineering, System Engineering, and Project Management

- Week 2: Requirement Elicitation Techniques

- Week 3: Stakeholder Requirements

- Week 4: System Requirements and Writing Good Requirements

- Week 5: Requirements Documentation and Different Types of Requirement Definitions

- Week 6: Agile Requirements Engineering and Iterative Design

- Week 7: Requirement Analysis and Prioritization

- Week 8: Requirements Validation and Verification

- Week 9: Managing Changes in Requirements

- Week 10: System Architecture and High-Level Design

- Week 11: System Integration and Interface Requirements

- Week 12: System Testing and Validation

- Week 13: Final Validation and System Handover

- Week 14: Project Presentation and Final Evaluation

- Week 15: Final Project Presentation and Evaluation